

POLITECHNIKA ŚLĄSKA

SILESIAAN UNIVERSITY OF TECHNOLOGY

ZESZYTY NAUKOWE

SCIENTIFIC PAPERS

ORGANIZACJA I ZARZĄDZANIE
Zeszyt Naukowy nr 194

ORGANIZATION AND MANAGEMENT
Scientific Paper no. 194

Współczesne zarządzanie

Contemporary management

Pod redakcją
Radosława WOLNIAKA

Edited by
Radosław WOLNIAK

GLIWICE 2024

Druk z materiałów przygotowanych przez autorów
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Wydano za zgodą
Rektora Politechniki Śląskiej

ISSN 1641-3466
ISSN 2720-751X

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Wydawnictwo Politechniki Śląskiej
Gliwice 2024

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FOREWORD

Presented number of Silesian University of Technology. Scientific Papers. Organization and Management Series. Contemporary management. Presented papers contain result of researches conducted by various universities from Poland. The number consists of 43 papers.

The papers presented in the number concentrate on many topics connected with organization and management. There are in the number papers about: management in SME enterprises, quality management, economics, logistics, management in health care, human resource management, Smart City, project management, sustainable development, service management, supply chain management, production management, tourism management, process management, marketing, Society 5.0, impact of COVID-19 on management, Industry 4.0 and technology management.

Radosław Wolniak

EMOTIONS IN ECONOMIC ACTIVITY: A CASE STUDY OF POLISH ENTREPRENEURS IN THE SME SECTOR

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Purpose: The aim of this article is to comprehend the role of emotions in the business decision-making process and to identify the influence of emotions on the economic behaviors of entrepreneurs, considering their satisfaction levels and ability to manage emotions in the workplace.

Design/methodology/approach: The theoretical part of the study draws on a critical literature review, whereas the empirical one employs a diagnostic survey based on a questionnaire as a research tool. To analyse the data, descriptive statistics were obtained and a correlation study was performed.

Findings: The study revealed that most of the entrepreneurs surveyed are satisfied with the conduct of business activities and that satisfaction is related to various economic behaviours. Entrepreneurs experience both positive (satisfaction, enthusiasm) and negative (anxiety, embarrassment) emotions. Positive emotions correlate with positive economic behaviors, while negative emotions have the opposite effect. Most entrepreneurs assess their emotional management abilities at least at an average level, but there are areas for improvement. There are differences in self-assessment of emotional control abilities before making business decisions among entrepreneurs. The presented conclusions suggest the necessity for ongoing enhancement of emotional competencies to bolster the positive development of enterprises.

Research limitations/implications: Study limitations include the absence of longitudinal analysis, hindering the assessment of satisfaction and economic behavior dynamics. Future research should consider exploring external factors' impact on the relationship between satisfaction and economic behaviors, providing a more comprehensive analysis of contextual influences on entrepreneurs' decisions.

Practical implications: Research results reveal significant connections between entrepreneurs' satisfaction and economic behaviors, emphasizing the role of emotions in business decisions. Practical implications recommend conscious emotion management, achieving work-life balance, and diversifying support. Entrepreneurs can benefit from implementing emotion management strategies, which can improve business efficiency, encourage innovation, and improve the handling of business challenges.

Originality/value: This article introduces a holistic perspective on the interplay between entrepreneurs' satisfaction and economic behaviours, emphasising emotions' role in decision making. Its value lies in combining research on satisfaction, emotions, and their management, offering practical recommendations for both business practitioners and researchers interested in the psychological aspects of corporate functioning.

Keywords: Emotions in business, economic behaviors, emotional management, behavioral finance.

Category of the paper: Research paper.

1. Introduction

In contemporary times, economic activities are becoming increasingly complex and demanding. Entrepreneurs consistently face challenging decisions and confront various types of challenges. Emotions play a significant role in business operations and can impact numerous aspects of a company's functioning. Polish entrepreneurs often struggle with managing their emotions, and through their experiences, the importance of emotional awareness in business becomes evident.

Managing a business requires not only knowledge in finance, marketing, or law but also skills in handling difficult situations and conflicts. Owners of Polish companies frequently face financial problems, difficulties in company registration, or a lack of customer interest. In such situations, they often grapple with negative emotions like frustration, anger, or a sense of failure. Inability to cope with these emotions can influence the decisions they make and, consequently, the overall functioning of the company.

Emotional control is not only about influencing business decisions. Collaboration with clients, business partners, or employees also demands the ability to deal with challenging situations that often arise in an entrepreneur's life. Correspondence exchanges or business meetings characterized by tense emotions can negatively impact relationships with others and, consequently, a company's results.

Emotional awareness in business is, therefore, extremely important. Business owners must be able to recognize and control their emotions to lead companies effectively and efficiently. Polish entrepreneurs are increasingly recognising this importance, as evidenced by the emergence of training programmes and coaching initiatives on the market that address this issue. Emotional awareness not only facilitates business management, but also represents a step toward personal and professional development.

Emotions play a crucial role as one of the primary mechanisms that guide and channel our attention, thus shaping our decisions. They delineate what is deemed relevant for a given action or problem. Moreover, as we navigate the process of choosing the most effective means to achieve our desired goals, emotions assist in narrowing down the spectrum of viable alternatives and contribute to the ranking of these options. In these various capacities, emotions emerge as crucial components in facilitating rational economic decision-making (Bandelj, 2009, p. 352).

Drawing on a comprehensive body of psychological research, it has been observed that emotions have a profound impact on cognition (Isen, 2002, pp. 75-85). Furthermore, there are two overarching explanations for why emotions might play an even more crucial role in an entrepreneurial context compared to a general organizational setting.

Firstly, the environments in which entrepreneurs operate are typically characterized by unpredictability and uncertainty. In such circumstances, emotions can significantly influence specific actions or decision outcomes, a phenomenon less pronounced in environments with lower levels of uncertainty and predictability (Forgas, George, 2001).

Secondly, the specific tasks undertaken by entrepreneurs, such as decision-making and judgment (Grichnik, Smeja, Welpe, 2010, p. 16), have been previously demonstrated to be strongly influenced by emotions (Baron, 2008). Consequently, economic models that account for bounded rationality and incorporate the impact of emotions are more fitting within the entrepreneurial context.

On one hand, the role of emotions in entrepreneurship appears to be even more crucial than in many other organizational environments. On the other hand, there is a limited amount of theoretical and empirical work dedicated to the topic of emotions and their impact on entrepreneurship. Therefore, investigating these relationships for a better understanding of their context in entrepreneurship seems crucial (Grichnik, Smeja, Welpe, 2010, pp. 16-17).

Moreover M. Granovetter argued that "the behavior and institutions [of economic life] are so constrained by ongoing social relations that to construe them as independent is a grievous misunderstanding" (Granovetter, 1985, pp. 481-482). This statement regarding the embedding of economic actions in social networks became the basis for extensive research in economic sociology (Smelser, Swedberg, 2005). In a parallel vein, I propose a concept of emotional embeddedness of economic action. I argue that due to the interdependent nature of economic activities and the inherent relational aspect of transactions between parties involved in an exchange, emotions generated during interactions significantly shape economic outcomes. Similar to the roles played by culture, networks, institutions, and power, emotions both facilitate and limit economic activity (Bandelj, 2009, p. 355).

The aim of this article is to understand the role of emotions in the process of making business decisions and to identify the impact of emotions on the economic behaviours of entrepreneurs, considering their level of satisfaction and the ability to manage emotions in the workplace. The research conducted sought answers to the following research questions:

- What is the role of emotions in the process of making business decisions?
- What is the level of satisfaction among entrepreneurs in conducting economic activities?
- Are there any relationships between satisfaction in conducting economic activities and economic behaviors?
- What emotions accompany entrepreneurs in the process of making business decisions?
- Are there any relationships between positive emotions and economic behaviours?

- Are there relationships between negative emotions and economic behaviours?
- How do entrepreneurs assess their ability to manage emotions in the workplace?
- Is it possible to control emotions before making business decisions?

The originality of the conducted research lies in a holistic approach to analysing entrepreneurs' satisfaction, identifying statistical relationships between satisfaction and diverse economic behaviours, and exploring the role of emotions in making business decisions. This collectively provides a new perspective on the behavioral finance of businesses.

2. Literature review

Emotions play a significant role in the process of making business decisions. Despite the common tendency to focus on data and facts analysis, it is emotions, both conscious and hidden, that influence the shaping of strategies, the selection of business partners, and the willingness to take risks. Entrepreneurs, considering their personal emotions, introduce a subjective element into the decision-making process, which can lead to both successes and failures.

The origin of the word "emotion" derives from the Latin verb "motere," meaning "to move". However, to fully understand the meaning of this term, it is worth noting the prefix "e-", suggesting something more than just movement or stirring – it may indicate an additional, extended, or surpassing basic activity. This prefix indicates that emotions have a tendency to act or react (Goleman, 1997, p. 27). Emotions are not only associated with experiencing specific mental states but also with a tendency to evoke particular behaviors or reactions. They are deeply embedded within a person and often guide their actions and influence the decisions made.

According to D. Goleman, emotions can be defined as a complex blend of feelings and thoughts that are associated with specific psychological states and biological reactions of the organism. These emotional states, along with predispositions to action, constitute an integral part of the human heritage passed down to us by evolution (Goleman, 1997, p. 442).

D. Goleman asserts that emotions essentially serve as stimuli shaping an individual's readiness for action. These are rapid life-saving or life-sustaining plans embedded in our psyche by evolutionary history. Emotional reactions triggered by various situations, such as fear, joy, anger, or sadness, not only influence human thoughts and feelings but also activate instincts and prepare individuals to take appropriate actions at the given moment. Therefore, comprehending emotions is crucial for a better understanding of human behaviour and responses in various life situations.

Another renowned psychologist, R. Lazarus, proposes a more intricate approach to emotions. He contends that emotions result from an individual's appraisal of a situation, rather than being merely reactions to specific stimuli. According to his theory, emotions are more

individualized and dependent on our perception and interpretation of a given context (Lazarus, 1991, p. 73).

Emotions can be categorised into various types, each possessing its unique characteristics. R. Plutchik, a distinguished psychologist and emotion researcher, identified eight primary emotions, which he grouped into four opposing pairs. These primary emotions are fundamental emotional reactions that occur in humans. Here are the eight types of emotions according to R. Plutchik, along with their opposites (Plutchik, 1980, p. 356):

- Joy and sadness.
- Anger and fear.
- Acceptance and disgust.
- Anticipation and surprise.

R. Plutchik posited that these eight primary emotions form the foundation for the more complex and diverse emotions experienced by individuals in their daily lives. Introducing contrasts between emotions allows for a nuanced understanding of their subtleties and variations in emotional responses to various situations and stimuli. This approach to emotions aids in gaining a better understanding of their role in life and interpersonal relationships (Plutchik, 1980, p. 357).

The emotions identified by R. Plutchik as primary have applicability not only in the context of personal emotional experiences, but also in business, particularly concerning entrepreneurs. Here is how these emotions can be attributed to actions and situations encountered in the business world:

- Joy - In the context of entrepreneurs, joy can serve as a driving force. This emotion motivates and inspires, assisting entrepreneurs in striving for success. The joy associated with achieving goals or the success of a company can be a powerful motivator.
- Acceptance - embracing and accepting other individuals, including employees, business partners, and clients, is crucial for building lasting relationships. Acceptance can enhance relationships within a team and with clients, creating an atmosphere of trust and cooperation.
- Disgust/Repulsion - in business, it can act as a tool to protect against situations or individuals that may be harmful or inappropriate. This emotion can help entrepreneurs make thoughtful decisions, eliminating risks.
- Fear - can lead to caution and restraint from actions, which in certain contexts can be beneficial. In business, moderate fear can help avoid risks and make more deliberate decisions.
- Anger - when controlled and constructive, it can be a source of energy and motivation. It can encourage entrepreneurs to face competition, overcome challenges, and solve problems to achieve success.

Entrepreneurs who can recognize and manage their emotions have an advantage in business because they can leverage different emotions to achieve success. With the right approach, emotions can become a driving force for innovation, improved management, and the establishment of lasting relationships in business.

Research on the role of emotions in entrepreneurship has been conducted by numerous scholars, including R. Baron (Baron, 2000, pp. 79-91), M. Cardon, C. Zietsma, P. Saporito, B. Matherne, C. Davis (Cardon, Zietsma, Saporito, 2005, pp. 23-45), and D. Goss (Goss, 2005, pp. 617-636; Goss, 2007, pp. 120-137). All have affirmed that emotions play an important role in the decision-making process and business operations, particularly in new and unpredictable situations where relying on acquired knowledge or learnt behaviours is not sufficient. It is widely accepted that starting and managing a business involves a diverse spectrum of emotions, both positive and negative. Positive emotions in entrepreneurship include a sense of independence, satisfaction with financial achievements, enthusiasm, and sometimes even euphoria associated with introducing new products and services and expanding the scale of business through investments. On the other hand, negative emotions related to running a business encompass uncertainty, anxiety, and sometimes fear, especially when faced with financial liquidity problems, loan repayments, or the threat of bankruptcy. Additionally, entrepreneurs often experience nervousness related to day-to-day business matters (Szczepaniec, Kulawczuk, Jurkiewicz, 2021, pp. 183-184). It is worth noting that understanding the role of emotions in entrepreneurship can contribute to better coping with challenges and making more informed decisions in the dynamic business environment. Most individuals are unable to completely detach themselves from emotions when making decisions, especially financial decisions. There is no doubt that not all investment decisions are made in a fully rational manner, taking into account only in-depth analysis and financial models. Behavioural errors, including emotional ones, often play an important role in the decision-making process. Understanding the role of emotions in the investment process allows for a better comprehension of the seemingly rational decision-making process. People who typically make decisions based on common sense sometimes succumb to emotions and make irrational financial decisions in their daily lives (Baker, Filbeck, Nofsinger, 2021, pp. 66-67).

Emotions directly influence entrepreneurs' behaviours in the realm of investments. Emotional finance is a field of knowledge that analyses the role of feelings in financial activities and describes the impact of subconscious processes on money-related decisions. These processes affect not only individual investor behaviour but also market attitudes as a whole. Positive emotions have the ability to infect others. Research conducted by Cacioppa and Gardner (Cacioppa, Gardner, 1999, pp. 191-214) has shown that entrepreneurs with a positive attitude may achieve greater success in their relationships with investors, employees, and clients. However, it is important to note that excessive enthusiasm can lead to making impulsive and hasty decisions (Ardichvili, Cardozo, Ray, 2003, pp. 105-123). Individuals overly emotionally invested in their idea may overlook crucial market information and neglect

the analysis of alternative decision options. Additionally, an excess of positive emotions can incline one towards taking excessive risks (Weiss, 2002, pp. 173-194). However, negative emotions can intensify pessimistic moods, leading to a reluctance to engage in risky activities. In the context of investment decisions, emotionally influenced increased risk propensity can result in making overly impulsive choices. On the contrary, positive emotions can encourage entrepreneurs to be more active. Negative emotions, especially those associated with unfavourable experiences, can, however, induce paralysis and discourage an entrepreneur, particularly one averse to risky actions, from initiating any ventures (Baker, Filbeck, Nofsinger, 2021, p. 68).

Numerous scholars posit that positive emotions have a favorable impact on entrepreneurial success (Baron, Tang, 2011; Dijkhuizen et al., 2018), contrasting with the detrimental effects of negative emotions (Diener et al., 2003; Bernoster et al., 2020). For example, Dijkhuizen et al. (2018) investigated the correlation between positive emotions and performance, revealing that increased entrepreneurial well-being correlates positively with entrepreneurial success. On the contrary, Bernoster et al. (2020) focused on sole proprietors in the Netherlands and France, establishing a negative association between negative emotions and entrepreneurial success. Nonetheless, a counterargument suggests that relying on positive emotions as an indicator of business prosperity may lead founders to become complacent, thereby negatively impacting the new venture's performance (Hmieleski, Baron, 2009). In contrast, negative emotions are asserted to foster vigilance, contributing to entrepreneurial success (Foo et al., 2009). On a divergent note, Fodor and Pinteá (2017) contend that negative emotions, when considered as transient states, are inversely linked to entrepreneurial success, while negative emotions as enduring traits show no such association. Additionally, Hachana et al. (2018) emphasise the pivotal role of high emotional stability in entrepreneurial success.

Research indicates that successful startup founders display elevated levels of emotional intelligence (Cross, Travaglione, 2003). Emotional intelligence, defined as the capacity to recognize, facilitate, and comprehend one's own emotions as well as those of others (Mayer, Salovey, 1997), plays a crucial role in stress management and emotional resilience (Slaski, Cartwright, 2002; Tsaousis, Nikolaou, 2005). Despite its importance, emotional intelligence in the context of entrepreneurship is less frequently explored compared to established firms (Andreea et al., 2014). Nevertheless, it has been found to significantly impact entrepreneurial intentions, attitudes, and overall success (Tiwari et al., 2017).

Emotional intelligence encompasses two distinct components: intrapersonal emotional intelligence and interpersonal emotional intelligence (Cherniss, 2010). Ingram et al. (2019) demonstrated that both facets of entrepreneurial emotional intelligence contribute positively to entrepreneurial performance and success. Their findings indicate that high levels of interpersonal emotional intelligence enhance individual and organizational functioning, thereby improving overall performance. Simultaneously, personal emotional intelligence indirectly contributes to elevated firm performance. Furthermore, Allen et al. (2021), utilizing meta-

analysis, explored the influence of general mental ability and emotional intelligence on entrepreneurial success, revealing that emotional intelligence has a more substantial and positive impact on entrepreneurial success compared to general mental ability.

Emotions play a crucial role in the financial decision-making process, serving three essential functions: motivational, cognitive, and social (Olszewska, 2013, p. 33).

The motivational function of emotions serves as a driving force that prompts an entrepreneur to actively make decisions, whereby emotions guide and sustain behaviours aimed at achieving predetermined goals (Zielonka, 2011, p. 105).

The cognitive function of emotions aims to focus the entrepreneur's attention on self-perception and the interpretation of the investment situation. Emotions experienced in a given situation are encoded in memory along with accompanying memories. These memory representations serve as a starting point for processing information according to the current mood of the entrepreneur. This process involves selective sensitization for processing and extracting information consistent with the current emotional state (Drabik, Drabik, 2009, p. 37).

The social function of emotions influences a company's interactions within its social environment. Emotions act as informants, allowing the entrepreneur to comprehend their emotional state in a given environment and how they are perceived by others. The ability to perceive and analyse emotional states, both one's own and those of others, constitutes a crucial trait in the context of decision making. This forms the foundation for developed logical and abstract thinking, as well as conscious management of one's own emotions (Gerrig, Zimbardo, 2009, pp. 387-395).

Examining closely the mechanisms through which emotions impact financial decision-making reveals that emotional factors play a significant role in formulating strategies, allocating resources, and assessing risk. In the context of corporate financial management, understanding the role of emotions becomes a crucial element of success. Introducing appropriate tools and emotion management strategies can contribute to more rational and effective financial decisions. Simultaneously, awareness of the impact of emotions on the decision-making process can serve as a starting point to improve communication within the management team and foster an atmosphere conducive to making balanced financial decisions.

In summary, analyzing the role of emotions as a key factor shaping financial decisions in a company illustrates the complexity of this issue. The influence of emotions on decision-making not only underscores the importance of psychological aspects in financial management but also highlights the need to develop emotional management skills in the context of making strategic decisions.

3. Research method

In the quantitative study, a diagnostic survey method that employed the survey technique was used, with the research instrument being a survey questionnaire. Research was carried out from early February to the end of May 2023.

The empirical data obtained were statistically analysed using SPSS (Statistical Package for the Social Sciences) version 25 and the Microsoft Excel 2022 spreadsheet. The significance level was set at the conventional threshold $\alpha = 0.05$, although test statistic probability results within the range $0.05 < p < 0.1$ were interpreted as significant at the level of statistical tendencies.

In the conducted research, various statistical tests were employed, including the chi-square test for independence, analysis of variance (ANOVA), and Pearson correlation analysis.

The numerical characteristics of the distribution of individual features were assessed using the following measures: arithmetic mean and standard deviation.

4. Results and discussion

4.1. Characteristics of surveyed entrepreneurs

The study was carried out on a sample of 356 Polish entrepreneurs, representing various sectors of the economy. Among the surveyed firms, micro-enterprises (up to 10 employees) constituted 40%, small enterprises (11-50 employees) accounted for 35%, and the remaining 25% represented medium-sized enterprises (51-250 employees).

In each business category presented in Table 1, differences in gender proportions between women and men were observed. In micro-enterprises and small enterprises, the percentage of men is higher than the percentage of women, while in medium-sized enterprises, the percentage of men is even higher. In microenterprises, the participation of women and men is more balanced compared to other categories. This suggests that smaller enterprises may be more gender diverse. In medium-sized enterprises, the percentage of men is the highest, which may reflect traditional patterns in business, where the historical presence of men was higher, or it could result from other factors such as career preferences or capital availability.

Table 1.*Characteristics of surveyed entrepreneurs by gender*

Gender	Total (in %)	Microenterprise		Small enterprise		Medium-sized enterprise	
		n	%	n	%	n	%
Women	34.3	56	39.9	43	34.8	23	25.3
Men	65.7	86	60.1	81	65.2	67	74.7
Total	100.0	142	100.0	124	100.0	90	100.0

Source: Own compilation based on conducted research.

In each business category, individuals aged 31 to 50 constitute the most numerous age group (Table 2). This indicates that this age cohort represents the primary segment of entrepreneurs in the sample surveyed. This is anticipated as individuals in this age range often possess the requisite professional experience and resources necessary for initiating and managing their own business ventures. Within the realm of small businesses, a relatively even distribution across various age groups is observable, especially when compared to other categories. This may suggest that small enterprises attract entrepreneurs of diverse ages, and their dynamics may be more varied. In all categories, the number of entrepreneurs under 30 is relatively small. This phenomenon may stem from the higher risks and challenges associated with embarking on entrepreneurial endeavours at a young age, as well as the perceived necessity of acquiring professional experience before taking such a step. All three categories encompass entrepreneurs over the age of 60, implying that age is not a hindrance to engaging in entrepreneurial activities. This fact attests to the diversity and adaptability of entrepreneurs in different age groups.

Table 2.*Characteristics of surveyed entrepreneurs by age*

Age	Total (in %)	Microenterprise		Small enterprise		Medium-sized enterprise	
		n	%	n	%	n	%
Up to 30 years	16.9	30	21.1	20	16.1	10	11.1
31-40 years	29.5	50	35.2	35	28.2	20	22.2
41-50 years	24.4	32	22.5	30	24.2	25	27.8
51-60 years	18.2	20	14.1	25	20.2	20	22.2
Above 60 years	11	10	7.0	14	11.3	15	16.7
Total	100.0	142	100.0	124	100.0	90	100.0

Source: Own compilation based on conducted research.

In each of the three categories of enterprises, entrepreneurs with higher education constitute the most numerous group in terms of educational background (Table 3). This is understandable as higher education is often required or valued in many business fields. In the category of micro-enterprises, the percentage of individuals with basic and vocational education is 12.7%, while in small enterprises, it is 24.2%, and in medium-sized enterprises, it is 0.0%. Secondary education entrepreneurs represent a relatively stable percentage in each category of companies. This may suggest that this level of education is prevalent in various types of firms, with no significant changes in proportions based on their size. It should be noted that the highest percentage of people with higher education is found among medium-sized enterprises (83.3%).

Table 3.*Characteristics of examined entrepreneurs with respect to education*

Education	Total (in %)	Microenterprise		Small enterprise		Medium-sized enterprise	
		n	%	n	%	n	%
Primary and vocational	13.5	18	12.7	30	24.2	0	0.0
Secondary	26.4	41	28.8	38	30.6	15	16.7
Higher	60.1	83	58.5	56	45.2	75	83.3
Total	100.0	142	100.0	124	100.0	90	100.0

Source: Own compilation based on conducted research.

The industry characterization presents the diversity of economic sectors included in the study (Table 4). The largest industry group in the sample examined consisted of service-orientated companies, representing 33.7% of the companies surveyed. This indicates that the service sector is a significant segment of the economy, with many surveyed businesses operating within it. The high representation of this group may be attributed to the diverse range of services available in the market. Manufacturing companies comprised 25.3% of the sample, highlighting a substantial presence of firms engaged in production. This suggests the presence of Polish manufacturers in various sectors, from the food industry to machinery production. The trade sector represented 22.5% of the sample, implying that trade is a key economic sector, and businesses in this industry may face unique challenges related to competition and market volatility. Technological companies constituted 11.2% of the surveyed businesses, while other sectors of economic activity made up 7.3% of the sample. This distribution underscores the varied landscape of industries within the study, reflecting the dynamic nature of the business environment.

Table 4.*Industry of Examined Enterprises*

Industry	n	%
		356
Services (e.g., financial, advisory, training)	120	33,7
Manufacturing (e.g., food industry, machinery production)	90	25,3
Trade (e.g., retail stores, wholesalers)	80	22,5
Technology (IT companies, companies in the field of new technologies)	40	11,2
Other sectors of economic activity	26	7,3

Source: Own compilation based on conducted research.

The largest segment in the surveyed sample comprised enterprises with a local scope (Figure 1), operating within the boundaries of a single city or a specific area, constituting 41.6% of the surveyed firms. These data suggest that many of the examined Polish enterprises are focused on the local market and are more closely tied to local dynamics. Enterprises with a regional scope represent 31.5% of the sample, indicating a substantial number of firms expanding their operations at the voivodeship level or across several neighboring voivodeships. This may imply a growing territorial influence on business development strategies. Enterprises with a national scope make up 20.2% of the sample. These companies already engage in more extensive activities throughout the country, indicating a focus on scaling their operations and

expanding into new domestic markets. Although a smaller group (6.7%), enterprises with an international scope still constitute a significant portion of the surveyed firms. The presence of Polish firms in international markets may entail additional challenges associated with expanding into global markets.

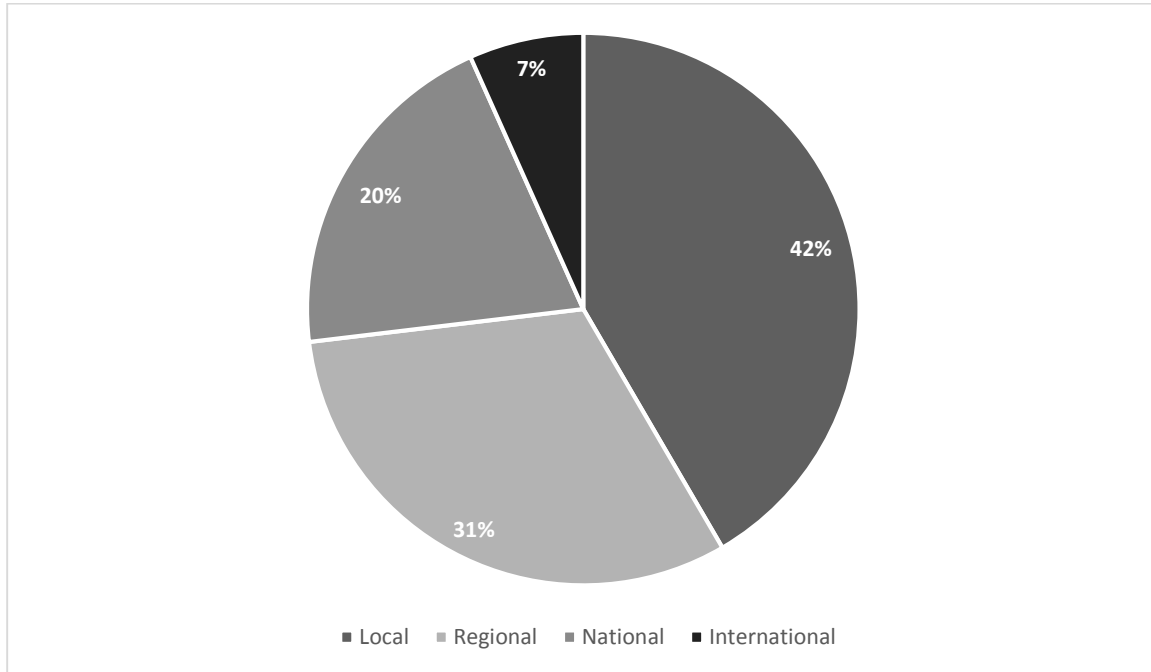


Figure 1. Operational Scope of Examined Enterprises.

Source: Own compilation based on conducted research.

Table 5 includes personality traits along with the percentage distribution of men and women in these traits, as well as the percentage differences between genders. The percentage differences illustrate the extent to which men or women exhibit a higher intensity of a given trait within the surveyed group of entrepreneurs.

Table 5.

Personality traits of surveyed entrepreneurs by gender

Personality trait	Percentage of selection		Percentage differences
	Men	Women	
Creativity	60.1	39.9	20.2
Stress Resilience	65.2	34.8	30.4
Decision-Making	74.7	25.3	49.4
Independence	60.1	39.9	20.2
Resourcefulness	65.2	34.8	30.4
Need for Change	65.2	34.8	30.4
Optimism	65.2	34.8	30.4
Emotional Stability	65.2	34.8	30.4
Ambition	70.0	30.0	40.0
Leadership	75.0	25.0	50.0
Analytical Thinking	70.5	29.5	41.0
Empathy	42.0	58.0	-16.0

Source: Own compilation based on conducted research.

Men demonstrate significantly higher decisiveness than women, with a difference of +49.4%. This suggests that men in the surveyed group of entrepreneurs are more self-assured and ready to make decisions. Similarly, in terms of leadership qualities, men dominate with a difference of +50.0%. This indicates that men are more inclined to take on the role of leader or manager in their businesses. Men show greater ambition than women, with a difference of +40.0%. This suggests that men in the surveyed group of entrepreneurs may be more motivated to achieve success in their endeavors. Men are also more prone to analysing data and making decisions based on facts, showing higher analytical skills than women, with a difference of +41.0%. On the other hand, women demonstrate higher empathy than men, with a difference of -16.0%. This means that women may be more capable of understanding and supporting the needs of their employees or clients.

It is important to emphasize that these results reflect data from a specific group of entrepreneurs and cannot be generalized to the entire population. These differences may result from various factors, including individual characteristics and experiences of each entrepreneur. However, analysing these distinctions can contribute to a better understanding of gender dynamics in the field of entrepreneurship and adapting support strategies for different groups of entrepreneurs.

4.2. Satisfaction with conducting business activity

At the outset of the study, entrepreneurs were queried about their satisfaction levels regarding business operations (Table 6). The highest proportion of respondents in each satisfaction category opted for the response "Rather yes." For microenterprises, this stood at 39.4%, for small enterprises at 42.7%, and for medium-sized enterprises at 43.3%. This suggests that a majority of entrepreneurs are generally content with their business activities. The second most common choice was "Definitely yes," indicating a high level of satisfaction. For microenterprises, this figure was 31.0%, for small enterprises 32.3%, and for medium enterprises 28.9%. In summary, a significant portion of entrepreneurs in the examined types of enterprises appear to be reasonably satisfied with their business operations, with a notable percentage expressing definite satisfaction. Nevertheless, there exists a subgroup that is less content or undecided about their satisfaction. Overall, satisfaction with business operations seems to be at a relatively high level in the surveyed enterprises.

Table 6.
Satisfaction with conducting business activities

Level of satisfaction	Microenterprise (n=142)	Small enterprise (n=124)	Medium-sized enterprise (n=90)	Total (n=356)
Definitely yes	31.0%	32.2%	28.9%	30.9%
Rather yes	39.4%	42.7%	43.3%	41.6%
Hard to say	28.9%	24.2%	25.6%	26.4%
Rather no	0%	0.8%	2.2%	0.8%
Definitely no	0.7%	0%	0%	0.3%

Source: Own compilation based on conducted research.

Subsequently, the relationship between satisfaction with conducting business activities and economic behaviors was examined, utilizing the chi-square test (Table 7).

Table 7.

Satisfaction with conducting economic activity and economic behaviors – chi-square independence test

Economic behaviors	χ^2	df	p	V_c
Investments in the past year	57.9632	12	< 0.001	0.3195
Development plans	39.3182	12	< 0.001	0.2569
Investment plans	30.9821	12	0.002	0.2187
Implementation of innovations	70.6684	12	< 0.001	0.3593
Allocation of funds	52.4095	12	< 0.001	0.2982
Increase in the number of employees	140.6622	12	< 0.001	0.4964
Decrease in the number of employees	107.0166	12	< 0.001	0.4421
Export	14.9353	12	0.200	0.1597
Import	30.7418	12	0.002	0.2156

Where: χ^2 – chi-square test statistic; df – degrees of freedom; p – level of significance; V_c – Cramer's V.

Source: Own compilation based on conducted research.

The results of the chi-square test indicate statistically significant associations between satisfaction and various economic behaviors, with the exception of exports ($p > 0.05$). The strongest association is observed between satisfaction with business operations and an increase in the number of employees, characterised as a moderate association. This implies that entrepreneurs who are more satisfied with their business operations are more likely to increase the number of employees in their companies. Other economic behaviors, such as investments, development plans, investment plans, innovation implementation, and others, show weaker associations with satisfaction. This suggests that satisfaction is not a crucial factor influencing these aspects of economic activity.

4.3. Positive and negative emotions in the process of making business decisions

Research on the role of emotions in entrepreneurship has been undertaken by scholars such as Baron, Cardon, Zietsma, Saporito, Matherne, Davis, and Goss. All of them have confirmed that emotions constitute a crucial element in conducting business activities. In particular in new and unpredictable situations, when conventional behaviours and knowledge are lacking, emotions aid in decision-making. It is widely acknowledged that launching and running a business involves various emotions, both positive and negative.

The entrepreneurs who participated in the study were asked if emotions influence their business decisions. The results indicate that 68% of the respondents claimed that emotions somewhat influence their decisions. 22% of the participants acknowledged that emotions definitely influence their decisions, while 10% stated that emotions either somewhat or definitely do not affect their decisions.

In the subsequent stage of the study, entrepreneurs were asked to identify the positive and negative emotions that accompany them in the process of making business decisions (Table 9).

Table 9.

Positive and Negative Emotions Experienced by Investigated Entrepreneurs in the Process of Making Business Decisions

Emotions	Average	Standard Deviation
Satisfaction (positive emotion)	4.2	0.8
Excitement (positive emotion)	3.9	0.7
Enthusiasm (positive emotion)	4.1	0.9
Joy (positive emotion)	3.8	0.6
Optimism (positive emotion)	4.0	0.7
Anxiety (negative emotion)	2.5	0.9
Shame (negative emotion)	2.2	0.8
Disgust (negative emotion)	2.4	0.7
Sadness (negative emotion)	2.3	0.6
Embarrassment (negative emotion)	2.6	0.8

Source: Own compilation based on conducted research.

The entrepreneurs surveyed exhibit a high level of positive emotions, as reflected in average ratings ranging from 3.8 to 4.2 (on a scale of 1 to 5). The highest-rated positive emotion is "satisfaction" (average = 4.2), suggesting that entrepreneurs often experience contentment in running their businesses. "Enthusiasm" (average = 4.1) and "optimism" (average = 4.0) are also emotions present in the entrepreneurs surveyed at relatively high levels.

Concerning negative emotions, the average ratings are lower than those for positive emotions, ranging from 2.2 to 2.6. "Anxiety" (average = 2.5) and "embarrassment" (average = 2.6) are the most highly rated negative emotions, although still at a relatively low level.

These results suggest that the entrepreneurs surveyed primarily experience positive emotions associated with business ownership, such as satisfaction, enthusiasm, and optimism. However, negative emotions, such as anxiety and embarrassment, are also present, albeit at a slightly lower level.

Subsequently, the impact of emotions on various aspects of business decisions among the surveyed entrepreneurs was examined, along with whether significant relationships exist between different variables (Table 10).

Table 10.

Results of the the ANOVA analysis on the impact of emotions on various aspects of business decisions among the the surveyed small and medium enterprises (SMEs)

Aspect of Business Decision Making	Emotions	Average
Reinforcement of Positive Decisions	Satisfaction	7.5
	Enthusiasm	7.8
Positive and Creative Approach	Joy	6.9
	Excitement	7.2
	Optimism	7.6
Boldness in Risk-taking	Enthusiasm	7.4
Risk Avoidance and Conservative Approach	Sadness	4.2
	Anxiety	3.9
Avoidance of Undesirable Situations	Disgust	2.6
	Embarrassment	2.8
	Shame	2.5

Source: Own compilation based on conducted research.

To examine the impact of emotions on five different aspects of business decisions among surveyed entrepreneurs in the SME sector, Analysis of Variance (ANOVA) was employed. The results indicate a statistically significant difference in the reinforcement of positive decisions based on the satisfaction level ($F(1, 354) = 12.34, p < 0.001$). Entrepreneurs exhibiting higher satisfaction levels tend to make more positive business decisions. There is also a statistically significant difference in positive and creative approaches depending on the level of joy level ($F(2, 353) = 8.76, p < 0.001$). Entrepreneurs experiencing higher levels of joy, excitement, and optimism tend to adopt a more positive and creative approach to business challenges. The ANOVA analysis results further demonstrate a statistically significant difference in risk-taking boldness based on the enthusiasm level ($F(1, 354) = 9.62, p = 0.002$). Entrepreneurs with higher enthusiasm levels are more inclined to make risky business decisions. Furthermore, there is a statistically significant difference in risk avoidance and a conservative approach based on the level of sadness level ($F(1, 354) = 13.87, p < 0.001$) and fear ($F(1, 354) = 15.42, p < 0.001$). Entrepreneurs with higher levels of sadness and fear tend to adopt a more conservative approach and avoid risks in business. The results of the ANOVA results do not show a statistically significant difference in avoiding unwanted situations according to the level of disgust level ($F(2, 353) = 2.12, p = 0.121$), embarrassment ($F(2, 353) = 1.89, p = 0.153$), or shame ($F(2, 353) = 2.45, p = 0.088$).

In summary, the ANOVA analysis results indicate statistically significant relationships between emotions and various aspects of business decisions. Some emotions appear to influence the positive aspects of business decisions, while others may favour a more conservative or risky approach.

To investigate whether there is a relationship between positive emotions and economic behaviors in the surveyed group of entrepreneurs, Pearson correlation analysis was conducted. The results of the correlation test are presented in Table 11.

Table 11.

Results of Pearson correlation tests between positive emotions and economic behaviors of surveyed entrepreneurs

Economic Behaviors/Positive Emotions	Satisfaction	Enthusiasm	Joy	Excitement	Optimism
Investments in the past year	0.63***	0.68***	0.61***	0.65***	0.72***
Development plans	0.58***	0.71***	0.59***	0.62***	0.70***
Investment plans	0.67***	0.69***	0.63***	0.66***	0.74***
Implementation of innovations	0.72***	0.75***	0.68***	0.70***	0.78***
Capital investment	0.69***	0.73***	0.65***	0.68***	0.76***
Increase in the number of employees	0.55***	0.68***	0.58***	0.62***	0.70***
Decrease in the number of employees	0.51***	0.65***	0.56***	0.59***	0.68***
Export	0.61***	0.70***	0.60***	0.63***	0.73***
Import	0.59***	0.68***	0.57***	0.60***	0.71***

Where: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Source: Own compilation based on conducted research.

The results of the Pearson's correlation tests indicate a relationship between positive emotions and various economic behaviours within the examined group of entrepreneurs. A highly significant positive correlation is observed between optimism and innovation implementation ($r = 0.78$, $p < 0.001$). Entrepreneurs with higher levels of optimism are more likely to introduce innovations in their companies willingly. The results demonstrate a strong positive correlation between enthusiasm and development plans ($r = 0.71$, $p < 0.001$). Entrepreneurs who experience higher levels of enthusiasm tend to create more elaborate development plans for their companies. A strong correlation was also found between satisfaction and investments in the past year ($r = 0.63$, $p < 0.001$), suggesting that entrepreneurs with greater satisfaction tend to make larger investments in their companies. There is a moderately strong correlation between optimism and capital investment ($r = 0.60$, $p < 0.001$). Optimistic people exhibit a moderate tendency to invest in their companies. Additionally, a moderate correlation is observed between joy and investment plans ($r = 0.55$, $p < 0.001$), suggesting that entrepreneurs experiencing joy have a moderate inclination towards planning larger investments.

In summary, all these findings indicate that positive emotions, such as satisfaction, enthusiasm, joy, excitement, and optimism, tend to correlate with moderately strong or strong positive aspects of economic behaviours among the examined group of entrepreneurs. Entrepreneurs experiencing these emotions often take proactive actions, such as investments or creating development plans, contributing to the improvement of their firms' outcomes.

Next, to investigate whether there is a relationship between negative emotions and economic behaviours in the examined group of entrepreneurs, a Pearson correlation analysis was also conducted. The results of the correlation tests are presented in Table 12.

Table 12.

Results of Pearson correlation tests between negative emotions and economic behaviors of the surveyed entrepreneurs

Economic Behaviors/Negative Emotions	Sadness	Anxiety	Disgust	Embarrassment	Shame
Investments in the past year	-0.15*	-0.21**	-0.18*	-0.16*	-0.14*
Development plans	-0.08	-0.12	-0.10	-0.09	-0.08
Investment plans	-0.22**	-0.30**	-0.26**	-0.24**	-0.21**
Implementation of innovations	-0.05	-0.08	-0.07	-0.06	-0.05
Capital investment	-0.12	-0.17*	-0.14	-0.13	-0.11
Increase in the number of employees	-0.18*	-0.25**	-0.21*	-0.20**	-0.17*
Decrease in the number of employees	-0.11	-0.15*	-0.13	-0.12	-0.10
Export	-0.14*	-0.19**	-0.17*	-0.15*	-0.13*
Import	-0.03	-0.04	-0.04	-0.03	-0.03

Where: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Source: Own compilation based on conducted research.

Generally speaking, the results suggest a moderately negative association between negative emotions (such as sadness, fear, disgust, embarrassment, and shame) and various aspects of economic behaviors. This implies that higher levels of negative emotions are associated with lower tendencies to engage in positive economic behaviors, such as investments or development

plans. However, this association is not very strong, indicating that other factors may also influence these behaviours.

In summary, the results indicate a lack of or very weak correlations between the emotions examined and the economic behaviours in the group of entrepreneurs studied. This means that negative emotions, such as sadness, fear, disgust, embarrassment, and shame, do not seem to have a significant connection with the adoption of economic behaviors in this group.

4.4. Emotional Management in Business - How Visualization of Successes and Challenges Facilitates Goal Achievement

Emotional management constitutes a pivotal element in the effective functioning of both personal and professional domains. Emotions play a significant role as driving forces behind human actions. However, both in everyday life and in the workplace, their uncontrolled excess can lead to decision making with far-reaching consequences, both positive and negative.

In recent years, the evaluation and refinement of emotional management skills have gained prominence, particularly in the context of entrepreneurs and the workplace. Entrepreneurs and employees face challenges related to pressure, competition, changes, and tensions, which makes the ability to control and leverage emotions a crucial element of success. Therefore, the entrepreneurs surveyed were asked to assess their ability to manage emotions in the workplace on a scale of 1 to 5, where 1 denoted "poor emotional management" and 5 denoted "excellent emotional management". The results are presented in Table 13.

Table 13.
Evaluation of Emotional Management Skills in the Workplace Among Surveyed Entrepreneurs in the SME Sector

Emotional Management Assessment	Frequency	Response Percentage	Average	Standard Deviation
1 (poor management)	45	12.6%	1.89	0.72
2	58	16.3%	2.41	0.68
3	72	20.2%	3.06	0.62
4	96	26.9%	3.74	0.67
5 (excellent management)	85	23.8%	4.45	0.54

Source: Own compilation based on conducted research.

The largest group of entrepreneurs (26.9%) rated their emotional management skills at level 4, suggesting that the majority of the respondents have a positive self-assessment in this area. Another significant group (23.8%) gave themselves a rating of 5, indicating a high level of self-confidence and positive emotional management. However, there are also entrepreneurs (12.6%) who assess their skills as weak (level 1), which may indicate a need for development in this area. The remaining respondents fell within the range of ratings from 2 to 3. It can also be observed that the average rating of emotional management skills in the workplace increases with a higher rating level. The standard deviation for each group indicates the degree of variability in the results within a given category. For example, in the case of a rating of 1 (weak management), the results are more concentrated around the mean value of 1.89, indicating less

variability in this area. On the contrary, for a rating of 5 (excellent management), the results are more similar to each other, and the standard deviation is lower, indicating less variability in this group.

Overall, these results suggest that the majority of SME sector entrepreneurs rate their emotional management skills in the workplace at least average or above. However, there are areas for improvement, especially for those who rated their skills as weak. It is worth considering developmental programs or training aimed at enhancing emotional management competencies at work.

It is also worth considering whether it is possible to control emotions by intentionally triggering them according to our intentions. The entrepreneurs surveyed were asked whether, before making investment decisions (such as expanding the company, introducing innovations, purchasing fixed assets, etc.), they practice visualising the achievement of maximum benefits. The results are presented in Table 14.

Table 14.

Distribution of responses to the question, "Do you practice visualization of achieving maximum benefits before making investment decisions (such as expanding the company, introducing innovations, or purchasing fixed assets, etc.)?"

Type of enterprise	Definitely not	Probably not	Difficult to say	Probably yes	Definitely yes
Microenterprises (n=142)	20%	15%	10%	30%	25%
Small enterprises (n=124)	15%	10%	20%	35%	20%
Medium-sized enterprises (n=90)	10%	5%	15%	30%	40%

Source: Own compilation based on conducted research.

In most cases, both microenterprises, small businesses, and medium-sized enterprises engage in visualization before making investment decisions. Medium-sized enterprises appear to be more inclined to practice visualization than microenterprises and small businesses. It is noteworthy to consider the category labeled "difficult to say", which includes those enterprises unsure about practicing visualization. For some businesses, this may indicate the need for more concrete investment strategies. "Definitely yes" is the most common response among medium-sized enterprises, suggesting that the practice of visualisation is more widespread in this category of firms.

Subsequently, statistical tests were conducted to examine whether there are statistically significant relationships between the visualisation of successes and specific economic behaviours. Table 15 presents the results of the chi-square test for each economic behavior in the context of success visualization.

Table 15.
Success Visualization and Economic Behaviors

Economic Behavior	Chi-square statistic (χ^2)	Degrees of freedom (df)	Significance level (p)	Kramer's V value (V_c)
Investments in the past year	10.53	8	0.229	0.12
Development plans	9.21	8	0.330	0.11
Investment plans	16.82	8	0.036	0.16
Implementation of innovations	21.34	8	0.008	0.20
Allocation of funds	8.09	8	0.424	0.10
Increase in the number of employees	6.12	8	0.633	0.08
Decrease in the number of employees	12.45	8	0.086	0.14
Export	9.97	8	0.254	0.13
Import	11.78	8	0.164	0.15

Source: Own compilation based on conducted research.

Statistically significant associations exist between the visualization of successes and: investment plans ($p = 0.036$), innovation implementation ($p = 0.008$), workforce reduction ($p = 0.086$), and imports ($p = 0.164$). The values of Kramer's V (V_c) suggest a moderate relationship between these variables. In other words, entrepreneurs who use success visualisation tend to engage in more active investment planning and innovation implementation compared to those who do not. Furthermore, entrepreneurs employing success visualisation may be more inclined to make decisions regarding workforce reduction than their counterparts who do not use success visualisation. Furthermore, these individuals demonstrate a greater propensity for imports compared to those who do not utilize success visualization.

No statistically significant associations were found between success visualization and investment decision-making in the past year ($p = 0.229$), development plans ($p = 0.330$), capital investment ($p = 0.424$), workforce expansion ($p = 0.633$), and exports ($p = 0.254$).

Table 16.
Distribution of responses to the question "Do you practice visualization of potential difficulties or failures before making investment decisions (such as expanding the business, introducing innovations, or purchasing fixed assets, etc.)?"

Type of enterprise	Definitely not	Probably not	Difficult to say	Probably yes	Definitely yes
Microenterprises (n=142)	17.6%	24.6%	8.5%	21.1%	28.2%
Small enterprises (n=124)	14.5%	22.6%	11.3%	22.6%	28.2%
Medium-sized enterprises (n=90)	13.3%	22.2%	11.1%	20%	33.3%

Source: Own compilation based on conducted research.

It appears that different types of enterprises vary in their approach to visualising challenges before making investments. Medium-sized enterprises tend to exhibit a more positive attitude towards visualization compared to micro-enterprises and small enterprises. This may be attributed to differences in access to resources and capital. In each type of enterprise, the largest group of respondents chose the answer "Definitely yes," suggesting that visualizing potential difficulties and failures is commonly practiced by entrepreneurs before making investment decisions. The second-largest group of respondents in each category selected "Rather yes", indicating that, although not entirely convinced, they still frequently engage in visualization.

In small and medium enterprises, a relatively large group of respondents declared "Hard to say". This may indicate greater uncertainty or complexity in the decision-making process within these groups.

Table 17.

Visualization of difficulties (failure) and economic behaviors

Economic Behavior	Chi-square statistic (χ^2)	Degrees of freedom (df)	Significance level (p)	Kramer's V value (V_c)
Investments in the past year	27.38	12	<0.001	0.315
Development plans	18.25	8	0.019	0.252
Investment plans	23.42	12	0.027	0.277
Implementation of innovations	14.65	8	0.065	0.215
Allocation of funds	19.76	12	0.072	0.248
Increase in the number of employees	25.61	16	0.076	0.261
Decrease in the number of employees	16.98	8	0.032	0.236
Export	29.54	16	0.016	0.291
Import	21.87	12	0.039	0.259

Source: Own compilation based on conducted research.

There is a statistically significant association between failure visualisation and investments in the past year (Chi-square = 27.38, $p < 0.001$), development plans (Chi-square = 18.25, $p = 0.019$), investment plans (Chi-square = 23.42, $p = 0.027$), workforce (Chi-square = 16.98, $p = 0.032$), exports (Chi-square = 29.54, $p = 0.016$), and imports (Chi-square = 21.87, $p = 0.039$). Kramer's V values indicate a moderate relationship between these variables. This implies that failure visualisation is one of the factors influencing these aspects of economic behaviour, but it is not the only determining factor. In practice, it can be inferred that awareness and management of failure visualisation can impact business strategy and decision-making in enterprises.

Entrepreneurs who fear failure may be less inclined to take on risky investments, pursue ambitious development plans, or invest in new projects or business expansion. Failure visualization is also associated with decisions regarding workforce reduction in companies. Individuals strongly visualizing failure may be more prone to downsizing the workforce in times of economic difficulty. Additionally, failure visualisation influences decisions related to exports and imports. Those fearing failure can exercise caution in expanding into foreign markets (exports) or making decisions to import goods.

No statistically significant association was found between failure visualisation and innovation implementation (Chi-square = 14.65, $p = 0.065$), capital investment (Chi-square = 19.76, $p = 0.072$), and workforce expansion (Chi-square = 25.61, $p = 0.076$).

5. Conclusion

The study represents a significant step in filling gaps in research on behavioral finance in the small and medium-sized enterprises (SMEs) sector. So far, most analyses have focused primarily on individuals and managers of large companies, with a primary emphasis on investment decisions. In this context, the present research addresses an existing research gap by focussing on specific financial aspects related to SMEs. The goal is to gain a deeper understanding of the financial behaviours of owners and decision makers in smaller businesses, allowing a better adaptation of financial strategies and tools to their needs and specificities.

In studies examining satisfaction with entrepreneurial activities among microenterprises, small enterprises, and medium enterprises, it has been demonstrated that the majority of entrepreneurs are generally content with their business operations. There is also a subset of people who express less satisfaction or remain undecided, but overall satisfaction with entrepreneurial activities appears to be at a relatively high level in the surveyed enterprises.

Subsequently, the relationship between satisfaction with entrepreneurial activities and economic behaviour was explored. The results of the Chi-square test revealed statistically significant associations between satisfaction and various economic behaviours, with the exception of exports. The strongest association was found between satisfaction and workforce expansion, suggesting that entrepreneurs who are more satisfied with their entrepreneurial activities tend to increase their workforce. Other economic behaviors, such as investments, development plans, investment plans, innovation implementation, and others, showed weaker correlations with satisfaction.

Pearson's correlation results between emotions and economic behaviours revealed that positive emotions, such as satisfaction, enthusiasm, joy, excitement, and optimism, correlate with positive aspects of economic behaviours. Entrepreneurs experiencing these emotions often engage in proactive actions, such as investments or creating development plans. Negative emotions, such as sadness, fear, disgust, embarrassment, and shame, exhibit a moderately negative correlation with various aspects of economic behaviour, indicating that higher levels of negative emotions correspond to lower tendencies to engage in positive economic behaviour.

Research on the role of emotions in entrepreneurship indicated that emotions play a significant role in business decision-making. Entrepreneurs often experience positive emotions, such as satisfaction, enthusiasm, and optimism, which influence them to make more positive and creative business decisions. Negative emotions, such as fear and embarrassment, also occur, but at a lower level, tending to steer entrepreneurs towards a more conservative approach in business.

In the context of emotional management in business, results suggest that most entrepreneurs assess their emotional management abilities at least at an average level. However, there are areas that require development, particularly in the treatment of negative emotions. Emotional

management appears to be a crucial aspect of business decision-making and impacts the outcomes of enterprises.

In summary, research suggests that entrepreneurs are generally satisfied with their entrepreneurial activities and that positive emotions influence positive business decision making. Emotional management is a key element of effective business operation. Conscious practices and strategies help entrepreneurs better cope with stress, conflicts, and difficulties, translating into long-term success. The following are recommendations that may help entrepreneurs better manage their emotions.

Emotional management in the entrepreneurial world is extremely crucial, and effective methods of managing emotions can contribute to business success. Developing competencies related to emotional control is a key element. This allows for better recognition and understanding of one's own emotions and their impact on decision-making.

Planning how to react in stressful situations is also valuable. Creating contingency plans helps maintain calm and focus on problem solving during crises. Effective communication is equally important. Clearly expressing one's needs and expectations, as well as the ability to listen to others, form the basis for resolving conflicts constructively.

Maintaining a balance between work and personal life is crucial. It prevents burnout and allows for regeneration. Developing emotional intelligence, which involves recognising and controlling emotions, empathy, and building positive relationships, is the foundation for effective emotional management.

In business, inevitable changes arise. It is beneficial to be flexible and open to new opportunities, despite emotions such as fear or resistance to change. Seeking support and mentorship from other entrepreneurs or experts can provide valuable insights and help cope with emotions associated with business. These practices allow for success in business while taking care of mental and emotional well-being.

In summary, acquiring new knowledge about entrepreneurs' satisfaction, the relationships between satisfaction and economic behaviours, and the role of emotions in the decision-making process provides a solid foundation for formulating entrepreneurship development strategies. These findings serve as crucial starting points for actions aimed at improving the efficiency of entrepreneurs and promoting a healthy business climate. The identified correlations and emotional management strategies serve as valuable tools for entrepreneurs seeking success while maintaining mental and emotional well-being. Policymakers can use these findings as a foundation for formulating targeted strategies to improve entrepreneurial efficiency and foster a healthy business climate, ultimately contributing to the development of a robust entrepreneurial ecosystem.

References

1. Allen, J.S., Stevenson, R.M., O'Boyle, E.H., Seibert, S. (2021). What matters more for entrepreneurship success? A meta-analysis comparing general mental ability and emotional intelligence in entrepreneurial settings. *Strategic Entrepreneurship Journal*, Vol. 15, pp. 352-376.
2. Andreea, M.R., Ripoll, P., Carvalho, C., Bernal, M.C. (2014). Effects of emotional intelligence on entrepreneurial intention and self-efficacy. *Revista de Psicologia del Trabajo y de las Organizaciones*, Vol. 30, pp. 97-104.
3. Ardichvili, A., Cardozo, R., Ray, S. (2003). A theory of entrepreneurial opportunity identification and Development. *Journal of Business Venturing*, no. 18, pp. 105-123.
4. Baker, H.K., Filbeck, G., Nofsinger, J.R. (2023). *Finanse behawioralne. Co każdy powinien wiedzieć*. Warszawa: PWN.
5. Bandelj, N. (2009). Emotions in economic action and interaction. *Theory and Society*, Vol. 38, pp. 347-366.
6. Baron, R. (2000). Counterfactual thinking and venture formation: the potential effects of thinking about "what might have been". *Journal of Business Venturing*, Vol. 15, pp. 79-91.
7. Baron, R. (2008). The role of affect in the entrepreneurial process. *Academy of Management Review*, Vol. 33, No. 2, pp. 328-340.
8. Baron, R.A., Tang, J. (2011). The role of entrepreneurs in firm-level innovation: Joint effects of positive affect, creativity, and environmental dynamism. *Journal of Business Venturing*, Vol. 26, Iss. 1, pp. 49-60.
9. Bernoster, I., Mukerjee, J., Thurik, R. (2020). The role of affect in entrepreneurial orientation. *Small Business Economics*, Vol. 54, pp. 235-256.
10. Cacioppo, J., Gardner, W. (n.d.). Emotion. *Annual Review of Psychology*, No. 50, pp. 191-214.
11. Cardon, M., Zietsma, C., Saporito, P., Matherne, B., Davis, C. (2005). A tale of passion: new insights into entrepreneurship from a parenthood metaphor. *Journal of Business Venturing*, Vol. 20, pp. 23-45.
12. Cherniss, C. (2010). Emotional intelligence: toward clarification of a concept. *Industrial Organizational Psychology*, Vol. 3, Iss. 2, pp. 110-126.
13. Cross, B., Travaglione, A. (2003). The untold story: Is the entrepreneur of the 21st century defined by emotional intelligence? *The International Journal of Organizational Analysis*, Vol. 11, pp. 221-228.
14. Diener, E., Oishi, S., Lucas, R.E. (2003). Personality, culture, and subjective well-being: emotional and cognitive evaluations of life. *Annual Review Psychology*, Vol. 54, pp. 403-425.

15. Dijkhuizen, J., Gorgievski, M., van Veldhoven, M., Schalk, R. (2018). Well-being, personal success and business performance among entrepreneurs: a two-wave study. *Journal of Happiness Studies*, Vol. 19, pp. 2187-2204.
16. Drabik, E., Drabik, I. (2009). Rozumienie emocji jako gwarancja racjonalnych zachowań uczestników rynków finansowych. *Ekonomia i Organizacja Gospodarki Żywnościowej. Zeszyty Naukowe SGGW*, No. 73, p. 37.
17. Foo, M.D., Uy, M.A., Baron, R.A. (2009). How do feelings influence effort? An empirical study of entrepreneurs' affect and venture effort. *Journal of Applied Psychology*, Vol. 94, pp. 1086-1094.
18. Forgas, J.P., George, J.M. (2001). Affective Influences on Judgments and Behavior in Organizations: An Information Processing Perspective. *Organizational Behavior and Human Decision Processes*, Vol. 86, Iss. 1, pp. 3-34.
19. Gerrig, R.J., Zimbardo, Ph.G. (2009). *Psychologia i życie*. Warszawa: PWN.
20. Goleman, D. (1997). *Inteligencja emocjonalna*. Poznań: Media Rodzina.
21. Goss, D. (2005). Entrepreneurship and "the social": towards a deference-emotion theory. *Human Relations*, Vol. 58, pp. 617-636.
22. Goss, D. (2007). Enterprise ritual: a theory of entrepreneurial emotion and exchange. *British Journal of Management*, Vol. 19, pp. 120-137.
23. Granovetter, M. (1985), Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, Vol. 91, pp. 481-510.
24. Grichnik, D., Smeja, A., Welpel, I. (2010). The importance of being emotional: How do emotions affect entrepreneurial opportunity evaluation and exploitation? *Journal of Economic Behavior & Organization*, Vol. 76, Iss. 1, pp. 15-29.
25. Hachana, R., Berraies, S., Ftiti, Z. (2018). Identifying personality traits associated with entrepreneurial success: Does gender matter? *Journal of Innovation Economics & Management*, Vol. 27, pp. 169-193.
26. Hmieleski, K.M., Baron, R.A. (2009). Entrepreneurs' optimism and new venture performance: A social cognitive perspective. *Academy of Management Journal*, Vol. 52, pp. 473-488.
27. Ingram, A., Peake, W.O., Stewart, W., Watson, W. (2019). Emotional intelligence and venture performance. *Journal of Small Business Management*, Vol. 57, pp. 780-800.
28. Isen, A.M. (2001). An Influence of Positive Affect on Decision Making in Complex Situations: Theoretical Issues With Practical Implications. *Journal of Consumer Psychology*, Vol. 11, Iss. 2, pp. 75-85.
29. Lazarus, R. (1991). *Emotion and Adaption*. Oxford: Oxford University Press.
30. Mayer J.D., Salovey, P. (1997). *What is Emotional Intelligence? Emotional Development and Emotional Intelligence: Implications for Educators*. New York: Basic Book.

31. Olszewska, S. (2013). Oddziaływanie emocji i skłonności poznawczych inwestorów na podejmowanie decyzji finansowych. *Studia Zarządzania i Finansów Wyższej Szkoły Bankowej w Poznaniu, No. 5*, p. 33.
32. Plutchik, R. (1980). *Emotion: A Psychoevolutionary synthesis*. Michigan: Harper and Row.
33. Slaski, M., Cartwright, S. (2002). Health, performance and emotional intelligence: an exploratory study of retail managers. *Stress and Health, Vol. 18*, pp. 63-68.
34. Smelser, N., Swedberg, R. (2005), *The handbook of economic sociology*. New Jersey: Princeton University Press.
35. Szczepaniec, M., Kulawczuk, P., Jurkiewicz, T. (2021). *Finanse behawioralne mikro, małych i średnich przedsiębiorstw. Jak unikać błędów w biznesie i podejmować optymalne decyzje*. Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego.
36. Tiwari, P., Bhat, A.K., Tikoria, J. (2017). An empirical analysis of the factors affecting social entrepreneurial intentions. *Journal of Global Entrepreneurship Research, Vol. 7*, pp. 1-25.
37. Tsaousis, L., Nikolaou, L. (2005). Exploring the relationship of emotional intelligence with physical and psychological health functioning. *Stress and Health, Vol. 21*, pp. 77-86.
38. Weiss, H. (2002). Deconstructing job satisfaction: separating evaluations, beliefs and affective experiences, *Human Resource Management Review No. 12*, pp. 173-194.
39. Zielonka, P. (2011). *Gięda i psychologia*. Warszawa: CeDeWu.

BENEFITS AND LIMITATIONS OF IMPLEMENTING THE ISO 9004:2018 STANDARD

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Purpose: The paper's main objective is to indicate the current state of knowledge regarding the results of implementing the ISO 9004:2018 standard, with a particular focus on identifying the potential benefits and limitations of its implementation. The study is in line with the research stream on improving quality management systems and striving for sustainable market success.

Design/methodology/approach: The paper is based on a narrative literature review through analysis of the publications available in scientific databases. It was then combined with the method of scientific reflection.

Findings: The paper highlights the opportunities that the implementation of the ISO 9004:2018 standard and its integrated self-assessment model offer to organisations. The analysis also revealed limitations associated with the implementation of the standard's recommendations.

Practical implications: The research contributes to the development of knowledge in the practical application of the standard and the self-assessment model. It can serve as a reference point for practitioners and scholars interested in the aforementioned subject matter.

Originality/value: The originality of the paper lies in its comprehensive analysis of the requirements of the ISO 9004:2018 standard, addressing significant issues both for the academic environment and practitioners in the field of quality management. The study highlights the benefits of applying the self-assessment model, and outlines the challenges associated with its implementation.

Keywords: ISO 9004:2018 standard, self-assessment model, quality improvement, sustainable success.

Category of the paper: Literature review.

1. Introduction

Operating in the current uncertain and dynamically changing environment requires organisations to maintain continuous readiness to implement changes aimed at improvement. This is a consequence of external market, financial and socio-legal changes, as well as changes occurring within the organisation. As a result of changes in customer preferences, the diversity

of products is increasing, and new expectations are continually emerging. Improvement focused on enhancing the ability to meet quality requirements is deeply ingrained in modern quality management systems. It finds its place among the seven principles of ISO 9001:2015. Improvement can also be seen as a distinguishing factor in a competitive market and in the process that ensures an organisation's sustained success. In this context, it seems justified to refer to the use of the recommendations of ISO 9004:2018, which enable the identification and assessment of areas requiring improvement, the implementation of innovative solutions, and the enhancement of the maturity level of the quality management system. The current version of ISO 9004:2018 was published in 2018 and provided guidelines for improving both quality management systems and actions taken throughout the organisation. Simultaneously, in comparison to ISO 9001:2015, it offers a broader perspective on the improvement process.

The available research provides partial knowledge regarding organisations' experiences in implementing the guidelines of ISO 9004:2018, which is much less frequently analysed in scientific publications than ISO 9001:2015 (Rogala, 2020, p. 130). This topic is insufficiently understood, creating a significant research gap that directed the aim of this study, that is the characterization of the content of ISO 9004:2018 and the identification of the benefits and limitations of its application in the practices of various organisations.

The objective outlined above guided the structure of the article. The first part characterizes ISO 9004:2018, followed by a presentation of the adopted research methodology. The subsequent section describes the potential benefits arising from the application of ISO 9004:2018, as well as its limitations. The article concludes with the research findings, and provides recommendations for the future.

2. Characteristics of the ISO 9004:2018 standard in the context of using the excellence model

The ISO 9004:2018 standard is often presented as a kind of complement to the requirements contained in the ISO 9001:2015 standard, but can also be used independently of it. Its content is helpful in the correct interpretation of the requirements contained in ISO 9001:2015, e.g. by including explanations or examples of actions required to meet these requirements (Rogala, 2020, p. 115). It contains tips on improving and expanding quality management systems already implemented in organisations, in accordance with the requirements of the ISO 9001 standard (Hoyle, 2018). It is recommended for organisations undertaking improvement activities that want to go beyond the guidelines contained in ISO 9001. It comprises a set of tips for improving the organisation, and guidelines for assessing the effectiveness and efficiency of its operations. It is also used to identify opportunities to make

improvements and innovations, as well as achieve long-term, sustainable success by ensuring the satisfaction of stakeholders and other interested parties (Asif, 2020).

It is said that while ISO 9001:2015 focuses on providing confidence regarding the manufacturing of products and/or the delivery of services, ISO 9004:2018 concentrates on providing confidence related to the organisation's ability to achieve sustained success (Łańcucki, 2019).

The nature of the standard has changed over the years. Currently, after the update, there is a strong emphasis on ensuring sustained success (Bravi, Murmura, 2021), meaning success that endures continuously in a complex, competitive and constantly changing environment, and is related to the seven quality management principles described in ISO 9000:2015. The updated standard from 2018 ensures compliance with the concepts and terminology of ISO 9000:2015 and ISO 9001:2015. It places a strong focus on the concepts of "organisational quality" and "organisational identity" (Łańcucki, 2019).

The standard provides guidelines that enable organisations to enhance their capability to achieve sustained success in a demanding, complex and ever-changing environment by relying on the organisation's ability to meet the needs and expectations of customers and other interested parties. These guidelines align with the principles of quality management outlined in ISO 9001:2015. Sustained success for an organisation can be achieved through effective organisational management, awareness of environmental needs, continuous learning, proper implementation of improvements, and the introduction of innovations (Soare et al., 2019). According to the standard, a mature organisation achieves sustained success by:

- understanding and meeting the needs and expectations of customers and other interested parties,
- monitoring changes in the organisation's environment,
- identifying potential areas for improvement, learning and innovation,
- defining and implementing strategies and objectives,
- managing processes and resources,
- building trust among employees, which should lead to greater engagement,
- establishing favourable relationships with suppliers and other organisations in the environment.

The guidelines contained in the standard can be used by any organisation, regardless of its size, type and type of business. However, unlike ISO 9001, the standard is not an inseparable set of guidelines; the guidelines contained therein can be used depending on the needs and capabilities of the organisation. The standard is also not intended for certification or to be referred to in relations with other entities, e.g. when concluding contracts, selecting suppliers, etc. (Rogala, 2020).

It can be observed that the standard influences both the tangible and intangible aspects of the organisation. It pertains not only to products and processes but also to the organisational structure, management system, human capital, cultural aspects, infrastructure, environment and relationships with stakeholders (Castka, Corbett, 2015). According to its content, it would be desirable for continuous improvement to become an integral part of the organisational culture and for all employees to be actively involved in the quality improvement process. However, quality improvement that leads to sustained success requires investing in training, building trust in top management, and creating incentives for participation in improvement and suggesting ideas for changes. In this regard, ISO 9004:2018 recognizes learning as the foundation for an effective and efficient improvement process and the introduction of innovative solutions (Jarvis, Palmy, 2018).

The standard pertains to systematic ways of continuously improving the overall performance of organisations operating in a dynamic environment. It also proposes a self-assessment tool. Its crucial sections are chapters 4 to 11. These chapters present guidelines for achieving sustained success for the organisation, which can be treated as criteria for business excellence. These guidelines are comprehensive in nature, meaning they encompass all relevant aspects related to the functioning of the organisation (Hoyle, 2018). The structure of ISO 9004:2018, is depicted in Figure 1, which highlights the key elements and the relationships between them.

Since the year 2000, a consistent element of the ISO 9004 standard has been the self-assessment questionnaire for organisations. In the 2018 version of the standard, this questionnaire is included in Annex A. It provides a comprehensive and detailed discussion of self-assessment tools, allowing organisations to assess the maturity level of their quality management system and to identify and prioritize potential areas for improvement (ISO 9004:2018). The systematic process of improving the overall performance of the organisation involves activities related to planning, implementation, analysis, evaluation and assessment of the effectiveness and efficiency of the management system.

In the current version of the standard, this annex consists of four parts: general provisions, maturity model, self-assessment of specific elements, and the application of self-assessment tools. By conducting a self-assessment using ISO 9004:2018, a general overview of the organisation's effectiveness can be gained, as well as the maturity level of its management system. The description and predefined criteria can be applied in the overall diagnosis of the organisation, and the results obtained in this way can serve as a basis for decision-making regarding organisational improvement (Rogala, 2020). Self-assessment can help identify areas requiring improvement and/or innovation, as well as determine priorities for subsequent actions. It aids in determining the organisation's maturity level, and if repeated, the progress achieved (its results) can contribute valuable insights to management reviews. Self-assessment also has potential as a learning tool, providing better outcomes for the organisation, promoting stakeholder engagement, and supporting the overall planning efforts of the organisation (Soare et al., 2019).

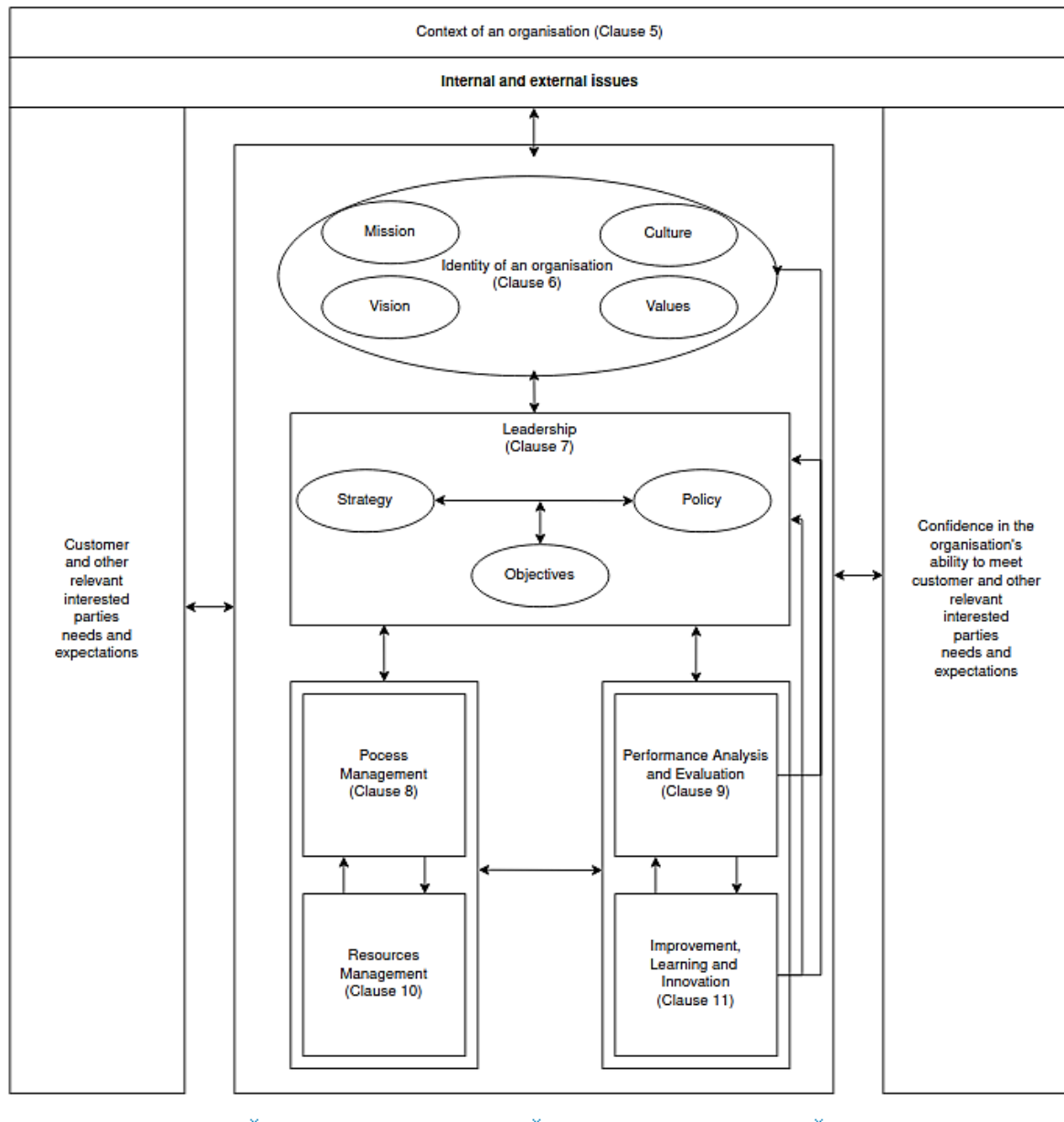


Figure 1. Model of guidelines and relationships included in the ISO 9004:2018 standard.

Source: International Standard ISO 9004:2018, Quality management - Quality of an organization - Guidance to achieve sustained success, <https://cdn.standards.iteh.ai/samples/70397/d62feac7c8b741a0927de13b1a76ead7/ISO-9004-2018.pdf>, 2.02.2024.

ISO 9004:2018 can be applied in various contexts (Horvat, Filipovic, 2018; Kuo, Tsai, 2019). It takes into account all internal and external resources, enhances customer focus, and is oriented towards meeting the needs of various stakeholders. Considering the diverse interests of different stakeholders, it recommends identifying the needs of individual parties and then attempting to reach a compromise in meeting those needs through risk analysis. For this reason, there is reference to ISO 31000:2009 Risk Management - Principles and Guidelines, which is considered a related standard to ISO 9004:2018 (Żuchowski, Łagowski, 2019). ISO 9004:2018 provides detailed instructions for organisational development, focusing on improving efficiency (Krajcsák, 2019). It is strongly oriented towards the goals of the

organisation and its environment, as well as the sustainable development of the organisation, as it is associated with sustained success. Sustained success is closely related to a qualitative orientation based on continuous improvement of processes and, consequently, products. It can be considered a tool for supporting the concept of continuous improvement, emphasizing a process-oriented approach. Its broad and flexible perspective on organisational strategy supports processes in creating a coherent system in economic, environmental and social spheres.

3. Methodology

The aim of the article is to indicate the current state of knowledge regarding the effects of implementing the ISO 9004:2018 standard, with a particular focus on identifying the potential benefits and limitations of its adoption. The article conducts an analysis of available publications, combining it with scholarly reflection. In attempting to identify what has been written on the subject, a narrative literature review methodology was applied. A narrative literature review summarizes previously published research on a given topic, focusing on concepts and theories, research methods and research findings. It mainly involves the collection and synthesis of existing literature, providing a comprehensive report on the current state of knowledge in the researched area. A narrative literature review is a significant part of the research process and helps establish theoretical frameworks as well as the direction or context for future research (Pautasso, 2019).

The subjective and selective choice of publications presenting the current state of knowledge (Paré et al., 2015) can have significant implications for analysing a specific issue. Its results can also justify the need for broader research. Its application requires maintaining proper research rigor and clarity of communication (Ferrari, 2015). Taking these requirements into account, the literature review adopted the following selection criteria:

- the complexity of the addressed subject matter, which led to the search for publications that comprehensively presented issues related to the application of the ISO 9004:2018 standard,
- the significance of the publication, measured by the number of citations, as well as its position among influential journals in the field of quality management and organisational improvement,
- accessing publications that integrate the topics of applying the ISO 9004:2018 standard, implementing the excellence model outlined in the ISO 9004:2018 standard, the achieved effects, and the identified limitations.

The literature searches, both in Polish and English, were carried out in the Scopus, EBSCO and WoS scientific databases. A search on August 28, 2023 for the phrase *ISO 9004:2018 model of excellence* did not yield any studies. Therefore, a query was built using the elements "ISO 9004:2018" AND "model of excellence". In this way, a total of 29 references were found.

Due to the fact that research results were sought on the application of the ISO 9004 standard amended in 2018, the results were verified and only publications issued in 2018-2023 were accepted for further analysis. When analysing the abstracts and then the full texts, the focus was mainly on those publications that not only described the ISO 9004:2018 standard, but above all contained research results relating to the effects of its application.

The second stage of literature selection was based on supplementing the database using the "snowballing" method, which involves incorporating articles from the literature references in the first layer of literature (Czakov, 2011).

By employing the described stages, a database of 39 publications was obtained, which was then subjected to verification through review of the abstracts. In this way, the texts were categorized into those directly related to the researched topic, those partially related, and those weakly associated with the research topic. Only the layer directly related to the researched topic underwent a detailed text analysis.

Ultimately, in-depth analysis was conducted on 21 publications, identified based on the examination of abstracts that aligned with the researched topic. The limited number of publications meeting the search criteria indicates that the researched topic is not widely discussed in the literature. These publications cover the period from 2018 onwards. Analysing their content allowed for identification of the benefits and limitations arising from the application of the ISO 9004:2018 standard.

4. Research results. Benefits from applying the ISO 9004:2018 standard

Having analysed the results of the research conducted by the authors, it can be concluded that one of the values of the ISO 9004:2018 standard is that its guidelines correspond with the requirements of ISO 9001. Both these standards are mutually complementary, ISO 9001:2015 emphasising performance measurement and ISO 9004:2018 focusing on improvement aspects.

The excellence model proposed in ISO 9004:2018 provides organisations with a multitude of opportunities and – if properly applied – can yield numerous benefits. The model is described as a set of guidelines for achieving sustained success in a volatile and challenging business environment. In a long-term perspective, the model implementation makes organisations capable of meeting the needs and expectations of customers and other stakeholders (Anttila, Jussila, 2021). It serves to identify opportunities for improvement and innovation as well as to pursue long-lasting and sustained success by striving for satisfaction of numerous stakeholders

(Asif, 2020; Kuo, Tsai, 2019). Another major advantage of the ISO 9004:2018 excellence model is being universal and comprehensive in nature.

ISO 9004:2018 can be applied in all kinds of organisations, irrespective of their size, type, industry, or environmental conditions (Anttila, Jussila, 2021). The guidelines defined in the standard refer to a variety of elements such as products, processes, organisational structure, management system, human aspects, cultural aspects, infrastructure, environment, and stakeholder relations. As such, the standard does not focus on product or service quality exclusively, but takes the comprehensive organisation context into account. Therefore, it is emphasised that the standard can help organisations to pursue success by way of an integrated process approach, considering diverse managerial needs.

Organisations typically follow customised quality management system implementation strategies, which they develop having analysed their competition, experience to date, and business practices in place. According to ISO 9004:2018, an organisation's identity and distinctive competitive advantages provide grounds for both the quality it offers and its sustained success. The standard's guidelines are universal enough to leave the organisation free to choose the solutions and tools it finds adequate given the specificity of its operations. The foregoing implies that the standard is in fact flexible in nature, encouraging effective implementation of the quality principles in a manner tailored to the specific needs and challenges of the organisation.

It is fairly evident that the implementation of the ISO 9004:2018 standard is complementary towards the Total Quality Management (TQM) approach. Following the premises of ISO 9004:2018 makes it significantly easier to implement the TQM principles, linking deployment of innovation with the TQM culture. While TQM requires high commitment from leaders, the key to the success of ISO 9004:2018 is to acquire and sustain effective and normative employee engagement and customer loyalty (Krajcsák, 2019). An attempt to introduce the TQM culture entails major organisational changes and making all employees committed to the concept of quality management, but it also requires support from top management. On the one hand, the ISO 9004:2018 standard enables a holistic view of quality, and on the other hand, it leaves much freedom of action and space for flexibility. It helps in maintaining stability and continuity of operations in various situations as well as in adapting to volatile business conditions.

The standard's guidelines, aimed at sustained success, can be applied to examine the maturity of Industry 4.0, of which Quality 4.0 is an integral part. One can use the ISO 9004 excellence model to assess Quality 4.0, but it may also serve as a baseline for drawing up a *roadmap* for Quality 4.0 (Glogovac et al., 2022).

According to some researchers, there is also a connection between ISO 9004 and striving for sustainable development of Q4.0 (Glogovac et al., 2022). The implementation of processes in an organisation aiming at sustainable success draws its strength from the organisation's own identity, as described in Chapter 6 of the standard, which comprises the mission, vision, values,

and culture (Żuchowski, Łagowski, 2019). The standard encompasses aspects such as the environment, corporate social responsibility, occupational health and safety, as well as innovation. All these elements can be combined in a number of process-oriented ways, while their interactions, as the ISO 9004:2018 standard suggests, can exert a synergistic effect on the pursuit of sustainable development goals. Chapter 7.2 of the standard advises the managers responsible for improvement actions to consider aspects such as quality, environment, energy, employment, as well as occupational health and safety, implying that they should pursue green governance (Żuchowski, Łagowski, 2021). Section 7.3 recommends that, when attempting to define and maintain goals, the senior management should consider and determine, based on their policy and strategy, the extent to which the organisation wants stakeholders to recognise it as a leader with a positive economic, environmental, and social impact.

An important advantage of the standard is that it provides guidelines for systematic and continuous performance improvement, and by that means, for improving the organization's profitability, regardless of the type, magnitude or specific nature of its operations (Tsai et al., 2017). A tool that may come in handy when attempting to measure the existing maturity level of the organisation's Quality Management System (QMS) is a self-assessment questionnaire, which allows managers to accurately determine strengths and weaknesses, and to identify priority areas for improvement (Wolniak, 2019). The self-assessment results provide a prompt to deploy improvement measures.

The content of the standard emphasises continuous learning and improvement, both at the level of an individual person and the organisation in its entirety. It supports a creative approach to problem solving and encourages innovation, which can help organisations to attain better outcomes and improve efficiency. What also contributes to improving the efficiency and effectiveness of organisations is the implementation of risk management, which creates an opportunity to respond quickly to unforeseen situations and to find solutions making it possible to attain the business goals previously set. The standard also emphasises the relevance of collaboration, teamwork, and communication, both within the organisation and with external stakeholders. It states that exchange of information, experience, and resources can contribute to a more effective pursuit of the organisation's goals.

Organisations that know and apply the ISO 9004:2018 guidelines derive measurable benefits from such efforts. These benefits may be perceived differently depending on the organisation's size, operational specifics, or industry. Some Italian businesses subject to a survey (Bravi, Murmura, 2021) declared that, having followed the ISO 9004:2018 guidelines, they had managed to improve their self-assessment activities, streamlined their organisational structure, and raised the awareness of corporate sustainability. Furthermore, the findings of the survey in question imply such effects as improved quality, increased competitiveness, and transition to the Total Quality Management (TQM) system. The aforementioned research has demonstrated slightly different benefits derived from implementing ISO 9004:2018,

depending on the business size. In large enterprises, those participating in the survey mainly mentioned streamlining the organisational structure and achieving sustained business success, while micro-enterprises observed varying benefits, such as a self-assessment opportunity and – similarly to large enterprises – attaining sustained business success.

A study conducted in Serbia (Glogovac et al., 2022), on the other hand, has indicated that the implementation of the ISO 9004:2018 maturity model can lead an organisation to success in various areas of operations, such as leadership, process management, resource management, as well as performance analysis and evaluation. The researchers have concluded that the ISO 9004:2018 guidelines can provide grounds for assessing the level of quality maturity under Industry 4.0. Some other benefits they have observed include identification of the opportunities for improvement and innovation, achieving sustained success, and improved satisfaction of various stakeholders.

5. Limits to the application of the ISO 9004:2018 standard

Research results also imply that there are certain limits to the implementation of the ISO 9004:2018 recommendations and guidelines. It is rather evident that the ISO 9004:2018 standard is both applied in practice and analysed in academic studies much less frequently than ISO 9001:2015 (Rogala, 2020). The lesser awareness of the ISO 9004 standard can be attributed to the fact that ISO 9004 is not subject to certification. The study by Jarvis and Palmes (2018) indicates that many organisations find the certificate award itself to be their primary goal, while the matters of quality culture building and continuous improvement are considered secondary. What may hinder the application of the standard's guidelines under Polish conditions is also the fact that there is still no Polish translation of the standard.

ISO 9004:2018 is also characterised by being relatively least constant in the specific function which it performs compared to the other ISO standards of the 9000 series. It has changed in nature over the years. Although it can be implemented independently of ISO 9001, its high utility value is observed primarily when both are applied in combination. However, the structures of these documents are not organised enough. They do not indicate explicitly which guidelines are duplicated, which extend one another, and which address additional matters not specifically addressed in ISO 9001. And even though the current version of the standard is clearly oriented towards achieving sustained success over the long term, the guidelines it contains are formulated very much like the ISO 9001 requirements pertaining to the quality management system. What also proves important is that these standards were updated in different years. Consequently, not until 2018 had it been possible to implement them in a complementary manner. Between 2015 and 2018, there were two different views of quality management in place (Rogala, 2020). Another limitation is that ISO 9004:2018 highlights what

an organisation should attain, but it does not explain how to accomplish that and is not specific as to what tools to employ in which situations. This ambiguity in the relationship between the standards as well as the overly generic nature of their recommendations can now be perceived as a serious limitation to the application of ISO 9004:2018.

With reference to a practical use case of the standard, the surveys conducted among the Italian companies imply a low level of familiarity with the ISO 9004 standard among managers (Bravi, Murmura, 2021). Surprisingly, only 11.2% of the businesses surveyed claimed that they were familiar with the standard, while 17.2% were only partially familiar with it, and 71.6% knew nothing about it. Among the knowledgeable respondents, only 11.8% complied with the standard, while 37.7% did so partially, and 50.4% did not follow the principles of the standard in question. Further results of the same survey indicate that the requirements of ISO 9004:2018 were primarily of interest to medium-sized companies. It was also observed that the degree of familiarity with the standard's guidelines depended on how much time had elapsed since the award of the ISO 9001 QMS certificate. A higher level of familiarity with the requirements of ISO 9004 was characteristic of businesses with more experience using a certified quality management system. That seems to be completely reasonable because, as organisations mature, they seek to improve the system they have implemented and look for new opportunities.

What also matters is the organisation size (Bravi, Murmura, 2021), since larger companies tend to have a more mature quality management system in place. In large businesses, one can observe continuous improvement to be introduced once the implementation of the quality management system is complete. Small enterprises pursuing QMS certification are driven by different rationale. Their efforts are primarily determined by an intent to achieve a better position, for instance, when applying for funding of their operations from external sources. For this reason, the recommendations provided in ISO 9004:2018 are implemented less frequently in small businesses. Large enterprises can be claimed to display more motivation to implement and improve their QMS, and therefore, these organisations may be particularly interested in following the requirements of the ISO 9004:2018 standard. Large businesses are also more capable in terms of human resources, technology, and financing. Furthermore, their managers are often more aware of the need to improve the organisation and strive for higher levels of process and product quality.

Even though the standard is considerably universal, it can also be considered somewhat inflexible (Glogovac et al., 2022) and lacking the capacity to adapt to certain organisation-specific circumstances, which applies, for instance, to SMEs and start-ups, where the pursuit of excellence is not the primary goal. Using a self-assessment questionnaire is only reasonable in those organisations which truly care about reaching a high maturity level. However, maturity itself is not a business goal which ensures sustained success, irrespective of the organisation type. Businesses representing the SME sector, and small companies as well as start-ups in particular, may be uninterested in pursuing maturity in quality terms. In operation, they tend to rely more on developing agility than on striving for maturity and continuous revitalisation

(Anttila, Jussila, 2021). Another limitation mentioned in the literature on the subject (Bravi, Murmura, 2021) is the implementation process perceived as complex compared to the requirements of ISO 9001:2015.

6. Conclusions

This article represents an overall body of research on quality management system improvement and addresses the pursuit of sustained market success. The study results upon which it comments can function as a reference for practitioners and researchers interested in the aforementioned subject. The ISO 9004:2018 standard at large and the excellence model it contains in particular offer many opportunities to organisations. The potential benefits they may acquire are quite numerous and diverse, and some of them are as follows:

1. Orientation towards sustainable development considering various aspects of the organisation's sustainability;
2. Improved satisfaction of customers and other stakeholders, attributable to a holistic view of quality, continuous collaboration, and development of communication focused on exploring and meeting the needs and requirements of all the organisation's stakeholders;
3. Increased operational efficiency and effectiveness, attained through continuous improvement, innovation deployment, and focus on processes, which enables organizations to be more effective pursuing their business objectives and striving for better results;
4. Flexible quality management that allows organisations to respond adequately to changing internal and external conditions as well as to stakeholder needs and expectations;
5. Focus on risk management, which helps organisations to recognise areas of uncertainty and to respond effectively to them.

Despite the vast array of benefits, as identified above, the degree of uptake of the standard appears to be relatively low. The analysis referred to in the article has also revealed other limitations accompanying the implementation of the ISO 9004:2018 recommendations. These include:

1. Low level of awareness of the standard's guidelines among organisations;
2. Complicated implementation process compared to ISO 9001:2015;
3. Ambiguous relationship between ISO 9004:2018 and ISO 9001:2015;
4. Rigidity and lack of capacity to adapt to specific conditions of a given organisation;
5. Lack of interest in pursuing quality maturity by some organisations;
6. Lack of a Polish translation of the standard, relevant under the domestic conditions.

Although the research completed to date has contributed to further development of knowledge by delivering practical information, it has also been encumbered with some limitations, which, however, can be eliminated in future research. They are mainly attributable to the research method applied as well as the nature of the study, being a review. The benefits of and limits to the implementation of the ISO 9004:2018 standard, as observed, do not take a number of aspects into account, such as the specifics of organisations, their size, type of business, industry, or maturity of quality management systems. Neither the specific needs nor the context of organisations are insignificant. Given the research results obtained, a prospect worth considering is exploratory qualitative research using in-depth interviews with managers. What also seems as an interesting option is a comparative analysis concerning organisations at different levels of quality maturity.

References

1. Anttila, J., Jussila, K. (2021). ISO 9004 - A stimulating quality management standard for the creative leaders of contemporary sustainable organizations. *Production Engineering Archives*, 27(2), 148-155. <https://doi.org/10.30657/pea.2021.27.19>.
2. Asif, M. (2020). Are QM models aligned with Industry 4.0? A perspective on current practices. *Journal of Cleaner Production*, 258, <https://doi.org/10.1016/j.jclepro.2020.120820>.
3. Bravi, L., Murmura, F. (2022). Evidences about ISO 9001: 2015 and ISO 9004: 2018 implementation in different-size organisations. *Total Quality Management & Business Excellence*, 33(11-12), 1366-1386. <https://doi.org/10.1108/TQM-11-2016-0097>.
4. Castka, P., Corbett, C.J. (2015). Management systems standards: Diffusion, impact and governance of ISO 9000, ISO 14000, and other management standards. *Information and Operations Management*, 7(3-4), 161-379. <https://doi.org/10.1561/02000000042>.
5. Czakon, W. (2011). Metodyka systematycznego przeglądu literatury. *Przegląd Organizacji*, 3, 57-61.
6. Ferrari, R. (2015). Writing narrative style literature reviews. *Medical writing*, 4(4), 230-235. <https://doi.org/10.1179/2047480615Z.000000000329>
7. Glogovac, M., Ruso, J., Milica, M. (2020). ISO 9004 maturity model for quality in industry 4.0. *Total Quality Management and Business Excellence*, 33(5-6), 529-547. <https://doi.org/10.1080/14783363.2020.1865793>.
8. Glogovac, M., Ruso, J., Arsic, S., Rakić, A., Milošević, I. (2022). Leadership for Quality 4.0 Improvement, Learning, and Innovation. *Engineering Management Journal*, 35(3), 313-329. [10.1080/10429247.2022.2108668](https://doi.org/10.1080/10429247.2022.2108668).

9. Horvat, A., Filipovic, J. (2018). Service quality and maturity of health care organizations through the lens of complexity leadership theory. *Journal of Evaluation in Clinical Practice*, 24(1), 301-307. <https://doi.org/10.1111/jep.12789>.
10. Hoyle, D. (2018). *ISO 9000 Quality Management System*. Taylor & Francis.
11. <https://cdn.standards.iteh.ai/samples/70397/d62feac7c8b741a0927de13b1a76ead7/ISO-9004-2018.pdf> pdf, 2.02.2023.
12. Implementation of an information platform system (2017). *Journal of Organizational Change Management*, 30(7), 1093–1108. <https://doi.org/10.1108/JOCM-03-2017-0048>.
13. Jarvis, A., Palmes, P.C. (2018). *Business sustainability: Going beyond ISO 9004:2018*. ASQ Quality Press.
14. Krajcsák, Z. (2019). Implementing open innovation using quality management systems: The role of organizational commitment and customer loyalty. *Journal of Open Innovation: Technology, Market, and Complexity*, 5(4), 90. <https://doi.org/10.3390/joitmc5040090>.
15. Kuo, T., Tsai, G.Y. (2019). The effects of employee perceived organisational culture on performance: The moderating effects of management maturity. *Total Quality Management & Business Excellence*, 30(3-4), 267-283. <https://doi.org/10.1080/14783363.2017.1302327>
16. Łańcucki, J. (ed.) (2019). *Systemy zarządzania w znormalizowanym świecie*. Poznań: Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu.
17. Negron, L.A. (2020). Relationship between quality management practices, performance and maturity quality management, a contingency approach. *Quality Management Journal*, 27(4), 215-228. <http://doi.org/10.1080/10686967.2020.1809582>.
18. Paré, G., Trudel, M.C., Jaana, M., Kitsiou, S. (2015). Synthesizing information systems knowledge: A typology of literature reviews. *Information & Management*, 52(2), 183-199. <http://doi.org/10.1016/j.im.2014.08.008>.
19. Pautasso, M. (2019). The Structure and Conduct of a Narrative Literature Review. In: *A Guide to the Scientific Career* (pp. 299-310). New York: Wiley. <http://doi.org/10.1002/9781118907283.ch31>.
20. Rogala, P. (2020). *Nurt normalizacyjny w zarządzaniu jakością*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.
21. Soare, I., Rusu, M., Militaru, C. (2019). Model for self-assessment of an organization's ability to achieve sustained success. *INCAS Bulletin*, 11(3), 229-237. <https://doi.org/10.13111/2066-8201.2019.11.3.20>.
22. Tsai, G.Y., Kuo, T., Lin, L-C. (2017). *The moderating effect of management maturity*.
23. Wolniak, R. (2019). The level of maturity of quality management systems in Poland - results of empirical research. *Sustainability*, 11(15), 4239. <https://doi.org/10.3390/su11154239>.
24. Żuchowski, J., Łagowski, E. (2019). Standard Solutions in Realisation of Sustainable Development Objectives. *Towaroznawcze Problemy Jakości*, 2, 15-24.
25. Żuchowski, J., Łagowski, E. (2021). Normalizacja w realizacji celów jakościowych koncepcji European Green Deal. *Problemy Jakości*, 7-8, 11-17.

ARE DIVIDENDS IMPACTED BY THE TIMING OF MACRO DATA RELEASES? CASE OF WIG, DAX AND S&P500

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Purpose: This paper attempts to reveal, on the one hand, whether dividend paid by dividend-paying companies from the WIG, DAX and S&P500 indices for the period 2017-2022 were characterized by positive dynamics of change in real terms, and whether decisions on the level of dividends recommended for payout are more determined by macroeconomic factors from the end of the year, in which the company generated financial results, or from the period, in which dividend decisions were made.

Design/methodology/approach: The research objective of this paper is accomplished by means of a thorough literature analysis. In the area of statistical methods, the authors refer to classical methods of correlational analysis, with a focus on non-parametric methods (Spearman's rho and Kendall's tau).

Findings: The analyses carried out made it possible to indicate that, for companies listed on the FSE and WSE, the only quantity correlated with changes in dividends paid is the PMI index, with a negative correlation for Polish companies and a positive one for German companies. This correlation occurs only if one considers December macroeconomic data readings. On the other hand, for NYSE-listed entities, statistically significant relationships were obtained for the PMI index (negative), the inflation rate (negative) and interest rates (positive). With the exception of interest rates, the correlations apply to both December readings and those from May of the dividend payout year. At the same time, the results indicate different decisions made by the boards of US, German and Polish companies in the face of the SARS-CoV-2 pandemic.

Research limitations/implications: The study was conducted on a limited number of analyzed companies and for a limited time range. Therefore, it could be biased, due to the deterministic stock sampling method and the research period.

Practical implications: Expanded knowledge of the impact of the timing of publication of macroeconomic parameters on decisions on dividend payouts and their amount. This knowledge is important for both investors and investment funds' boards. Consequently, one can make better investment decisions.

Social implications: Among the paper's social implications, the most important appears to be a possible change in the investors' attitude towards dividend-paying companies that not only pay dividends systematically, but also have positive dynamics of change, and the realization

that dividend decisions are affected not only by a number of determinants, but also by the timing of their occurrence. Ultimately, investors' needs could be better addressed.

Originality/value: The paper evaluates the impact of macroeconomic determinants on changes in dividend payouts by companies for the period 2017-2022. What is new in the paper is the analysis of whether the timing of the publication of macroeconomic parameters significantly affects the level of dividends paid, thereby filling our knowledge gap.

Keywords: dividend-paying companies, determinants of dividend policy, macroeconomic indicators, inflation.

Category of the paper: Research paper.

1. Introduction

A dividend paid by a company is a confirmation that the board is properly carrying out its responsibilities in managing the company, and thus acting in the interests of stockholders, while a systematically paid dividend is also a form of stockholder pressure on the board (Skousen, 2011, pp. 145-148). Therefore, analyzing the signals coming from the boards of companies, especially dividend aristocrats, is in the interest of not only institutional investors, but also long-term individual investors. One of the tools influencing the type of dividend-paying company's stock ownership and its attractiveness is the development of an automatic dividend reinvestment program (known as Drip¹), which, especially for dividend investors, is a facilitator when it comes to dividend reinvestment (Lichtenfeld, 2011, pp. 215-218).

The literature notes interest not only in the topic of stock price determination of dividend payout decisions (e.g., S. Desmukh., A.M. Goel and K.M. Howe, P. Asquith and D.W. Mullins Jr, B. Graham, M. Lichtenfeld, H. Rubin, and C. Spaht II, M. Skousen), but also the very dynamics of changes in dividends paid and their impact on the attitudes of capital market investors (among others, M. Baker and J. Wurgler, P. Asquith and D.W. Mullins Jr, J.R. Woolridge and C. Ghosh, F. Modigliani and M. Miller, D.J. Skinner and E.F. Soltes).

The results of the literature analysis indicate a logical connection, in particular, between two subject areas related to dividend payouts. On the one hand, stockholders, especially those who are oriented toward receiving dividends, analyze the systematics of the distribution of the financial result and whether the dividends paid are characterized by a positive growth rate. On the other hand, the boards of companies, when recommending the level of dividends to be paid to stockholders each year, reckon with a number of factors that determine not only the possibility of payout, but also its amount, including growth. Despite the extensive time frame and location of the research, it does not solve the following problem: since capital market investors count on the systematic payout of increasing dividends, whether they are actually increasing in real terms after taking into account the level of inflation and, moreover, whether

¹ Another similar program used by companies is Dsp – buying stocks directly from the company.

decisions on the level of dividends recommended for payout are determined, to a greater extent, by macroeconomic factors from the end of the year, in which the company generated financial results, or perhaps from the period (month), in which dividend decisions were made.

Therefore, the purpose of this paper is to reveal, on the one hand, whether dividend paid by dividend-paying companies from the WIG, DAX and S&P500 indices for the period 2017-2022 were characterized by positive dynamics of change in real terms, and whether decisions on the level of dividends recommended for payout are more determined by macroeconomic factors from the end of the year, in which the company generated financial results, or from the period, in which dividend decisions were made.

The research carried out refers, with its scope, to companies of the WIG, DAX and S&P500 indices, which in the period 2017-2022 paid dividends, with the possibility of not paying dividends once, due to the SARS-CoV-2 pandemic. All calculations were performed using MS Excel and Statistica.

2. Literature review and research hypotheses development

D.J. Skinner and E.F. Soltes (Skinner, Soltes, 2011) believe that the payout of dividends represents a stronger commitment of management to stockholders than the purchase of stocks for redemption. The strength of this commitment in such a case is further compounded by the application of the company's dividend policy with a plan to pay increasing dividends. In contrast, K.P. Fuller and M.A. Goldstein (Fuller, Goldstein, 2011, p. 457) note that monthly stock prices of dividend-paying companies outperform those of non-dividend-paying companies and, during periods of index depreciation, the difference in favor of the former widens to 2 percentage points. W. Al Salamat, M.Q.M. Momani and K. Batayneh (Al. Salamat, Momani, Batayneh, 2021, pp. 166-172), based on their research for the period 2010-2019 on the Jordan Stock Exchange, also found that dividend-paying companies are characterized by lower stock price volatility. Studies conducted by A. Williams and M. Miller (Williams, Miller, 2013, pp. 58-69) as well as K.P. Fuller and M.A. Goldstein (Fuller, Goldstein, 2011) also confirm the legitimacy of investments in dividend-paying companies. Regardless of changes in stock prices in the capital market, dividends provide a hedge against depreciation in the value of a securities portfolio. Moreover, H. Rubin and C. Spaht II (Rubin, Spaht, 2011, p. 12) noted that investors, who make investments in dividend-paying companies over a 10- or 15-year horizon, while reinvesting the dividends, guarantee their financial independence. Regardless of stock price changes, an ever-increasing dividend is an endless cash flow. F. Modigliani and M. Miller (Miller, Modigliani, 1961, p. 430) emphasize that, for companies following a fixed dividend policy, with a long-term target payout rate, investors will interpret any change in dividends as a change in board's view of the company's future and its profits. P. Asquith and

D.W. Mullins Jr. (Asquith, Mullins, 1983, pp. 77-96) point out that, when investing in dividend-paying companies, what matters is not only whether the company pays dividends consistently, but what the rate of its growth is. According to the authors, issuers that pay high dividends with high growth rates are characterized by stable stock prices. This is in the interest of the company's authorities, who, by proposing increasing dividends to stockholders, try to influence not only the type of dividends, but also the company's stock ownership structure. It is worth adding that a stable stock ownership during a downturn in the capital market will take advantage of the discount to add weight to the stock portfolio of such a company. Seeing the broader background of the company's operations and boards' decisions, it can also use the dividends received for this purpose. However, it is worth noting that the tradition of paying increasing dividends is popular in those countries with a developed capital market. Specifically, one points to issuers listed on the American (components of the S&P500 index), German (companies in the DAX index), or French (companies in the CAC40 index), and selectively Polish (components of the WIG index) market.

Previous research in the field of analysis of changes in dividend payouts and related decisions of dividend investors (increase or decrease in the share of stock portfolio of a given company, including complete divestment) has made it possible to recognize patterns of their behavior. First of all, it should be stated that an investor's income in the form of dividend is more important to them than the uncertain return from the sale of stocks (Cwynar, Cwynar, 2007; Kowerski, 2011). Therefore, some investors choose for their portfolios companies that pay dividends, at the same time abandoning investment in stocks of those entities, that do not systematically share part of the profit with stockholders. Therefore, the so-called "bird in the hand" theory means that the dividend received by the investor is more secure than capital gains, since the dividend paid out cannot be taken away from investors and profits transferred to subsequent investments can be lost at least in part through unsuccessful board decisions. M. Miller and F. Modigliani (Brigham, Houston, 2015, p. 582) rejected this theory², pointing out that most investors intend to reinvest dividends received in stocks of entities with similar investment risks. Therefore, the risk of cash transfer to investors is determined by the risk of cash flow from operating activities and not by the distribution policy.

It is worth adding that an increase in dividends is not a simultaneous guarantee of a higher dividend in the future. However, it is a signal that the company's board takes the dividend policy and investors seriously. The question should then be raised as to what happens when the board proposes to raise the level of future dividend and, at the same time, the company's financial results do not recognize an increase in individual elements (Lichtenfeld, 2015, p. 106). Despite the company's temporarily worse financial results, the board sends a signal that the company is able to pay a higher dividend and its future is not at risk. M. Miller and F. Modigliani (Hawawini, Viallat, 2007, p. 445) noted that companies are reluctant to change

² It has been named the "bird in the hand error".

the level of dividends paid, because such changes could suggest better or worse prospects for the companies' operations, respectively. J.R. Woolridge and C. Ghosh (Woolridge, Ghosh, 1986, pp. 20-32) conducted a study of 408 companies that had cut dividend payouts, divided into those that cut dividends and experienced a decline in earnings, those, whose board warned investors of deteriorating performance even before cutting dividends, and a third group, in which dividends were cut, but at the same time announced growth plans or improved financial result. The study found that most companies cut dividends as a result of deteriorating earnings, but if dividends were cut as a result of new investments, the decline in stock prices was milder, and stock prices returned to the trading level before the changes were announced.

Therefore, the decisions of boards to increase the planned dividend are mostly responsible for the increase in stock prices and the decrease or non-payment of the dividend causes a sell-off in stocks, and thus a decline in stock prices. This relationship has been called the signaling effect or the significant information hypothesis. Related to this theory is the concept of so-called dividend stickiness. Boards are reluctant to propose to start paying dividends if future payout is uncertain. In contrast, those companies that have paid dividends so far will try to maintain their dividend-paying company status. Therefore, companies paying dividends continuously on the basis of their adopted dividend policy attract certain groups of investors, particularly those, who prefer to receive dividends. This is the so-called dividend clientele effect, as described by F. Black and M. Scholes (Black, Scholes, 1974) in 1974 and F. Modigliani and M. Miller as early as 1961 (Miller, Modigliani, 1961). Research conducted by F. Allen, A.E. Bernardo and I. Welch (Allen, Bernardo, Welch, 2000, pp. 2499-2536) confirm that institutional clients, in particular, are attracted to those issuers that pay dividends. Research conducted by Evbayiro-Osagie E.I. and Osayuwa E.E (Evbayiro-Osagie, Osayuwa, 2023, pp. 155-169) for the period 2012-2020 of companies listed on the Nigerian Stock Exchange also confirm, that dividends paid in the past affect the systematics of the distribution of the financial result in the future.

It is worth noting one more aspect of systematic dividend payouts. Those boards that recommend paying dividends on an uninterrupted basis win the votes of stockholders, who count on their continued payment. Based on research conducted by S. Desmukh, A.M. Goel and K.M. Howe (Desmukh, Goel, Howe, 2013), it can be concluded, that overconfident CEOs pay lower dividends than rational CEOs. The study omitted the analysis of whether dividends were paid at a constant level over the long term or increasing. In the context of the cited issues of signaling and dividend stickiness, the so-called dividend feeding theory becomes important. A company's management, wishing to indirectly influence the behavior of stock prices, may start or even increase dividend payouts. According to a study conducted by M. Baker and J. Wurgler (Baker & Wurgler, 2004), companies that do not pay dividends are traded lower.

Since, in light of the cited attitudes of investor behavior, it becomes important how market participants react to changes in the amount of dividends paid, it is worth expanding the review of the literature and research to include the determinants of dividend payouts that affect the decisions of company boards to pay and, more importantly, changes in the amount of dividends paid. The issue of factors affecting dividends paid is widely described in foreign and domestic

literature (e.g. J.H. von Eije, W.L. Megginson, S.P. Ferris, N. Sen, H. Pei Yui, H. DeAngelo, L. DeAngelo, D. Skinner, A. Damodaran, M. Jagannathan, C.P. Stephens, M.S. Weisbach, E.F. Fama, K.R. French, G. Grullon, D.L. Ikenberry, A. Brav, J.R. Graham, C.R. Harvey, R. Michaely, B. Horbaczewska, R. Tuzimek, M. Kowerski, A. Szablewski, T. Słoński & B. Jabłoński). Due to their number and complex nature, they are shown to be divided into microeconomic determinants (such as available investment projects, net profit and retained earnings, cash flow, liquidity, cash, assets, equity, fixed capital, capital structure, depreciation level, return on assets (ROA), return on equity (ROE), the life cycle of the company, the need to maintain control over the entity, the level of debt and board's aversion to increasing debt, concluded contracts, and stockholder preferences), macroeconomic determinants (such as inflation, gross domestic product (GDP), interest rate levels, changes in the level of quotation of a country's currency, the dynamics of exports and imports, the tax system, the legal system and legal restrictions) and others, often described as market or psychological (such as economic sentiment, PMI, market indicators or capital market conditions). It should be added that due to the specificity of the listed determinants, their impact is not equal. For some, a lesser impact on dividend proposals can be indicated (e.g. concluded contracts, or the level of depreciation) and for others, a significant impact (e.g. the level of debt, the level of interest rates). Moreover, the determinants of dividends shown in the literature can take the character of stimulants, while others can take the character of destimulants, as shown in Table 1.

Table 1.

Selected stimulants and destimulants of the level of dividend payouts in alphabetical order

Determinants of the level of dividend payout	Type of influence on dividend payout
depreciation	destimulant
enterprise life cycle	stimulant
inflation	destimulant
cost of financing the entity's branch*	destimulant
new share issue – loss of control of the company	destimulant
tax burden on the parent company*	destimulant
foreign exchange restrictions and limitations*	destimulant
contractual restrictions	destimulant
GDP	stimulant
PMI	stimulant
debt level	destimulant
stockholder preference – counting on cash	stimulant
stockholder preference – counting on value growth	destimulant
investment projects	destimulant
cash flows	stimulant
favorability of tax policy	stimulant
favorability of legal conditions	stimulant
return on equity (ROE)	stimulant
cash	stimulant
P/BV ratio	stimulant
P/E ratio	destimulant
WIG index changes	stimulant
net profit, retained earnings	stimulant

* International companies.

Source: Jabłoński, Prymon, 2017, p. 46.

Given the subject matter of the paper, the following section focuses on the analysis of the most important of the macroeconomic determinants of dividend policy affecting the systematics and growth of dividends paid.

Research conducted by I. Jabbouri (Jabbouri, 2016, pp. 283-298) for companies in the MENA region³ for the period 2004-2013 indicates a negative correlation between dividend payouts and the state of the economy. The author noted that managers of companies in the MENA region appear to increase dividend payouts during periods of economic slump in an attempt to reassure investors. Considering other international studies on the impact of gross domestic product (GDP) on the dividend policy of real estate companies, M. Romus, A. Rizga, M.R. Abdillah and N.B. Zakaria (Romus, Rizga, Abdillah, Zakaria, 2020, pp. 1-6) indicated that the rate of GDP growth has a positive impact on the performance of companies and on the dividend policy. On the other hand, from a study conducted by S.D. Misra (Misra, 2015, pp. 440-456) shows that the growth rate of real GDP positively and significantly affects the dividend payout ratio of Indian banking sector institutions. M. Kowerski (Kowerski, 2011, pp. 125-134, 269-279) conducted a study for the period 1995-2009, which shows that the economic situation of the country, as measured by the rate of change of GDP in the previous year, has a significant impact on dividend payout decisions in the base year. It is worth mentioning that this correlation applied only to companies with good financial condition and was not confirmed for companies in worse economic and financial condition. Moreover, in good economic times, companies that had not previously paid dividends began distributing the financial result to stockholders. These conclusions are also confirmed by studies conducted by W. Dębski and I. Bujnowicz (Dębski, Bujnowicz, 2008, p. 9), from which it follows that for the period 1994-2005 there was a strong link between the condition and development of the financial market and economic growth. Research conducted for the period 2002-2013 by B. Jabłoński and J. Kuczowic (Jabłoński, Kuczowic, 2015, pp. 443-457) among companies listed on the Warsaw Stock Exchange indicates that dividend decisions are significantly influenced by perceptions of the future, making GDP a better reflection than PMI of the sentiment of boards regarding dividend payouts. These conclusions correspond, to some extent, with the results of a study conducted by M. Kowerski (Kowerski, 2011, pp. 269-279) on the link between indicators characterizing economic sentiment (indicators calculated, for example, by the European Commission, the Institute of Economic Development of the Warsaw School of Economics or the PMI index were used as measures) and dividends paid. The author found that the better the economic sentiment was in June of a given year, the higher the dividends were in the same year. Interestingly, the author's research also shows that there is an increase in the likelihood of dividends being paid when the capital market is characterized by strong growths, i.e. possible increases or decreases in indices may have a greater impact on dividend

³ MENA is the area of the Middle East and North Africa. According to the World Bank, MENA countries include Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, the UAE and Yemen.

policy than changes in economic situation. The existence of a stable long-term relationship between dividend payouts and real economic activity, as well as the price level adjusted by inflation, was confirmed by T. Basse and S. Reddemann (Basse, Reddemann, 2011, pp. 33-64).

Slightly different findings are presented by the authors of a study of companies on the Pakistan Stock Exchange. F. Khan, A. Ullah, A.A. Muhammad and K.I. Muhammad (Khan, Ullah, Muhammad, Muhammad, 2019, pp. 111-121) conducted research for the period 2001-2017 for macroeconomic variables, from which there is a negative relationship between the interest rate, inflation rate and GDP growth rate and the dividend payout ratio. Also, research conducted by I.N. Yakuba (Yakuba, 2019, pp. 31-50) of companies listed on the capital market in Ghana for the period 2006-2015 does not confirm a strong determination of dividend payouts on the level of inflation. It is noteworthy, however, that the research concerned a specific group of institutions, namely banks, for which changes in inflation (its decline) and thus, as a consequence, a decline in market interest rates negatively affect the financial result (result from lending activities), and thus negatively affect the ability to pay dividends. Similar conclusions were reached by Evbayiro-Osagie E.I., Osayuwa E.E (Evbayiro-Osagie, Osayuwa, 2023, pp. 155-169) for financial companies listed in Nigeria. It is worth adding that, from the point of view of capital market investors, dividends paid may lose their significance especially when they are characterized by low or even negative growth rates. In a high-inflation economic environment, the real value of dividends in the period between the resolution on their distribution and the actual payment is declining at a rapid rate. H. Hazlitt (Hazlitt, 2007) and M. Skousen (Skousen, 2011) point out that high inflation reduces or even stops the payout of dividends. This phenomenon may result, in such macroeconomic conditions, from increased investment by companies dictated by the desire to preserve the value of cash in real assets. As E.F. Brigham and J.F. Houston (Brigham, Houston, 2015, p. 201) note, during periods when inflation is at a low level, a stable dividend policy and the payout of a fixed dividend is sufficient. However, according to the authors, when there is increased inflation, investors already expect rising dividends.

Studies of the impact on dividends paid of successive macroeconomic parameters conducted by H.W. Akani and Y. Swenem in Nigeria for the period 1981-2014 (Akani, Swenem, 2017, pp. 55-63) indicated a significant negative impact of interest rates and the rate of exchange on the dividends paid by manufacturing enterprises. Just referring to the impact of interest rates on dividend payments, it is worth referring to the results of studies conducted by M. Romus, A. Rizga, M.R. Abdillah and N.B. Zakaria (Romus, Rizga, Abdillah, Zakaria, 2020, pp. 1-6). The authors indicate that the interest rate did not have a significant impact on the dividend policy of the entities studied. Also A.A. Muhammad and F. Khan (Muhammad, Khan, 2018, pp. 111-121) observed a negative impact of the interest rate on the dividend payout ratios of textile companies for the period 2001-2017.

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

H₁: Changes in gross domestic product are positively correlated with the level of dividends paid.

H₂: The PMI index is positively correlated with the level of dividends paid.

H₃: The inflation rate is negatively correlated with the level of dividends paid.

H₄: The level of interest rates is negatively correlated with the level of dividends paid.

Each of the indicated hypotheses was analyzed in two variants: in variant one, the relevant macroeconomic variables were considered on the basis of data as of the end of December of the year preceding the dividend payout, and in variant two – as of the end of May of the year of dividend payout. In addition, the study considered not only the absolute level of dividends paid (on an annual basis), but also their growth (absolute and relative). Thus, for each research hypothesis formulated, six sub-hypotheses were analyzed. A description of the research sample and research methodology is included in the next section of the paper.

3. Sample selection and methodology

The research sample was selected to provide, on the one hand, the broadest possible view of the issue at hand and, at the same time, by the decision of the authors, its selection is intended to be a certain compromise between the availability of data and the certainty of the findings and conclusions made.

In order to ensure that the diverse local conditions are reflected, the authors decided to study three markets: the US as the best-developed capital market, the German market – taking into account the economic ties between Poland and the Federal Republic of Germany – and the Polish market. Taking into account the objectives of this study and the desire to provide appropriate guidance also to those investing in the indicated markets, it was limited to the study of the largest companies listed on the indicated markets in terms of capitalization. For this purpose, when analyzing the Polish market, the 30 largest companies included in the WIG index were taken into account. Similarly, the analysis of the German market was based on data on the 30 largest companies making up the DAX index, while for the US exchanges – 30 entities from the S&P500 index (as of 30 September 2023).

Since the analysis conducted concerns dividend-paying companies, it became necessary to choose an appropriate criterion to classify a company as a dividend-paying company. Since the study period covered 2017-2022, it was decided to define a dividend-paying company as an entity that has paid dividends for at least five years in the indicated time frame. Thus, the fact of the occurrence of the SARS-CoV2 pandemic, the negative consequences of which could have affected the temporary suspension of dividend payouts, was taken into

account. Finally, 13 companies listed on the Warsaw Stock Exchange, 26 entities listed on the Frankfurt Stock Exchange and 24 entities of the New York Stock Exchange were included in the study. They are presented in Table 2.

Table 2.
Companies qualified for the study

Stock exchange	Companies	Number of companies
Warsaw Stock Exchange	ACP.WA, BDX.WA, SPL.WA, CPS.WA, BHW.WA, ING.WA, LPP.WA, PEO.WA, PKN.WA, ZAP.WA, PZU.WA, ZWC.WA	13
Frankfurt Stock Exchange	ADS.DE, ALV.DE, BAS.DE, BAYN.DE, BEI.DE, BMW.DE, CON.DE, DTG.DE, DB1.DE, DHL.DE, DTE.DE, EOAN.DE, FME.DE, FRE.DE, HEI.DE, HEN.DE, IFX.DE, LIN.DE, MRK.DE, MUV2.DE, PUM.DE, RWE.DE, SAP.DE, SIE.DE, VNA.DE, VOW3.DE	26
New York Stock Exchange	AAPL.US, T.US, BAC.US, CVX.US, CSCO.US, KO.US, CMCSA.US, XOM.US, GE.US, HD.US, INTC.US, JNJ.US, JPM.US, MRK.US, MSFT.US, ORCL.US, PEP.US, PFE.US, PM.US, PG.US, VZ.US, V.US, WMT.US, WFC.US	24

Source: Own study.

In the next step, data on dividends paid (on an annualized basis) were downloaded from investing.com and stooq.com, as well as the levels of the indicated macroeconomic variables. In addition, quotes from Yahoo Finance were used in constructing hypothetical portfolios of stocks.

Conducting a comparative analysis for such a set of variables requires having the volumes to make comparisons. Thus, there is a need to make some normalization of the studied volumes. The comparability of data on dividends paid was ensured by standardizing the level of dividends for individual companies (for companies paying a fixed dividend, a level equal to zero was assumed). A similar procedure was carried out for increments (absolute and relative). On several occasions it was impossible to calculate the percentage change in the level of dividends due to their non-payout in the previous year. Such cases were excluded from further analysis.

When analyzing the dynamics of dividend changes, the researcher is faced with the problem of how to generalize the conclusions made for individual entities to the entire sample. Therefore, as a first step, the distributions of standardized dividend levels were analyzed, and in addition, the average dividend growth rate was estimated (based on untransformed data). For this purpose, the classical geometric average return was used, as well as the estimated average dividend growth rate based on an exponential regression model. In favor of the second solution is the fact that the geometric average return is, in fact, a function only of the initial and final dividend levels, while it completely ignores their formation in the remaining periods. Due to the significant variation in the quantities studied and the presence of extreme observations, the median, rather than the average, was chosen as the appropriate measure of the average change in the level of dividends.

The problem of generalizing the conclusions made can be avoided by analyzing a hypothetical portfolio built from the shares under consideration and rebuilt every year. In order to ensure that the various entities are treated equally, it was decided to build portfolios composed of equal shares of the indicated stocks (according to the price at the first session of the year), and then analyze the dividends attributable to the owners of such a portfolio. This approach also avoids the problem of a company's failure to pay dividends in a given year, as it is practically certain that at least one dividend-paying company included in such a portfolio will pay dividends. However, the problem arises, in this case, of the impact of the volatility of the prices of the stocks studied on the hypothetical dividends calculated in this way, since, in reality, the method indicated leads to an analysis of the dividend yield. Although asset price fluctuations may lead to different conclusions than the analysis of the dividend level itself, it was decided to carry it out in order to make a comparative analysis with the conclusions obtained for dividend levels.

Finally, the relationships between the aforementioned macroeconomic variables: inflation, the level of the PMI index, changes in GDP or the level of interest rates were examined based on methods of correlation analysis. For this purpose, Spearman's rank correlation coefficient and Kendall's tau were used. Since an analysis for individual entities does not seem advisable in view of the few observations available, the available data were considered collectively, excluding the cross-sectional aspect (which was made possible by prior standardization). The results of the analyses are presented in the next section.

4. Analysis of the impact of the timing of the publication of macroeconomic parameters on the level of determination of the change in dividend payouts of companies in the WIG, DAX and S&P500 indices

In the first step, following the previously formulated methodology of the study, the level of dividends for each analyzed entity was standardized. The results in tabular and graphical form are presented below, for each market separately.

Table 3.

Selected statistics characterizing the distribution of standardized dividends paid by companies listed on the WSE, FSE and NYSE in 2017-2022

Stock exchange	Measure	2017	2018	2019	2020	2021	2022
WSE	Mean	-0.01	-0.05	0.11	-0.89	0.10	0.74
	Median	-0.13	0.11	0.29	-0.89	0.12	1.04
	St.dev.	1.01	0.67	0.65	0.87	1.05	0.94
	IQ range	1.39	0.90	1.08	1.25	1.71	1.27
FSE	Mean	-0.71	-0.10	0.16	-0.13	0.02	0.76
	Median	-0.83	-0.07	0.10	0.13	0.33	1.11
	St.dev.	0.88	0.75	0.46	0.93	0.90	1.18
	IQ range	1.39	1.26	0.73	0.90	1.41	1.20

Cont. table 3.

NYSE	Mean	-1.11	-0.55	-0.19	0.23	0.62	1.00
	Median	-1.41	-0.84	-0.25	0.31	0.80	1.36
	St.dev.	0.86	0.57	0.66	0.38	0.74	0.89
	IQ range	0.30	0.46	0.42	0.37	0.16	0.42

Source: own research.

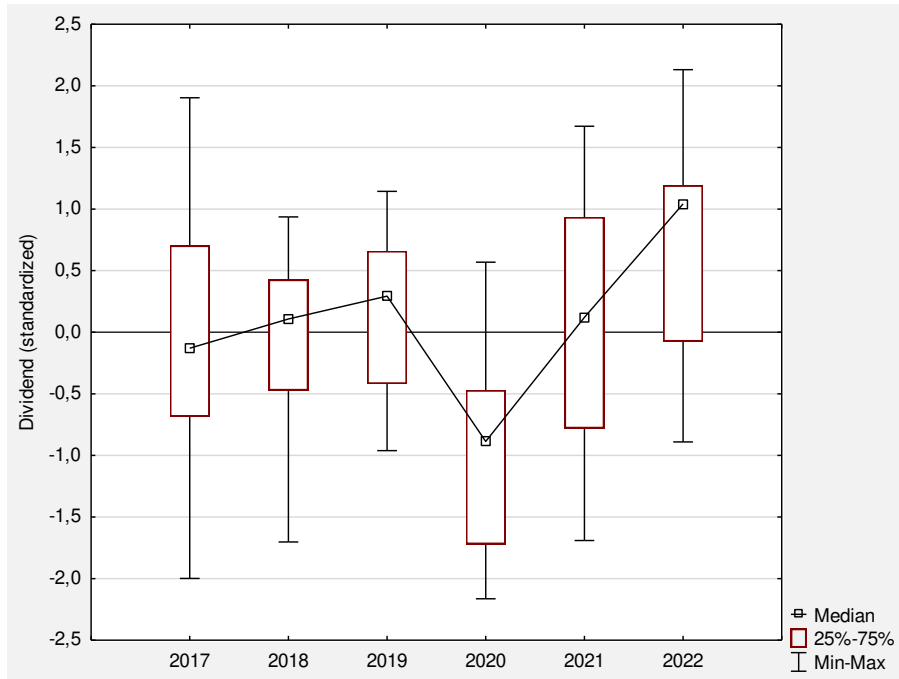


Figure 1. Distribution of standardized dividends paid by the surveyed companies listed on the WSE in 2017-2022.

Source: own research.

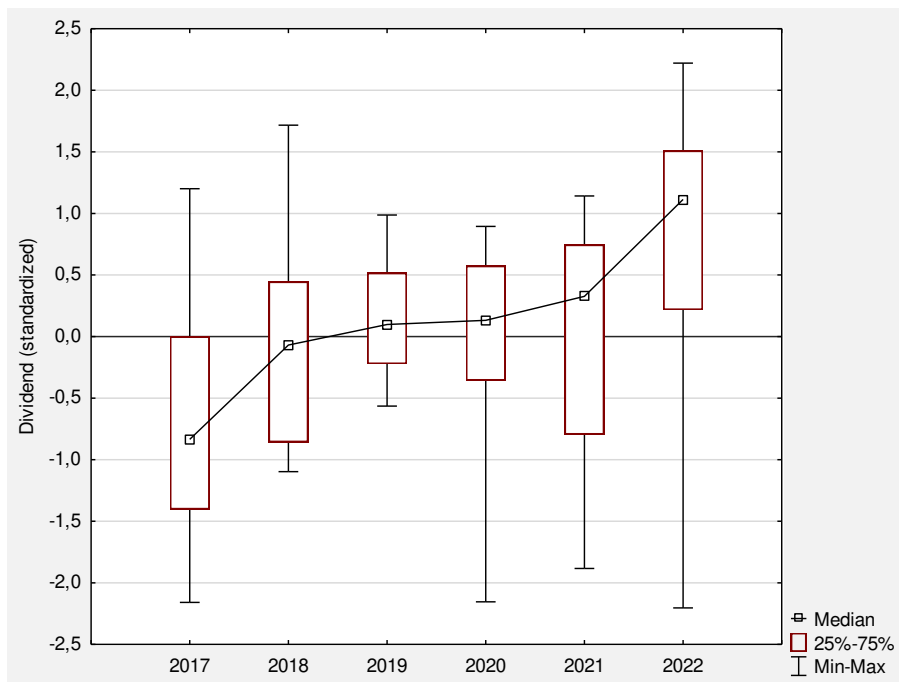


Figure 2. Distribution of standardized dividends paid by the surveyed companies listed on the FSE in 2017-2022

Source: own research.

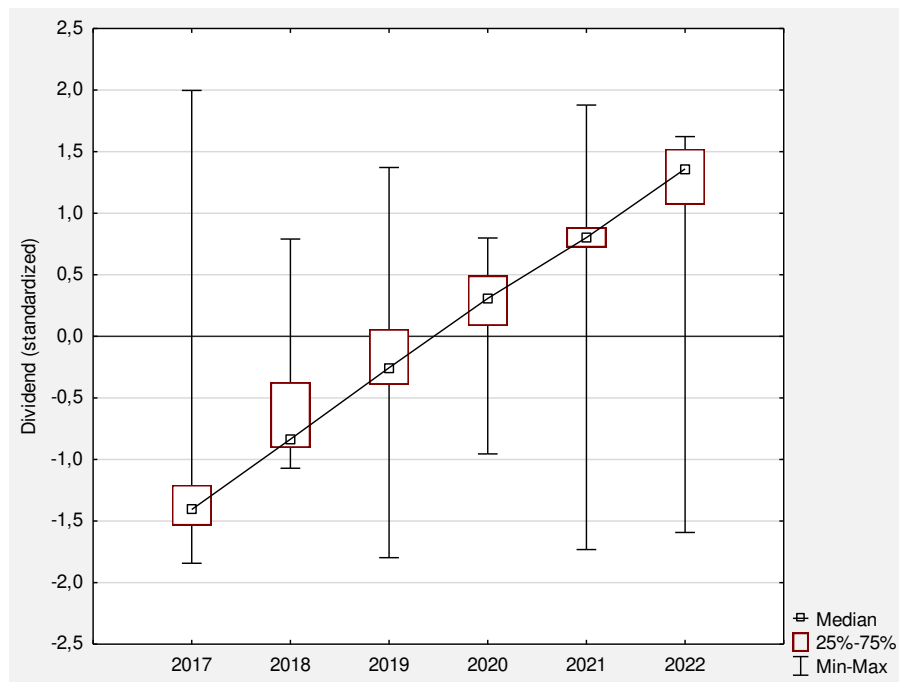


Figure 3. Distribution of standardized dividends paid by the surveyed companies listed on the NYSE in 2017-2022

Source: own research.

For each of the analyzed markets, there is an upward trend in the nominal level of dividends paid, but only in the case of the US market can we talk about the systematic nature of the recorded increases. German companies have decisively reduced the growth rate of payouts in 2019-2020. Polish companies, on the other hand, reacted to the onset of the SARS-CoV-2 pandemic with a sharp decline in dividends paid, which only returned to pre-pandemic levels in 2022. What should be noted is the greater homogeneity of the dividend policy of US companies vis-à-vis Polish and German companies expressed by a decisively lower quartile deviation in subsequent years. At the same time, there was no clear change with regard to the variation in the level of dividends over time, with the possible exception of a slight decline in the pre-pandemic period. In the next step, the level of dividends in real terms was analyzed (the consumer price index was chosen as the deflator).

Table 4.

Selected statistics characterizing the distribution of standardized actual dividends paid by companies listed on the WSE, FSE and NYSE in 2017-2022

Stock exchange	Measure	2017	2018	2019	2020	2021	2022
WSE	Mean	0.24	0.17	0.25	-0.83	0.01	0.17
	Median	0.39	0.32	0.50	-0.90	0.04	0.63
	St.dev.	1.08	0.71	0.72	0.90	1.07	1.00
	IQ range	1.57	0.63	1.22	1.25	1.74	1.27
FSE	Mean	-0.55	-0.00	0.28	0.01	0.02	0.24
	Median	-0.70	0.29	0.25	0.30	0.24	0.60
	St.dev.	0.89	0.82	0.50	1.07	0.99	1.23
	IQ range	1.63	1.31	0.76	1.21	1.43	1.70

Cont. table 4.

NYSE	Mean	-0.85	-0.35	-0.01	0.66	0.60	-0.05
	Median	-1.24	-0.38	0.11	0.73	0.82	0.59
	St.dev.	0.99	0.67	0.78	0.61	0.82	1.14
	IQ range	0.92	1.12	0.65	0.53	0.72	1.77

Source: own research.

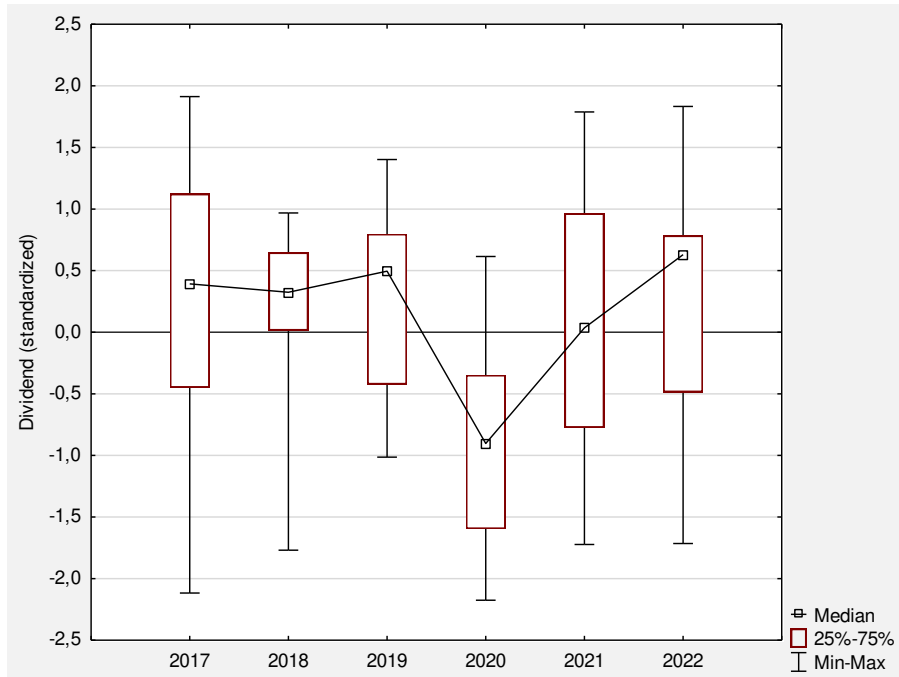


Figure 4. Distribution of standardized actual dividends paid by the surveyed companies listed on the WSE in 2017-2022.

Source: own research.

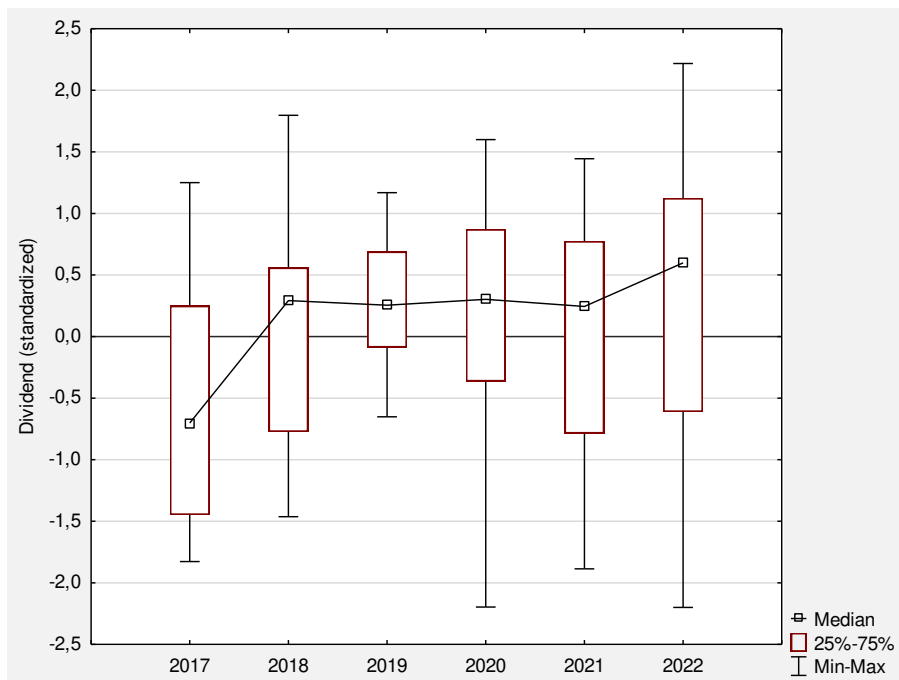


Figure 5. Distribution of standardized actual dividends paid by the surveyed companies listed on the FSE in 2017-2022.

Source: own research.

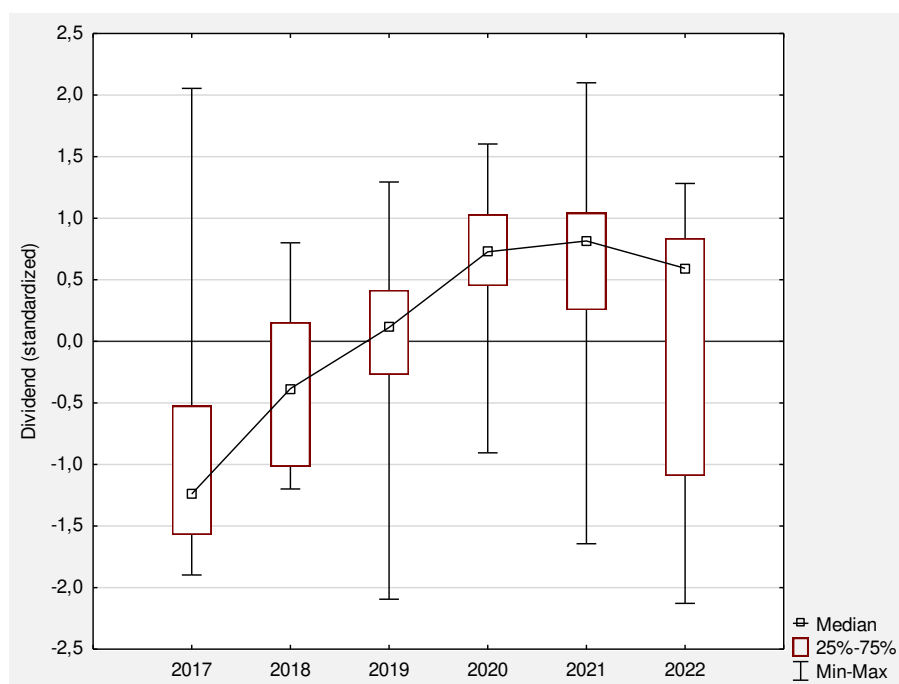


Figure 6. Distribution of standardized actual dividends paid by the surveyed companies listed on the NYSE in 2017-2022.

Source: own research.

Analysis of the level of dividends paid in real terms leads to slightly different conclusions. For companies listed on the WSE, it can be noted that, during the period under study, they maintained a similar level in real terms, with the exception of 2020 (the likely effect of the SARS-CoV-2 epidemic). Companies listed on the Frankfurt Stock Exchange showed an upward trend in the level of real dividends in 2017 and 2022, while in the remaining years dividends remained stable (this was not changed by the pandemic either). In contrast, a different picture is obtained by analyzing US companies: the value of dividends in real terms rose steadily until 2021, when the upward dynamics slowed down, and turned into a downward trend in 2022. The conclusions formulated previously are confirmed by the data describing the growth rate of dividends and the dividend yield during the period under study obtained by means of the regression function (Table 5).

Table 5.

Selected statistics characterizing the growth rate of dividends paid by companies listed on the WSE, FSE and NYSE in 2017-2022

Variable	Measure	Type	WSE	FSE	NYSE
Dividend level growth	Average	Nominal	6.14%	3.05%	4.46%
	Median	Nominal	4.98%	2.99%	5.68%
	St.dev.	Nominal	29.44%	14.08%	9.29%
	Average	Real	1.36%	0.56%	1.25%
	Median	Real	0.04%	0.51%	2.44%
	St.dev.	Real	28.09%	13.76%	9.00%
Portfolio dividend yield growth	Average	Nominal	4.79%	-0.18%	-1.78%
	Average	Real	0.26%	-2.58%	-4.80%

Source: own research.

The next step analyzed the fluctuations in the level of dividends of the annually reconstructed portfolio built in equal value shares from the stocks under study, i.e. actual development of the average dividend yield for the instruments indicated.

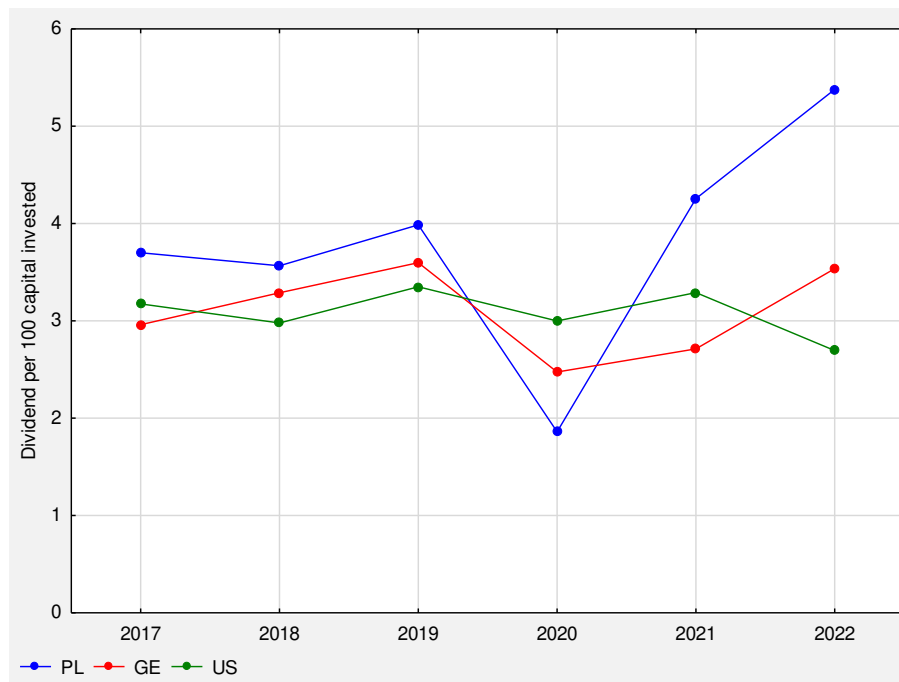


Figure 7. Average dividend yield of surveyed companies in 2017-2022.

Source: own research.

The dividend yield for the hypothetical portfolio of stocks followed a similar pattern to dividends alone only for the Polish stocks analyzed. The dividend yield of companies listed on the NYSE was relatively stable, while for instruments listed on the FSE it is noticeable that it declined during the SARS-CoV-2 pandemic and later returned to pre-pandemic levels. Thus, having analyzed the fluctuations in both the dividends themselves and the dividend yield, it can be indicated that the strongest reaction in the area of dividend policy to the SARS-CoV-2 pandemic was shown by managers of Polish companies, significantly reducing their payouts and increasing the level of retained earnings for fear of potentially adverse further changes in the general economic situation. This is also evidenced by an analysis of the decisions of the indicated entities to either increase or decrease dividends paid.

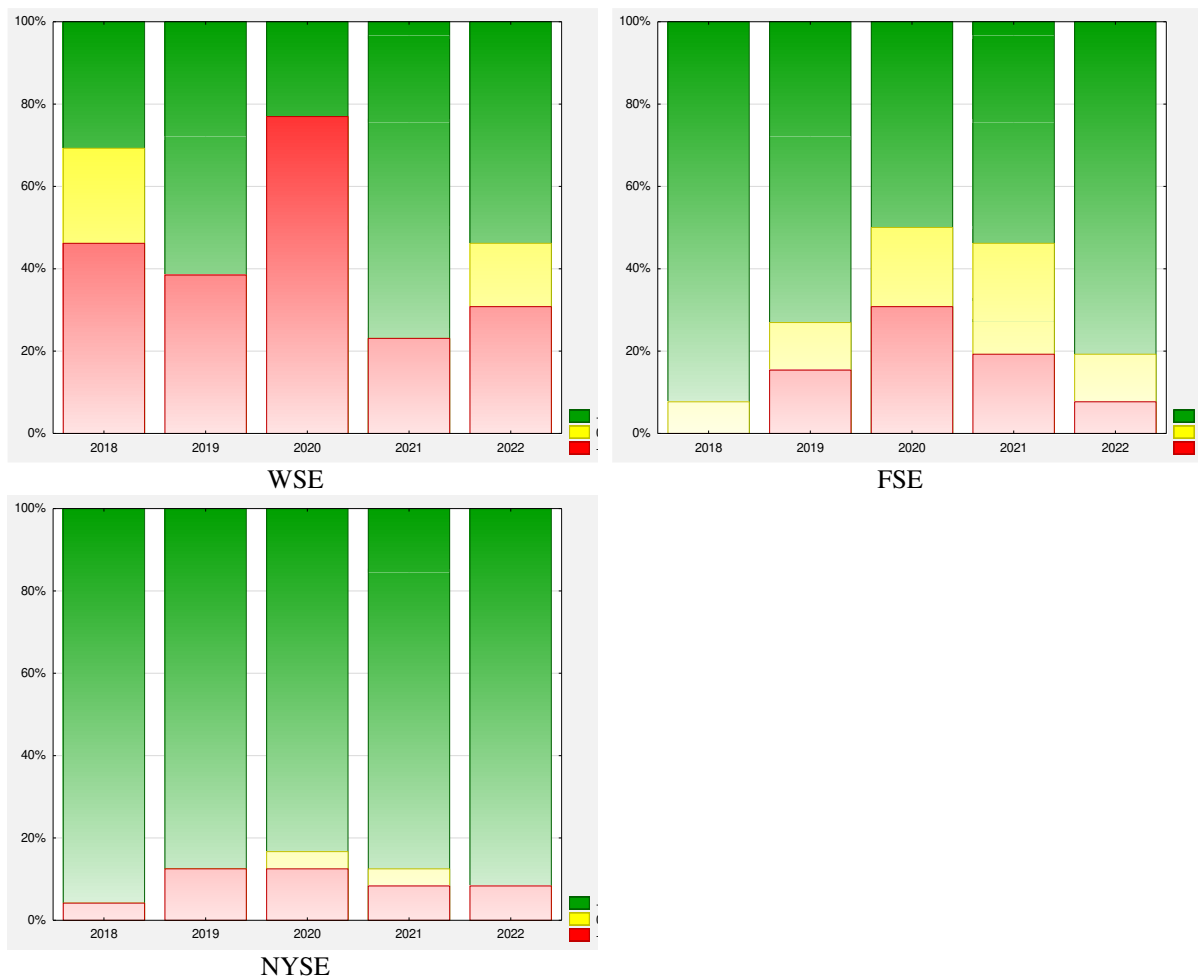


Figure 8. Decisions regarding dividends paid in the study sample in 2017-2022.

Source: own research.

It is further evident that the dividend policy of the largest US companies paying dividends is markedly different from that of Polish companies, although the decisions made during the SARS-CoV-2 pandemic were similar – in each of the analyzed markets, a greater number of companies reduced dividend payouts. In the case of the US, the difference is several times smaller than the Polish one (and is not necessarily related to the pandemic, as US companies began to limit payouts as early as 2019). Closer to the reactions of Polish entities were the decisions of German companies, although a significant disparity is also observable. It is worth noting that, regardless of economic conditions, about 90% of the surveyed companies listed on the NYSE increased the level of dividends paid. For both German and US entities, however, the impact of the increased inflation of 2021-2022 is evident, as despite the nominal increase in both countries there was a dramatic increase in companies paying dividends with a declining real value.

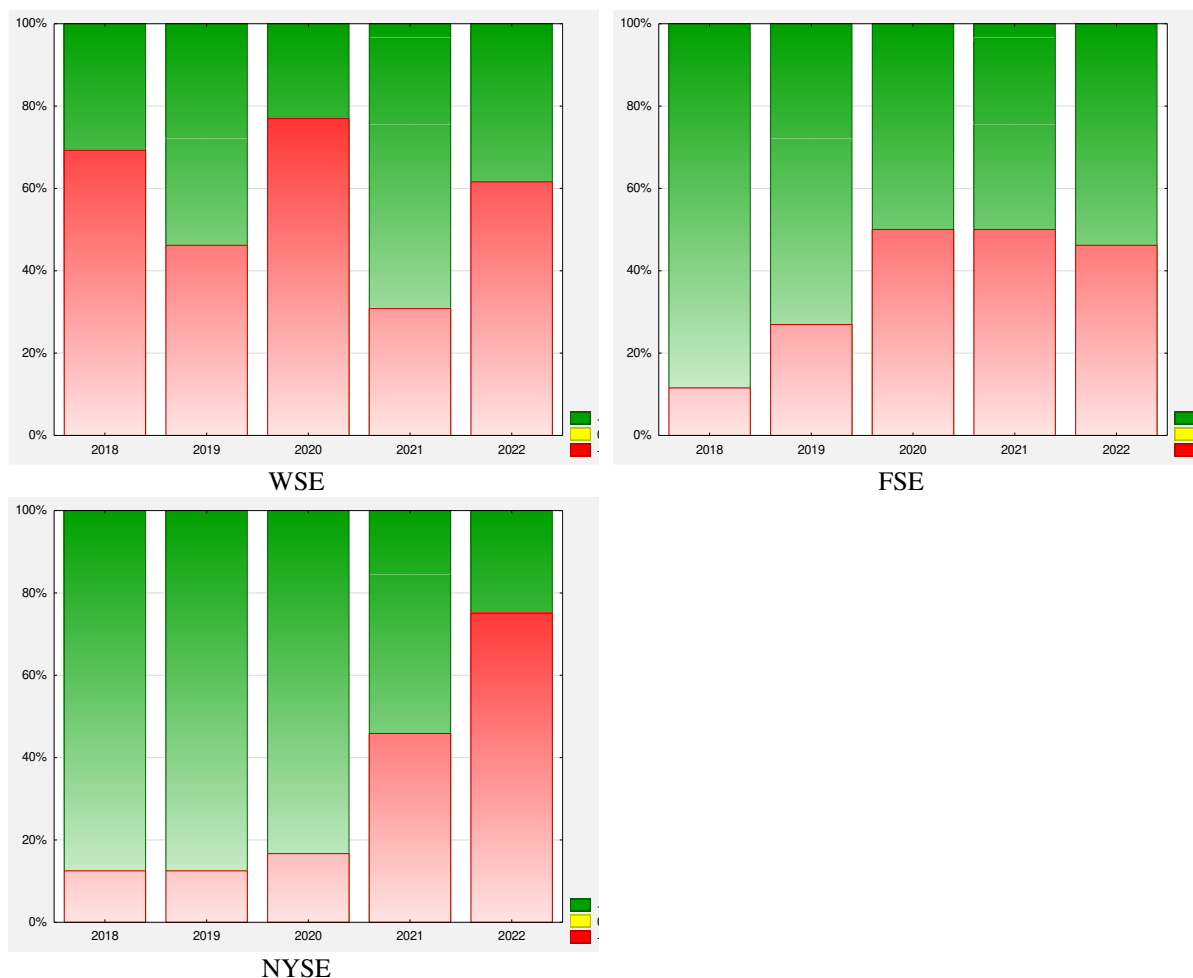


Figure 9. Decisions regarding dividends paid in real terms in the study sample in 2017-2022.

Source: own research.

In the next step, the impact of changes in selected macroeconomic quantities on the development of the level of dividends paid, their changes in absolute and relative terms was analyzed (Table 5 presents the results based on Spearman's rank correlation coefficient. Due to the convergence of conclusions, Kendall's tau values were not presented separately).

Table 6.

Spearman's rank correlation coefficient between selected macroeconomic variables (data as of the end of last December) and dividends and their absolute and relative changes for companies listed on the WSE, FSE and NYSE in 2017-2022

Stock exchange	Macro variable	DIV	Δ DIV	% Δ DIV
WSE	GDP	- 0.016	- 0.096	0.027
	PMI	- 0.183	- 0.234*	- 0.083
	Inflation	0.004	- 0.022	0.001
	Interest rates	- 0.016	- 0.096	0.027
FSE	GDP	0.093	0.087	0.103
	PMI	0.091	0.133	0.179**
	Inflation	- 0.024	- 0.036	- 0.094
	Interest rates	0.137	0.089	0.124

Cont. table 6.

NYSE	GDP	- 0.001	0.147	0.149
	PMI	0.040	- 0.212**	- 0.211**
	Inflation	0.063	- 0.216**	- 0.212**
	Interest rates	- 0.015	0.250***	0.269***

* - statistically significant at the 0.1 level; ** - statistically significant at the 0.05 level; *** - statistically significant at the 0.01 level

Source: own research.

Table 7.

Spearman's rank correlation coefficient between selected macroeconomic variables (data as of the end of May this year) and dividends and their absolute and relative changes for companies listed on the WSE, FSE and NYSE in 2017-2022

Stock exchange	Macro variable	DIV	Δ DIV	% Δ DIV
WSE	GDP	0.030	- 0.051	0.051
	PMI	- 0.138	0.061	- 0.055
	Inflation	- 0.025	- 0.111	- 0.032
	Interest rates	- 0.070	- 0.076	0.005
FSE	GDP	0.030	0.019	0.035
	PMI	0.026	- 0.109	- 0.100
	Inflation	- 0.024	- 0.036	- 0.094
	Interest rates	0.022	0.019	- 0.027
NYSE	GDP	0.028	0.038	0.048
	PMI	0.053	- 0.277***	- 0.271***
	Inflation	0.040	- 0.212**	- 0.211**
	Interest rates	0.015	- 0.023	- 0.001

* - statistically significant at the 0.1 level; ** - statistically significant at the 0.05 level; *** - statistically significant at the 0.01 level.

Source: own research.

Among the analyzed relationships, only the relationships between changes in the level of dividends (both in amount and percentage) and selected macroeconomic variables under study can be considered statistically significant. Absolute changes in the level of dividends showed a negative correlation with changes in the PMI index (macroeconomic data at the end of December, for Poland), while a positive correlation for German stocks (macroeconomic data at the end of December). For the macroeconomic data readings at the end of May of the relevant year, such correlations were not observed.

Table 8.

Decision to reject or not to reject research hypotheses for companies listed on the WSE, FSE and NYSE

Stock exchange	WSE	FSE	NYSE
H ₁	rejected (0)	rejected (0)	rejected (0)
H ₂	rejected (-)	not rejected	rejected (-)
H ₃	rejected (0)	rejected (0)	not rejected
H ₄	rejected (0)	rejected (0)	rejected (+)

Source: own research.

At the same time, the amount, as well as the percentage change in the level of dividends paid shows a statistically significant negative correlation with the PMI index for stocks listed on the NYSE, both for readings at the end of December and the end of May. At the same time,

analyzing the data at the end of December, one can see a positive correlation between interest rates and relative and absolute changes in the level of dividends paid by US companies. A discussion of the results obtained is presented in the next section.

5. Discussion and conclusions

The results obtained do not confirm the previous conclusions with regard to Polish companies or other countries analyzed so far. For companies listed on the WSE, the only relevant factor turned out to be the level of the PMI index in December of the year preceding the year of the dividend payout and, surprisingly, its impact turned out to be negative. Thus, it is possible that the improvement in the economy resulted in the company undertaking additional investments, which then translated into a decision to increase retained earnings and, as a result, lower the assumed growth of dividends paid (since it should be noted that the aforementioned measure is not correlated with the level of dividends, but their growth). The rationale for the existence of a time lag (since the May level of the PMI is not correlated with changes or the level of dividends paid) is the presumably long period of decision-making on additional investments by companies.

The opposite direction of correlation is seen for German companies. Increased December PMI readings are accompanied by decisions to increase dividends paid above average. At the same time, there is a lack of any correlation for the May readings. It is possible that German companies, anticipating an improvement in the economy, and having excessive reserves of previously accumulated capital, decide to partially transfer it to stockholders.

The correlations observed for US companies should be considered the strongest documented. Both absolute and percentage changes in dividends paid are significantly correlated with the PMI and inflation rate observed at the end of December and May. The conclusions obtained for changes in the price level have been previously confirmed in the literature (Khan, Ullah, Muhammad, Muhammad, 2019; Yakuba, 2019; Hazlitt, 2007; Skousen, 2011). It is worth noting, however, that in this study they refer not so much to the level of dividends as to their growth. The results obtained are somewhat natural, since a rising inflation rate accelerates the erosion of the value of retained earnings, prompting boards to slow the growth of dividends paid. The relationship between changes in dividends paid and the PMI is analogous to that of Polish companies, and a plausible explanation for this may be analogous, with the change that NYSE-listed companies show an equally strong negative correlation also for readings in May of a given year. This may indicate the greater importance placed by company boards on the latest macroeconomic data. At the same time, contrary to the results (Khan, Ullah, Muhammad, Muhammad, 2019; Akani, Swenem, 2017; Muhammad, Khan, 2018), the relationship turns out to be positive. This phenomenon can be explained by referring

to the expected reaction of the financial market to increases in interest rates, which generally leads to a decline in current prices. It seems possible that there is a desire to compensate for capital losses incurred due to rising interest rates with above-average dividend payouts. Nevertheless, the described mechanisms require further research.

Summarizing the research results obtained, it is necessary to emphasize the differences between the markets with regard to the relationship between dividend payments and macroeconomic variables – in particular, between the US market and European companies, as well as the similarities between the Polish and German markets. However, the indicated similarities in terms of dependence on macroeconomic quantities do not translate into similar dividend policies – entities listed on the WSE decide to increase dividends less often than those listed on the FSE or NYSE, and it can be presumed that they make dividend decisions dependent on current events (e.g. the SARS-CoV-2 pandemic). At the same time, it should be emphasized that the analysis carried out concerns only the largest entities, being also geographically limited. The authors hope to expand the subject and geographic scope of their study with a special focus on companies listed on other European stock exchanges. This issue will be the subject of their subsequent research.

References

1. Akani, H.W., Swenem, Y. (2017). Macroeconomic Aggregates and Retention Ratio of Quoted Firms in Nigeria. *Asian Finance & Banking Review*, Vol. 1, No. 1.
2. Allen, F., Bernardo, A.E., Welch, I. (2000). A Theory of Dividends Based on Tax Clienteles. *Journal of Finance*, Vol. 60, No. 6, pp. 2499-2536.
3. Asquith, P., Mullins, Jr D.W. (1983). The Impact of Initiating Dividend Payment on Shareholders' Wealth. *Journal of Business*, Vol. 56, No. 1.
4. Baker, M., Wurgler, J. (2004) Appearing and Disappearing Dividends: The Link to Catering Incentives. *Journal of Financial Economics*, Vol. 73.
5. Basse, T., Reddemann, S. (2011). Inflation and the Dividend Policy of US Firms. *Economy watch*, No. 6.
6. Black, F., Scholes, M. (1974). The effects of dividend yield and dividend policy on common stock prices and returns. *Journal of Financial Economics*, No. 1.
7. Brav, A., Graham, J.R., Harvey, C.R., Michaely, R. (2005). Payout Policy in the 21st Century. *Journal of Financial Economics*, No. 77.
8. Brigham, E.F., Houston, J.F. (2015). *Fundamentals of financial management*. Warsaw: PWN.

9. Cwynar, A., Cwynar, W. (2007). *Kreowanie wartości spółki poprzez długoterminowe decyzje finansowe*. Warsaw: The Publishing House of the University of Information Technology and Management.
10. Damodaran, A. *Analyzing Cash Returned to Stockholders*. Retrieved from: <http://pages.stern.nyu.edu/~adamodar/pdfiles/acf2E/Chap11.pdf>, 20.09.2023.
11. DeAngelo, H., DeAngelo, L., Skinner, D. (2000). Special Dividends and The Evolution of Dividend Signaling. *Journal of Financial Economics, No. 57*.
12. Desmukh, S., Goel, A.M., Howe, K.M. *CEO Overconfidence and Dividend Policy*. Retrieved from <https://ssrn.com/abstract=1496404>, 19.09.2023.
13. Dębski, W., Bujnowicz, I. (2008). Model współzależności rozwoju systemu finansowego i wzrostu gospodarczego w Polsce. *Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania Uniwersytetu Szczecińskiego, No. 9*, p. 9.
14. Eijie, von H., Megginson, W. *Flexibility of Dividend Policies and Shareholders' Returns in the European Union*. Retrieved from: <http://ssrn.com/abstract=1342671>, 20.09.2023.
15. Evbayiro-Osagie, E.I., Osayuwa, E.E. (2023). Determinants of Dividend Payout Behaviour of Listed Financial Firms. *Baze University Journal of Entrepreneurship and Interdisciplinary Studies, Vol. 2*.
16. Evidence from Listed Banks in Ghana. *Management & Accounting Review, Vol. 18, No. 3*.
17. Fama, E.F., French, K.R. (2001). Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay? *Journal of Financial Economics, Vol. 60*.
18. Ferris, S.P., Sen, N., Pei Yui, H. (2006) Are Fewer Firms Paying More Dividends? *Journal of Multinational Financial Management, Vol. 16*.
19. Fuller, K.P., Goldstein, M.A. (2011). Do dividends matter more in declining markets? *Journal of Corporate Finance, Vol. 17, No. 3*, pp. 457-473.
20. Graham, B. (2007). *Inteligentny inwestor*. Warsaw: Studio Emka Publishing House.
21. Grullon, G., Ikenberry, D.L. (2000). What Do We Know About Stock Repurchase? *Journal of Applied Corporate Finance, Vol. 13, No. 1*.
22. Hawawini, G., Viallat, C. (2007) *Finanse menedżerskie. Kreowanie wartości dla akcjonariuszy*. Warsaw: PWE.
23. Hazlitt, H. (2007). *Inflacja, wróg publiczny, nr 1*. Warsaw: Fijorr Publishing.
24. Horbaczewska, B. (2012). *Wyплаты dla akcjonariuszy a wycena akcji na rynku kapitałowym*. Warsaw: CeDeWu.
25. Jabbouri, I. (2016). Determinants of corporate dividend policy in emerging markets: Evidence from MENA stock markets. *Research in International Business and Finance, Vol. 37*.
26. Jabłoński, B., Kuczowic, J. (2015). Microeconomic and Macroeconomic Determinants of the Dividend Policy in Companies Quoted at Warsaw Stock Exchange – Research Results. *Ekonomia i Prawo. Economics and Law, Vol. 14, No. 4*.

27. Jabłoński, B., Prymon, K. (2017). *Polityka dywidend współczesnego przedsiębiorstwa – teoria i praktyka*. Katowice: The Publishing House of the University of Economics in Katowice.
28. Jagannathan, M., Stephens, C.P., Weisbach, M.S. (2000). Financial Flexibility and the Choice Between Dividends and Stock Repurchases. *Journal of Financial Economics*, No. 57.
29. Khan, F., Ullah, A., Muhammad, A.A., Muhammad, K.I. (2019). The Relationship Between Macroeconomic Variables and the Dividend Payout Ratio of the Textile Sector Listed on Pakistan Stock Market. *Sarhad Journal of Management Sciences*, Vol. 4, Iss. 1.
30. Kowerski, M. (2011), *Ekonomiczne uwarunkowania decyzji o wypłatach dywidend przez spółki publiczne*. Kraków/Rzeszów/Zamość: Academic Consortium Publishing House of the Cracow University of Economics, University of Information Technology and Management in Rzeszów and College of Management and Administration in Zamość.
31. Lichtenfeld, M. (2015). *Get Rich with Dividends*. New Jersey: John Wiley & Sons Inc.
32. Miller, M.H., Modigliani, F. (1961). Dividend Policy, Growth, and the Valuation of Shares. *Journal of Business*, Vol. 34, No. 4.
33. Misra, S.D. (2015). Determinants of dividend policy: a study of the Indian banking sector. *International Journal of Indian Culture and Business Management*, Vol. 11, Iss. 4.
34. Muhammad, A.A., Khan, F. (2018). The Relationship Between Macroeconomic Variables and the Dividend Payout Ratio of the Textile Sector Listed on Pakistan Stock Market. *Sarhad Journal of Management Sciences (SJMS)*, Vol. 4, Iss. 1.
35. Romus, M., Rizga, A., Abdillah, M.R., Zakaria, N.B. (2020). Selected Firms Environmental Variables: Macroeconomic Variables, Performance and Dividend Policy Analysis. *IOP Conf. Series: Earth and Environmental Science*, No. 469.
36. Rubin, H., Spaht, II C. (2011), Financial Independence Through Dollar Cost Averaging and Dividend Reinvestment. *Journal of Applied Business and Economics*, No. 4.
37. Skinner, D.J., Soltes, E.F. (2011) What Do Dividends Tell Us About Earnings Quality? *Review of Accounting Studies*, Vol. 16, No. 1.
38. Skousen, M. (2011). *Investing in One Lesson*. Warsaw: Fijorr Publishing Company.
39. Skousen, M. (2011). *Struktura produkcji. Giełda, kapitał, konsumpcja*. Warsaw: Fijorr Publishing.
40. Słoński, T. (2012). *Analiza wpływu wspomaganego długiem wykupu akcji (LBO) na wartość spółki*. Wrocław: The Publishing House of the University of Economics in Wrocław.
41. Szablewski, A (2003). *Strategie wzrostu wartości firmy. Studium przypadków*. Warsaw: Poltext.
42. Szablewski, A., Tuzimek, R. (2006). *Wycena i zarządzanie wartością firmy*. Warsaw: Poltext.

43. Tuzimek, R. (2013). *Decyzje finansowe w spółkach giełdowych a wartość akcji*. Warsaw: The Higher School of Economics Publishing House.
44. Williams, A., Miller, M. (2013). Do Stocks with Dividends Outperform the Market During Recessions? *Journal of Accounting and Finance*, Vol. 13, No. 1, pp. 58-69.
45. Woolridge, J.R., Ghosh, C. (1986). Dividend Cuts: Do They Always Signal Bad News? *Midland Corporate Finance Journal*, No. 3, pp. 20-32.
46. Yakuba, I.N. (2019). Revisiting the Factors Influencing Corporate Dividend Policy Decisions: Evidence from Listed Banks in Ghana. *Management & Accounting Review*, Vol. 18, No. 3.

LOGISTICS CUSTOMER SERVICE MANAGEMENT ON THE EXAMPLE OF A MANUFACTURING COMPANY

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Purpose: The aim of the article is to analyze the operation of company X in the context of logistic customer service in practice.

Design/methodology/approach: The idea of the work is to present the theoretical part of customer service and compare it to logistic customer service in practice. It also includes comparisons of practical solutions of company X to theoretical requirements.

Findings: The research issue discussed in the article was a survey. Its purpose is to present customer service in Patrick's Day in company X. 81 people of different genders and age groups responded anonymously to the survey questions 15- >60 years. General knowledge of the logistics industry and responses from opinion makers were taken into account. The responses of the surveyed people were presented graphically along with their descriptions.

Research limitations/implications: The practical part is intended to reflect the actual compliance of company X with the imposed rules. The Logistics Customer Service Principles were created to ensure a consistent and effective approach to customer service in the context of logistics.

Practical implications: The type of customer service strategy depends on the specific goals and needs of a given business. The essence of logistic customer service is the effective management of the flow of products and services from the place of production to the place of consumption in order to meet customer needs. Logistics customer service covers many aspects, such as planning, controlling and monitoring the flow of goods, inventory management, transport, warehousing and coordination of activities between various links in the supply chain.

Social implications: Customer service also means the ability to accept customer opinions and comments with an open mind. Customers should be able to express their opinions and complaints and then respond effectively.

Originality/value: The article draws attention to the importance of a non-routine approach to the dynamics of opportunities. This is important for management as a scientific discipline, but also for managers, which indicates various possible development paths.

Keywords: Customer, logistic customer service, logistics.

Category of the paper: Research paper.

1. Introduction

Logistic customer service is understood as the ability to meet the expectations and needs of the customer. It is a multidimensional process that combines many pre-transaction, transactional and post-trade activities (Majchrzak-Lepczyk, 2014; Książkiewicz, 2011). This is one of the most important aspects of the operation of enterprises. It aims to meet the needs of customers, retain them and acquire them (Kręt, 2020; Kramarz, 2014; Majchrzak-Lepczyk, 2019). Proper logistic customer service ensures a good reputation of the company, optimization of costs, improvement of internal processes of the company and minimizes the risk of unavailability of products or delays. The type of customer service strategy depends on the specific goals and needs of the business (Rucińska, 2016). The essence of logistics customer service is the effective management of the flow of products and services from the place of production to the place of consumption in order to meet the needs of customers (Barcik, 2012). Logistics customer service encompasses many aspects, such as planning, controlling and monitoring the flow of goods, inventory management, transport, warehousing, and coordination of activities between different links in the supply chain (Adryjańczyk, Olech, Kuboń, Szelaż-Sikora, Sikora, Gródek-Szostak, Niemiec, Stuglik, 2020). Customer service is also about being able to accept customer feedback and comments with an open mind. The concept of customer service is multidimensional, combining logistics and marketing aspects, taking into account the mutual complementarity and dependence of logistics and marketing potential in the field of customer service. Companies need to attract customers in many ways, logistics and marketing services that guarantee reliability are essential. Service, punctuality and safety of deliveries, professional communication or building relationships with buyers. Importantly, existing customers are characterized by high price sensitivity and low product and brand loyalty, which leads to problems with demand forecasting and good distribution. Among the logistics concepts and activities carried out to meet the incalculable needs and requirements of consumers, the fundamental tasks are assigned to logistics services. "To ensure customer satisfaction, it's important that customers are satisfied with the level of service that will impact their loyalty to the company"(Harasim, Dziwulski, 2018). Customers should be able to express their opinions and complaints and then respond effectively. A customer service strategy is a plan of action to provide the best possible customer service and build lasting relationships with customers. The strategy outlines how the company will respond to customer needs, expectations, and feedback and deliver personalized, effective, and rewarding customer experiences (Kadlubek, 2011). "The customer service strategy is considered to be perspective, plan, deception, and pattern of action in order to maintain or occupy a particular position in the market" (Dyczkowska, 2015).

The customer service strategy applies not only to the service industry (including retail), but to all companies that serve customers, such as manufacturing companies (Kolasińska-Morawska, Fernówka, 2018). The concept of servicing companies is related to the product marketing strategy and sales strategy. A customer service strategy can be a combination of marketing and sales strategy (Rydzkowski, 2011). However, they mainly concern the stages of customer service (Huk, Goń, Pękalska, 2019). As such, the customer service strategy is somewhat independent of the product's marketing strategy, especially if the product is a fabricator. The basic approach to customer service therefore focuses on one of the very important elements of contact with the customer, which is customer service (Kaczmar, Suchy, 2020; Jeziński, 2013).

The practical part of the article was based on this solution, in order to reflect the actual attitude of company X to the imposed rules. The Logistics Customer Service Principles were created to ensure a consistent and effective approach to customer service in the context of logistics. The aim of the article is to analyze the operation of company X in the context of logistic customer service in practice. The idea of the work is to present the theoretical part of customer service and compare it to logistic customer service in practice. It also includes comparisons of practical solutions of company X to theoretical requirements.

2. Customer service in enterprise X in practice

To assess the operation of company X in the field of customer service in practice, an anonymous public survey was created in which 81 people participated. The survey consisted of 13 questions, including 10 directly related to company X. Respondents most often had the opportunity to answer YES/NO questions. The purpose of creating the survey questionnaire was to present the weaker points in customer service in company X and proposals for their changes. In the survey, the majority of people surveyed - 59.3% - were women. Men constituted 40.7%. Another aspect examined regarding the characteristics of the respondents was their age. Due to the possibility of its large discrepancy, the described range started from 15 years to 60 and up. In the study regarding company X the answers were as follows: 31-45 - 30.9%, 15-19 - 8.6%, 46-60 - 7.4%, while the smallest group of people were over sixty years of age, as there were 5 participants every constitutes 6.2% of the total. Respondents showed that the dominant answer in the study was professionally active status - 54.3%. The smallest group of people interacting is the group of retirees. The first aspect examined directly relating to company X was the availability of their stores in Poland. The majority of survey participants, as many as 67.9%, answered that they did not have the described commercial facility in their city.

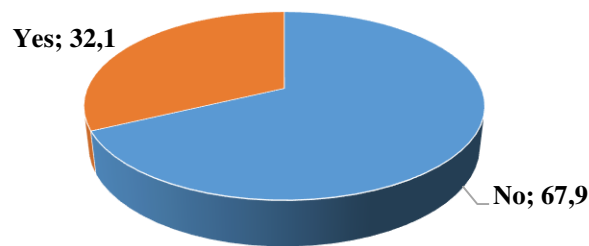


Figure 1. Availability of Enterprise X stores.

Source: Own study based on conducted research.

Buyers who want to make a purchase in company X must commute to larger cities in Poland. There are a total of eleven sales points in Poland, while there are three points in Warsaw alone. A significant number of opinion makers live in the Silesian Voivodeship, the capital of which is the city of Katowice, where the company has its store. This limits consumers' ability to purchase products in-store. In this case, purchasing goods online may be the solution. The results of the questionnaire show that the largest number of respondents made purchases in a stationary store - 44.4%. In second place in the hierarchy is the answer: stationary store and online store - 34.6%. The smallest part is made up of online purchases - 21%.

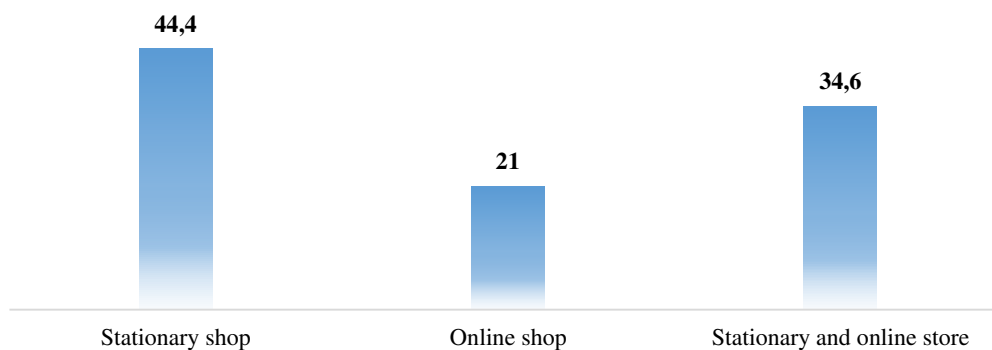


Figure 2. Possibility to make purchases.

Source: Own study based on conducted research.

Due to the fact that these studies show that this is an upward trend, the survey results are surprising. In the next stage, respondents who had marked answers regarding purchases in an online store in the previous question answered questions in this regard as part of the study. The questions concerned the ease of use of the application and the store's website, whether the order was delivered within the specified deadline, as well as whether the order was complete. The study results are presented in Table 1.

Table 1.*Research based on a survey regarding an online store*

Question	Available answers	Results
Is the store website/app easy to use?	YES/NO	YES - 81,1% NO - 18,9%
Was the goods delivered on time?	YES/NO	YES - 84,9% NO - 15,1%
Was the order complete?	YES/NO	YES - 88% NO - 12%

Source: Own study based on conducted research

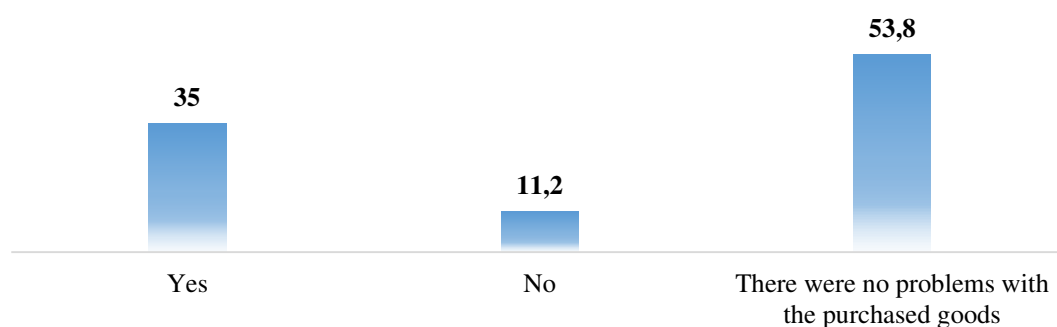
Respondents who in the survey chose the answer regarding shopping only in stationary stores were asked to express their opinion in this aspect. The effects are illustrated in table number 2.

Table 2.*Respondents' answers regarding purchases in an online store*

Question	Available answers	Results
Were the store staff helpful while shopping? (answers to questions, help in making decisions)	YES/NO	YES - 77% NO - 23%
Was the expected product available in the store?	YES/NO	YES - 80,8% NP. - 19,2%

Source: Own study based on conducted research

The later stage of the study consisted of an insight into the service provided by company.

**Figure 3.** Possibility to make purchases.

Source: Own study based on conducted research.

The company's assistance in the event of errors and dysfunctions is based, among others, on: on the quick response of employees, good contact with the customer, quick replacement or complaint, as well as the level of positive warranty considerations. To this question, the majority of respondents - 53.8% answered that there were no problems with the purchased goods. 35% of survey participants stated that company.

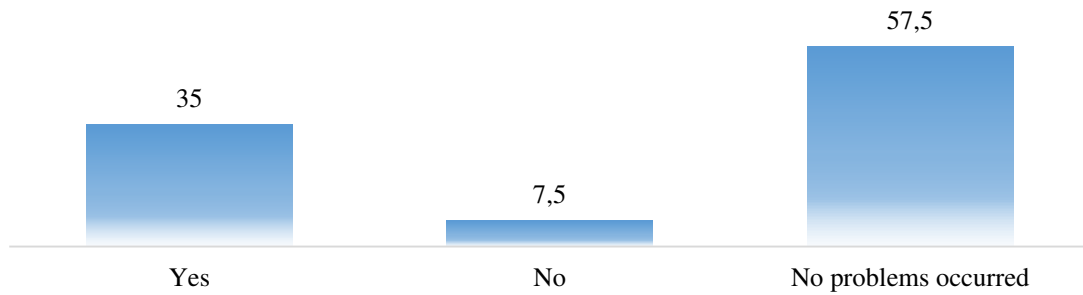


Figure 4. Company assistance in case of problems with purchased goods.

Source: Own study based on conducted research.

The next question concerned problems with the purchased goods. among others such as:

- production defects,
- damage to the goods during transport,
- incorrect packaging,
- technical defects of the product.

The results in this case are not much different from the previous study. Most people (57.5%) marked the answer "No problems occurred". The second most frequently chosen option (35%) ensures that Company X provides assistance in the event of a problem. Only 6 people surveyed (7.5%) responded negatively. The question summarizing the entire survey was mandatory for the study participants. Its aim was to determine whether, in general, they are satisfied with the customer service in company X. 85.2% of respondents expressed satisfaction with the service in the store of company X. 14.8% are not satisfied in this aspect.

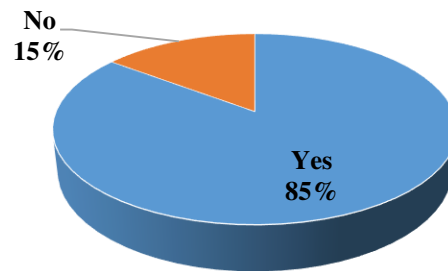


Figure 5. Customer satisfaction with enterprise service X.

Source: Own study based on conducted research.

The study shows that company X is a prosperous and customer-oriented company. It can also be said that the quality of customer service is at a high level, as evidenced by the predominance of positive responses in the survey. The company has competent and experienced employees who perform their work with the greatest care and accuracy. However, the company cannot stop at this level of service, because quality processes must be constantly improved.

3. Proposed changes for company X

The table below presents my proposed changes for company X to improve its functioning. In my study, I relied on the elements and measurements of customer service included in table 3 and on information obtained from the survey. The table of proposed changes aims to improve and modernize logistic customer service in practice.

Table 3.
Proposals for changes for company X

Customer service elements	Results based on own research
Product availability	The availability of products in company X's stores is good, but not perfect. In this case, the best solution for the company will be to maintain a constant level of inventory at each of its sales points. It would also be necessary to use the DRP system - Distribution Requirements Planning, which will allow for the optimization of warehouse levels and minimize the risk of stock shortages (Bień, Jędrzejczyk, Kucęba, 2020).
Delivery time	To improve on-time deliveries, company X should analyze its logistics process from the moment the customer places the order to the moment the product is delivered. This will allow you to find the element of the process that causes delays in delivery. Another solution is to train staff to improve the order picking and packing process or enable ongoing problem solving during the logistics process (Wiącek, Ligeikienés, 2020).
Ease of use of available online purchase options	To make the application and website easier to use, the company should minimize the number of clicks and information needed to place an order. A good solution would also be the possibility of changing the website preferences for the buyer, which will make it easier for him to search for the desired product (Zieliński, 2021).
Completeness of the order	In order to minimize shortages in orders sent to customers, the IT system should be modernized as much as possible. The solution for the company will be an RFID computer system that will simplify product identification and control of their flow.
Employee assistance during shopping	To improve this aspect of customer service, company X should retrain its employees. A bonus system would motivate staff to strive for the good of the client and make it easier to find weaker individuals in the team. An adequate solution would also be to survey the store's customers who would identify the weaker and stronger points of service (Fura, Surmacz, 2014; Marcysiak, Pieniak-Lendzion, Lendzion, 2013).
System for removing errors and dysfunctions in distribution	The most beneficial solution in the system for removing errors and dysfunctions in distribution will be a thorough analysis of the reasons for these inconveniences. For this purpose, company X should accurately report the situations that arise. Staff should implement corrective procedures as quickly as possible to reduce customer response times and waits (Smyk, 2014).
After-sales service	To improve the after-sales system, the company should improve communication with the customer. Provide detailed information regarding the return, complaint or exchange procedure. The use of the CRM - Customer Relationship Management system will be beneficial for the company (Szydelko, 2012).

Source: Own study based on conducted research.

The change proposals for company x are aimed at improving customer service in practice. The application of changes is aimed at (Kolasińska-Morawska, Fernówka, 2018; Kawa, 2017):

- improve product availability,
- improve delivery times,
- make it easier for buyers to use the application and website,
- minimize order shortages (Sułkowski, Morawski, 2014),

- improve advice when shopping,
- minimize and quick response to errors and dysfunctions,
- improve the after-sales system (Majchrzak-Lepczyk, 2015).

Continuously introducing changes for the better is crucial to the success of a company. This is an important aspect for stimulating innovation in companies. Constantly searching for new solutions, technologies and processes can discover more effective and efficient ways of operating. This contributes to increasing the effectiveness and efficiency of the proceedings. The company can increase team productivity and minimize wastage of time and resources. Thanks to numerous training courses and awards, employees will increase their motivation and willingness to learn, which will improve the overall comfort of work in company X. This leads to greater profitability and increased profits. Companies that do not change risk being marginalized by more innovative and progressive corporations. At this point, the market is too competitive for the company to abandon changes in the modernization of customer service processes. Most consumers are demanding and expect the best possible service. The business world is constantly changing both in terms of market trends and new technologies. The proposed changes in the table will help Company X move towards constantly evolving standards.

4. Summary

Logistics customer service is broadly understood and combines the issue of customer service with logistics. Every company tries to make this aspect as good as possible because it attracts consumers and increases revenues. The described business has many branches in which it must meet the appropriate requirements for logistic customer service. In order to find out in the best way whether this aspect is met, logistic customer service was characterized on the example of company X. To sum up the above-mentioned stages, a table of proposed changes for company X was based, among other things, on the idea of using logistics IT systems in the enterprise. The responses of the surveyed people were presented graphically along with their descriptions. As a result of this work, it can be concluded that company X, in general, performs very well in terms of logistic customer service. The respondents answered the questions mostly in a positive way. Customer service is at a high level, however, the table of proposed changes is aimed at striving for the highest possible level of logistic customer service, which gives the company benefits such as customer loyalty, recommendations and satisfaction.

References

1. Adryjańczyk, S., Olech, E., Kuboń, M., Szelań-Sikora, A., Sikora, J., Gródek-Szostak, Z., Niemiec, M., Stuglik, J. (2020). Wybrane aspekty logistyki serwisowej w przedsiębiorstwach produkcyjnych. In: M. Kuboń (ed.), *Transport i logistyka w dobie inżynierii mechanicznej*. Wydawnictwo „Inżynieria Rolnicza”.
2. Barcik, R. (2012). Znaczenie obsługi klienta w logistyce. *Logistyka*, 4, 35-36.
3. Bień, J., Jędrzejczyk, W., Kucęba, R. (2020). Ekoinnowacyjne potrzeby przedsiębiorstw z sektora MSP a potencjał sieci ekoinnowacji Ecolabnet. *Przegląd Organizacji*, 3, 12-18, DOI: 10.33141/po.2020.03.02
4. Dyczkowska, J. (2015). Zarządzanie logistyczną obsługą klienta. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Problemy Zarządzania, Finansów i Marketingu*, 41(2), 447-458, DOI:10.18276/pzfm.2015.41/2-36
5. Fura, B., Surmacz, T. (2014). Zarządzanie środowiskowe w przedsiębiorstwach jako narzędzie służące budowie zielonych łańcuchów dostaw. *Logistyka*, 6, 13265-13270.
6. Harasim, W., Dziwulski, J. (2018). Logistyczna obsługa klienta i jej znaczenie z perspektywy strategii organizacji. *Zeszyty Naukowe – Wyższa Szkoła Promocji w Warszawie*, 1, 44-60.
7. Huk, K., Goń, A., Pękalska, J. (2019). Logistyka zwrotów a logistyczna obsługa klienta w procesach sprzedaży realizowanych w e-commerce. *Przedsiębiorczość i Zarządzanie*, 20(5), 31-41.
8. Jezierski, A. (2013). *Logistyczne determinanty kształtowania struktur rynku*. Wydawnictwo Uniwersytetu Gdańskiego.
9. Kaczmar, I., Suchy, M. (2020). Nowe strategie biznesowe na przykładzie łańcucha dostaw produktów spożywczych. In: G. Dzieniszewski, M. Kuboń (eds.), *Łańcuchy logistyczne w gospodarce żywnościowej* (pp. 183-200). Wydawnictwo „Inżynieria Rolnicza”.
10. Kadłubek, M. (2011). Założenia logistycznej obsługi klienta w przedsiębiorstwie. *Zeszyty Naukowe Politechniki Częstochowskiej. Zarządzanie*, 4, 15-27.
11. Kawa, A. (2017). *Analiza rynku KEP w Polsce*. DOI:10.13140/RG.2.2.12101.76008
12. Kolasińska-Morawska, K., Fernówka, P. (2018). Logistyka na rzecz obsługi klienta. *Przedsiębiorczość i Zarządzanie*, 19(5.3), 9-25.
13. Kramarz, M. (2014). *Elementy logistyczne obsługi klienta w sieci dystrybucji*. Difin.
14. Kręt, P. (2020). E-commerce w czasie pandemii COVID-19. *Management and Quality – Zarządzanie i Jakość*, 2(3), 42-54.
15. Książkiewicz, D. (2011). Przewozy kurierskie. In: W. Rydzkowski (eds.), *Usługi logistyczne. Teoria i praktyka* (pp. 86-118). Wydawnictwo Instytutu Logistyki i Magazynowania.

16. Majchrzak-Lepczyk, J. (2014). Obsługa klienta w wymiarze logistyczno-marketingowym. *Gospodarka Materialowa i Logistyka*, 17.
17. Majchrzak-Lepczyk, J. (2015). Logistyczno-marketingowe aspekty w sieci tworzenia wartości. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, 217, 68-80.
18. Majchrzak-Lepczyk, J. (2019). Kreowanie wartości dla klienta wyzwaniem dla e-commerce. *Przedsiębiorczość i Zarządzanie*, 20(7.2), 109-121.
19. Marcysiak, A., Pieniak-Lendzion, K., Lendzion, M. (2013). Usługi kurierskie na rynku usług logistycznych w Polsce. *Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego*, 96, 29-38.
20. Rucińska, D. (2016). Rynek przesyłek kurierskich, ekspresowych i paczkowych (KEP) – warunki funkcjonowania i rozwoju w drugiej dekadzie XXI wieku. *Zeszyty Naukowe Uniwersytetu Gdańskiego. Ekonomika Transportu i Logistyka*, 61, 167-179.
21. Rydzkowski, W. (2011). *Usługi logistyczne. Teoria i praktyka*. Instytut Logistyki i Magazynowania.
22. Smyk, S. (2014). Wymiar operacyjny obsługi logistycznej. *Przedsiębiorczość i Zarządzanie*, 15(5.1), 115-126.
23. Sułkowski, Ł., Morawski, P. (2014). Obsługa klienta w procesach zarządzania logistycznego. *Przedsiębiorczość i Zarządzanie*, 15(5.3), 197-212.
24. Szydełko, M. (2012). Logistyczna obsługa klienta jako element kształtowania przewagi konkurencyjnej przedsiębiorstwa. *Logistyka*, 5, 194-199.
25. Wiącek, M., Ligeikienės, R.A. (2020). Stakeholders versus Technological Changes – Theory and Practice. *Marketing i Rynek*, 12, 3-13. DOI: 10.33226/1231-7853.2020.12.1
26. Zieliński, K. (2021). Metody wyboru i oceny dostawców jako element logistyki zaopatrzenia. In: P. Belch (ed.), *Logistyka i transport – wybrane zagadnienia w świetle badań naukowych i praktyki gospodarczej* (pp. 41-52). Oficyna Wydawnicza Politechniki Rzeszowskiej.

SELECTED ASPECTS OF PROJECT MANAGEMENT FOR THE IMPLEMENTATION OF A NEW STANDARD OF COST ACCOUNTING IN HEALTH CARE UNITS

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Purpose: The aim of the article is to discuss the most important aspects related to the management of the project of implementing the cost accounting standard in hospitals in Poland. A properly implemented standard is to enable the support of management processes and proper financial management in the health care system at the macro level as well as at the level of the healthcare entity. The first period of operation of these regulations is an opportunity to take stock in this respect.

Design/methodology/approach: The research was conducted by using a survey questionnaire. On the basis of the questionnaire survey in 52 hospitals in Poland. The obtained test results were subjected to the basic statistical analyses.

Findings: On the basis of the analyses of the results of empirical research, recommendations were formulated regarding the principles of implementation of the cost accounting standard in hospitals and the directions of its effective use in management processes in the future.

Research limitations/implications: The utilization of survey research is associated with the presence of subjectivity in assessments by respondents.

Originality/value: The article presents important recommendations for health care managers on projects to implement the new cost accounting standard in health care entities in Poland.

Keywords: hospital, cost accounting, project management.

Category of the paper: Research paper.

1. Introduction

The main source of the health care system's problems is primarily the limited financial resources available within the system, but its effectiveness is also affected by the ineffective management of these resources (Rogowska, 2019). A solution supporting management processes in the field of financial management is the Regulation of the Minister of Health of

26 October 2020 on recommendations for the standard of cost accounting for healthcare providers. Proper implementation of this recommendation is a challenge for healthcare entities in Poland. The aim of the article is to discuss the most important aspects related to the management of the project of implementation of the cost accounting standard in hospitals in Poland. A properly implemented standard is to enable the support of management processes and proper financial management in the health care system at the macro level as well as at the level of the healthcare entity. The first period of operation of these regulations is an opportunity to take stock in this respect. The study was conducted using a questionnaire in 52 hospitals in Poland. On the basis of the conducted analyses of the results of empirical research, conclusions were formulated related to the implementation of the new cost accounting standard, but above all the potential possibilities of its use in analytical work for the needs of various stakeholder groups - internal and external (Głód, Mucha-Wójcik, 2019).

2. Standard of cost accounting in healthcare entities – principles of implementation

Challenges related to the information potential in the accounting system of healthcare entities are quite a challenge (Hass-Symotiuk, Kludacz-Alessandri, Cygańska, 2020). At the same time, the role of cost accounting in the healthcare sector is increasing (Carroll, Lord, 2016).

In the past, there have been attempts to standardize solutions in this area at the national level, as well as there have been demands for the use of more modern solutions, for example in the form of activity cost accounting (Chluska, 2007). These problems do not only concern the Polish healthcare system (Jovanović, Dražić-Lutilsky, Vašiček, 2019).

The history of cost accounting regulations in healthcare is quite extensive. The first regulation on cost accounting in health care units was the Regulation of the Minister of Health and Social Care of 22 December 1998 on the detailed principles of cost accounting in public health care institutions. This regulation made it necessary to record costs in a way that would enable the calculation of unit costs of health services. According to this legal act, the costs incurred by a health care institution should be recorded by type and by cost centres in the subject-entity system. The generic cost system groups costs by type, i.e. consumption of materials and energy, external services, taxes and fees, salaries, employee benefits, depreciation, other costs. On the other hand, costs in the entity system are grouped according to cost centres, which constitute a separate scope of activity of a health care institution.

Another attempt in this area was a solution based on variable cost accounting introduced by the Regulation of the Minister of Health of 8 July 2015 on recommendations for the standard of cost accounting for healthcare providers, which is based on a resource-process approach.

Taking into account further comments on problems with the implementation of the cost accounting standard for healthcare providers has been included in the Regulation of the Minister of Health of 26 October 2020. on recommendations for the standard of cost accounting for healthcare providers. The regulation has been in force since 1.01.2021. and is mandatorily required for healthcare providers who have entered into a contract for the provision of health care services.

The main assumptions of the new cost accounting standard include, first of all, the unification of type accounts and cost generation centers. First of all, the records of the costs of medical materials, medical and non-medical services and the costs of salaries have been detailed. An important change is the clear indication of the account numbers of cost centers in accordance with the classification of the so-called departmental codes of the Ministry of Health. Further sections of the regulation present a unified method of applying the distribution keys for common costs in the scope of the medical and auxiliary parts. An important change in the new cost accounting is the clearly defined components of management costs and the uniform method of calculating the costs of sales of a given medicinal product. The final effect of these regulations is also the presentation of the method of calculating the cost of the procedure and the man-day.

The implementation of new regulations in the field of cost accounting in healthcare entities in Poland can be treated from the perspective of project management. The success of cost accounting implementation is influenced by both behavioural and organisational factors, e.g. management board support, relationship with the implemented competitive strategy, connection with performance appraisal and remuneration systems, training, implementation of accounting by employees and having appropriate resources for implementation (Wnuk-Pel, 2010).

An important issue in this area is also the use of IT solutions that supports the cost settlement process itself, but also include an analytical component (Azevedo, Duarte, Santos, 2022). In addition, there are dilemmas related to the very methodology of managing such an implementation project, even towards the use of agile solutions (Jiménez, Afonso, Fernandes, 2020). In addition, the implementation of solutions in this area is the subject of comparative research at the international level (Bertoni, De Rosa, Dražić Lutilsky, 2017).

First of all, the prevailing view is that the area is an opportunity to support management processes in healthcare entities, but it is also a significant challenge in the processes of its effective implementation (Kihuba et al., 2016).

3. Research Method

The discussed empirical research was conducted in the fourth quarter of 2022 among 52 hospitals in Poland. 19 hospitals are located in the Silesian Voivodeship, 13 hospitals in the Lublin Voivodeship, and 12 hospitals in the Podkarpackie Voivodeship. On the other hand, 3 hospitals come from the Świętokrzyskie Voivodeship, 2 hospitals each from the Podlaskie and Małopolskie Voivodeships, and 1 hospital represents the West Pomeranian Voivodeship.

An important criterion describing the research sample is the type of hospitals according to the division, which is the essence of the creation of the so-called hospital network in Poland. Therefore, in the structure of the surveyed hospitals, 21 belong to the first level (40.4%) and also 21 belong to the second level – 67 hospitals. The sample includes 8 tertiary hospitals (15.4%) and one national hospital and one pulmonary hospital. 41 hospitals surveyed (78.9%) have an accreditation certificate confirming compliance with quality standards verified by the Quality Monitoring Centre.

The five-point Likert scales used in the empirical study were based on a modified tool developed by Eriotis, Stamatiadis and Vasiliou (2011) and adapted to the realities of the Polish health care system and regulations concerning the cost accounting standard.

In accordance with the adopted tool, the assessment of the management of the project implementing the cost accounting standard in the context of health care units was based on 7 thematic areas, which included:

- the level of knowledge and experience of the employees of the analysis and costs department,
- assessment of the quality of the IT system,
- the relationship between the medical staff and the administrative staff,
- use of expert knowledge,
- training support
- assessment of the support of management processes by the new cost accounting standard,
- assessment of the possibility of using the new cost accounting standard.

The defined area of empirical research allows basic assessments to be made in the research area undertaken.

4. Analysis of empirical research results

The assessment of the level of knowledge and experience of the employees of the analysis and costs department was based on 4 questions. The arithmetic mean taking into account the total score of all questions was 3.82, which indicates a rather high level of knowledge and experience of the employees of the analysis and costs department in the opinion of the respondents. Taking into account the type of units, the highest level of knowledge and experience of the employees of the analysis and cost department was assessed in the case of first-level hospitals (3.96), and the lowest in tertiary hospitals (3.5). The table below presents a summary of the average responses to individual questions on a 5-point scale (1 – very low, 5 – very high).

Table 1.

Average ratings of answers to questions on the level of knowledge and experience of the employees of the analysis and cost department

	Average
The level of education of the employees of the analysis and cost department	3,86
The level of professional experience of the employees of the analysis and cost department in the field of cost accounting	3,79
The level of education in the area of finance and accounting of the head of the unit	3,77
The level of professional experience in the area of finance and accounting of the head of the unit	3,95

Source: Author's own elaboration based on empirical research

In the second area, the units were diagnosed in terms of IT quality system assessment. On the basis of the responses received, it should be stated that in total, more than 60% of the units answered in the affirmative to the 4 statements made. More than 8% of the units agreed with a strong affirmative answer. Difficulties with indicating a clear answer were noted in the case of less than 29% of units. In the remaining units, the statements were negative to the thesis put forward. A detailed structure of the answers to the questions posed in the area of IT quality system assessment is presented in Table 2.

Table 2.

Structure of responses to questions related to the assessment of the IT quality system

	Definitely yes	Yes	It's hard to say	No	Definitely no
Existing information technology is able to provide the data needed for the new cost accounting standard	12,50%	62,50%	22,92%	2,08%	0,00%
Our IT systems in various domain areas (finance and accounting module; costs module; HR and payroll module; warehouse management module, medical statistics module, pharmacy module, etc.) are integrated	12,50%	81,25%	6,25%	0,00%	0,00%

Cont. table 2.

Information systems offer user-friendly query capabilities for different audiences	2,08%	41,67%	47,92%	8,33%	0,00%
An information system typically provides data that is accurate and up-to-date	6,25%	56,25%	37,50%	0,00%	0,00%

Source: Author's own elaboration based on empirical research.

Another area of evaluation of the implementation of the cost accounting standard is related to the relationship between medical and administrative staff. Respondents were asked two questions in this area. The vast majority of respondents positively assessed the optimal level of relations between administrative staff and medical staff. However, when assessing the extent to which healthcare professionals use data from management processes, a large percentage of entities struggle to determine a clear impact. A detailed structure of the answers to the questions posed in the area of relations between medical and administrative staff is presented in Table 3.

Table 3.

Structure of answers to questions related to the relationship between medical and administrative staff

	Definitely yes	Yes	It's hard to say	No	Definitely no
The relationship between the administrative staff and our medical staff in terms of the implementation of the new cost accounting standard can be described as optimal	29,17%	41,67%	25,00%	4,17%	0,00%
Medical staff are eager to use data from the field of cost accounting and analyses in management processes at the level of selected organizational units (e.g. department, outpatient clinic)	8,34%	45,83%	45,83%	0,00%	0,00%

Source: Author's own elaboration based on empirical research.

The use of expert knowledge in the process of implementing the cost accounting standard is another area that has been assessed among the audited entities. Three questions were used to assess this area. In the majority of units (33.33%) difficulties were encountered in assessing the use of expert knowledge, and less than 29% of respondents expressed a negative opinion on the assessment of the use of this knowledge. A detailed structure of the responses to the questions posed in the area of expert knowledge support is presented in Table 4.

Table 4.

Structure of replies to questions on the use of expertise

	Definitely yes	Yes	It's hard to say	No	Definitely no
During the design of the new cost accounting system, professional support of consultants was provided	6,25%	25,00%	43,75%	22,92%	2,08%
During the implementation of the new cost accounting standard, professional support of consultants was provided	10,42%	33,33%	29,17%	25,00%	2,08%

Cont. table 4.

Professional support of consultants was provided in the preparation of an analysis system based on the new cost accounting standard	10,42%	37,50%	27,08%	16,67%	8,33%
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Source: Author's own elaboration based on empirical research.

In the evaluation of training support, mostly positive opinions were received (in total, over 45% of the surveyed units). However, it is important to emphasize that there are difficulties in assessing the conduct of training in the use of an appropriate analysis system resulting from the new cost accounting standard. Table 5 presents the structure of responses to the statements made in the area of training support.

Table 5.

Structure of responses to training support questions

	Definitely yes	Yes	It's hard to say	No	Definitely no
Appropriate training was provided on the design of the new account standard Costs	4,17%	37,50%	33,33%	22,92%	2,08%
Appropriate training was provided on the implementation of the new cost accounting standard	4,17%	52,08%	39,58%	4,17%	0,00%
Appropriate training was provided on the use of the appropriate analysis system resulting from the new cost accounting standard	4,17%	33,33%	54,17%	8,33%	0,00%

Source: Author's own elaboration based on empirical research.

Another area of project management for the implementation of a new cost accounting standard in health care units included support for management processes by a new cost accounting standard. As in the case of the assessment of training support, also in this area, in the vast majority of statements, the respondents encountered difficulties in unambiguously determining the level of support for management processes by the new cost accounting standard. The difficulties in this assessment relate primarily to supporting planning processes in defining objectives, policies and directions of action, including the use of elements of budgeting and forecasting, as well as supporting negotiation processes in the field of negotiations with the National Health Fund and internal negotiations conducted in the entity. On the other hand, support for coordination processes related to analyses and cooperation between units of a healthcare entity (e.g. departments/outpatient clinics and auxiliary organizational units of a medical and non-medical nature) and support for supervision and internal control processes were positively assessed. Table 6 presents a detailed structure of the responses received to the statements made in the field of support for management processes by the new cost accounting standard.

Table 6.

Structure of answers to questions related to the support of management processes by the new cost accounting standard

	Definitely yes	Yes	It's hard to say	No	Definitely no
The implementation of the new cost accounting standard supports planning processes in terms of defining goals, policies and directions of action, including the use of budgeting and forecasting elements	8,33%	31,25%	50,00%	8,33%	2,08%
The implemented cost accounting standard allows for the collection and preparation of information, usually in the form of reports and analyses on the functioning of individual organizational units	8,33%	31,25%	37,50%	22,92%	0,00%
The new cost accounting standard supports coordination processes related to analyses and cooperation between healthcare entity units (e.g. departments/outpatient clinics and medical and non-medical auxiliary organizational units)	14,58%	50,00%	31,25%	4,17%	0,00%
The new cost accounting standard supports the evaluation processes in terms of employee evaluation, implementation of reported improvements, and assessment of the profitability of medical procedures performed	4,17%	41,67%	47,92%	6,25%	0,00%
The new cost accounting standard supports the processes of supervision and internal control.	6,25%	47,92%	41,67%	4,17%	0,00%
The new cost accounting standard supports elements of personnel controlling, in particular in the field of analysis and forecasting of payroll costs	8,33%	41,67%	47,92%	0,00%	2,08%
The new cost accounting standard supports negotiation processes in the field of negotiations with the National Health Fund and internal negotiations conducted in the entity	6,25%	22,92%	60,42%	8,33%	2,08%
The new cost accounting standard supports the presentation of the entity's results in a professional and transparent manner with an appropriate level of detail for various stakeholder groups	8,33%	33,33%	52,08%	6,25%	0,00%

Source: Author's own elaboration based on empirical research.

The last area in the process of assessing the project management of the implementation of the new cost accounting standard in health care units was the possibility of using the new cost accounting standard. In the total assessment of all the statements made, as many as 54% of entities encountered difficulties in assessing the possibility of using the new cost accounting standard. According to the respondents, the greatest doubts should be indicated in the statement concerning the possibility of conducting a comparative analysis of the cost intensity of the procedures carried out in various health care units. As in the other cases, the structure of the responses to the convicted statements contained in this area is presented. A summary of the response structure is presented in Table 7.

Table 7.*Structure of answers to questions on the possibility of using the new cost accounting standard*

	Definitely yes	Yes	It's hard to say	No	Definitely no
The implementation of a new standard of cost accounting made it possible to calculate the costs of treatment of a single medical case	2,08%	31,25%	56,25%	10,42%	0,00%
The new cost accounting standard enabled a reliable assessment of the profitability of individual organizational units	10,42%	47,92%	37,50%	4,17%	0,00%
The new cost accounting standard will affect the provision of reliable data necessary in the tariff process	6,25%	33,33%	52,08%	8,33%	0,00%
The new accounting standard will enable a comparative analysis of the cost intensity of procedures carried out in various health care units	4,17%	18,75%	68,75%	8,33%	0,00%

Source: Author's own elaboration based on empirical research.

The results presented in the table above indicate possible directions for the development of implemented solutions so that they can realistically support decision-making and management processes in healthcare entities.

5. Conclusions

Cost accounting is a management accounting tool that enables efficient management of health care units. The Cost Accounting Standard Regulation imposes an obligation on hospitals to keep cost accounting primarily for external use. The currently introduced system of cost accounting in healthcare entities is an example of a traditional system of cost accounting, modified for the purposes of a clearly distinguished single user. The processes of subordinating the reporting of healthcare entities to the needs of external users are certainly quite challenging. Adapting the structure of the accounting information system to the needs resulting from the expectations of internal and external users is a natural process. But it should maintain certain foundations in terms of its construction and execution. It cannot only be a response to the immediate needs of a selected group of users and ignore not only the fundamental principles of construction, but also the needs of other stakeholders.

The analysis of the results of empirical research indicates that there are no major problems related to the possession of appropriate knowledge and experience in healthcare entities in the area of the new cost accounting standard. The context of IT systems supporting this area was also highly rated. The main problem is to use the effects of the implementation of the new rules for cost settlement. The cost settlement itself is actually the first stage of a larger process of analysis for management purposes. Therefore, there is a challenge regarding the integration of

various domain systems and the development of analytical tools supporting the analysis system towards a comprehensive approach in line with the controlling philosophy (Głód, 2016).

Therefore, in the future, there is a prospect of conducting research on the maturity of these systems in the context of process maturity of accounting processes (Dreszer, Głód, 2022). Continuation of the presented research in healthcare entities in subsequent periods of operation of the cost accounting standard may allow to assess the increase in process maturity in this area.

References

1. Azevedo, J., Duarte, J., Santos, M.F. (2022). Implementing a business intelligence cost accounting solution in a healthcare setting. *Procedia Computer Science*, 198, 329-334.
2. Bertoni, M., De Rosa, B., Dražić Lutilsky, I. (2017). Opportunities for the improvement of cost accounting systems in public hospitals in Italy and Croatia: A case study. *Management: Journal Of Contemporary Management Issues*, 22(Special Issue), 109-128.
3. Carroll, N., Lord, J.C. (2016). The growing importance of cost accounting for hospitals. *Journal of health care finance*, 43(2), 172.
4. Chluska, J. (2007). Determinanty wprowadzenia rachunku kosztów działań w szpitalu. *Zeszyty Teoretyczne Rachunkowości*, 38, 25-36.
5. Dreszer, I., Głód, G. (2022). Doskonalenie procesów księgowych w kontekście dojrzałości procesowej przedsiębiorstwa. In: H. Cichocki, A. Tomaszewski (Ed.), *Organizacja hybrydowa w teorii i praktyce* (pp. 137-146). Warszawa: Oficyna Wydawnicza SGH.
6. Eriotis, N., Stamatiadis, F., Vasiliou, D. (2011). Assessing accrual accounting reform in Greek public hospitals: An empirical investigation. *International Journal of Economic Sciences and Applied Research*, 4(1), 153-183.
7. Głód, G., Mucha-Wójcik, B. (2019). System analiz kosztowych i zarządczych szpitala a oczekiwania interesariuszy zewnętrznych. *Roczniki Kolegium Analiz Ekonomicznych*, 56, *Technologie informatyczne w administracji publicznej i służbie zdrowia*. Szkoła Główna Handlowa, 245-259.
8. Głód, W. (2016). Wsparcie informatyczne systemu rachunku kosztów w jednostkach ochrony zdrowia. *Studia Ekonomiczne*, 278, 141-153.
9. Hass-Symotiuk, M., Kludacz-Alessandri, M., Cygańska, M. (2020). *Rachunkowość podmiotów leczniczych i jej potencjał informacyjny*. Wolters Kluwer.
10. Jiménez, V., Afonso, P., Fernandes, G. (2020). Using agile project management in the design and implementation of activity-based costing systems. *Sustainability*, 12(24), 10352.
11. Jovanović, T., Dražić-Lutinsky, I., Vašiček, D. (2019). Implementation of cost accounting as the economic pillar of management accounting systems in public hospitals—the case of Slovenia and Croatia. *Economic research-Ekonomska istraživanja*, 32(1), 3754-3772.

12. Kihuba, E., Gheorghe, A., Bozzani, F., English, M., Griffiths, U.K. (2016). Opportunities and challenges for implementing cost accounting systems in the Kenyan health system. *Global health action*, 9(1), 30621.
13. Regulation of the Minister of Health and Social Welfare of 22 December 1998 on detailed rules of cost accounting in public healthcare units (Journal of Laws 1998, No. 164, item 1194).
14. Regulation of the Minister of Health of 26.10.2020 on recommendations regarding the cost accounting standard at healthcare providers (Journal of Laws 2020, item 2045).
15. Regulation of the Minister of Health of 8 July 2015 on recommendations for the cost accounting standard at healthcare providers (Journal of Laws 2015, item 1126).
16. Rogowska, K. (2019). Ochrona zdrowia jako strategiczny obszar zarządzania państwa. *Nierówności społeczne a wzrost gospodarczy*, 59, 212-225.
17. Wnuk-Pel, T. (2010). Pomiar sukcesu wdrożenia rachunku kosztów działań w przedsiębiorstwach działających w Polsce. *Zeszyty Teoretyczne Rachunkowości*, 59, 175-204.

MANAGEMENT OF DOMESTIC HOT WATER SYSTEM BASED ON THE EXAMPLE OF A GAS-FIRED INSTANTANEOUS WATER HEATER

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Purpose: The aim of the study was to present the actual efficiency of a gas-fired instantaneous water heater for the production of domestic hot water.

Design/methodology/approach: The object of the study was a gas-fired instantaneous domestic hot water heater located in a flat in Krakow. Measurements with a suitable device were carried out for three basic variants of hot water preparation, defined as showering, washing hands and washing dishes.

Findings: The tests and analyses carried out have revealed that the current efficiency (average efficiency based on 3 measurements – 77.61%) differs radically from that indicated on the water heater data sheet. Such a drop in efficiency may be caused e.g. by fouling of the surface of the heat exchanger on the flue gas side and scaling of the exchanger on the heated side.

Research limitations/implications: The tests proved that the heater did not reach its nominal efficiency during the tests, but on the other hand, simulations of different intensities and durations of water consumption did not drastically change the efficiency of hot water preparation.

Practical implications: Regular cleaning of the exchanger would probably reduce the difference between the efficiency declared by the manufacturer and the one achieved during the tests. A clean heater will also ensure a sufficiently low level of carbon monoxide in the flue gas, which has a real impact on the safety of the appliance.

Social implications: The values obtained from the measurements for each operating mode can help occupants understand how to prepare water most efficiently with this particular appliance, which will have a real impact on the bills they pay. The user will be provided with information on what percentage of energy they use from the volume of gas burned.

Originality/value: Gas-fired instantaneous water heaters provide an efficient and energy-saving solution, especially in situations where the demand for hot water is low, and immediate access to it is crucial.

Keywords: hot water, hot water management, gas-fired instantaneous water heater.

Category of the paper: Research paper.

1. Introduction

Nowadays, in the face of growing challenges related to energy efficiency and sustainable development, the role of modern technologies in the field of hot water production is becoming crucial. In this context, gas-fired instantaneous water heaters respond to the needs of modern households and enterprises, offering not only an effective but also an economical solution for providing heated water. Gas-fired instantaneous water heaters are devices that warming up domestic water in an on-demand system. They are typically wall-mounted, commonly installed in bathrooms or attics. Their modern versions utilize the energy from condensing water vapor, making them condensing gas water heaters (Danielak, 2018). Gas-fired instantaneous water heaters are among the very popular heating appliances for domestic hot water preparation (Rodrigues, Gomes, 2014; Oleniacz et al., 2016). Just a few years ago it was estimated that there were about 2 million such appliances in operation in Poland. Their long service life is largely due to their short operating time compared with conventional solid fuel boilers. For this reason, many of them are over 20 years old, and the average age for old-type heaters is about 32 years. The average efficiency is estimated at 82%. Improper use, such as neglecting maintenance, leads to significant decreases in the efficiency of the appliances. Such a heater should be inspected and maintained at least annually by an appropriately qualified person. The inspection should be carried out by a person authorised by the manufacturer in order to comply with the terms of the warranty. This is also the way to ensure that appliance maintains its high efficiency for as long as possible and thus does not unnecessarily increase operating costs. In extreme cases, negligence can lead to dangerous situations, such as carbon monoxide poisoning (Czerski et al., 2010). Gas-fired instantaneous water heaters due to their widespread use in households, are the subject of research presented in publications (Czerski et al., 2013; Bourke et al., 2014; Huang et al., 2019; Raluy, Dias, 2020).

When operated properly, instantaneous water heaters can remain highly efficient for many years, and the use of new technologies can reduce carbon monoxide emissions by even several thousand times. Their simple design and small overall dimensions (the size of a small kitchen cupboard) mean that they can be installed in rooms with small floor space. According to the Regulation of the Minister of Infrastructure of April 12, 2002 (Journal of Laws 2022.0.1225, i.e.), the cubic capacity of such a room should be no less than 8 m³ for appliances with an open combustion chamber and 6.5m³ for heaters with a closed chamber.

Taking the above into consideration, several issues regarding the use of gas-fired instantaneous water heaters have been presented (Ciepło z natury, 2024):

- Instantaneous water heaters are known for their high energy efficiency. Unlike traditional tank water heaters, they do not store water, eliminating energy losses associated with maintaining water at a constant temperature.

- Gas-fired instantaneous water heaters offer the convenience of accessing hot water at any time. Additionally, they are often equipped with safety systems such as flow sensors and smoke detectors.
- They are typically smaller and lighter than traditional boilers, allowing for space savings in rooms.
- Due to their energy efficiency and the water heating system only operating when needed, instantaneous heaters can contribute to reducing energy bills.
- These devices provide hot water in real-time without the need to wait for it to heat up in a tank.
- Many models of instantaneous water heaters offer the option to adjust the temperature, allowing users to customize it to their individual preferences.
- They can be used both in homes and in workplaces, restaurants, hotels, or industrial facilities where there is a demand for a continuous supply of hot water.
- Compared to some traditional gas boilers, instantaneous water heaters may be more environmentally friendly as they minimize energy losses.

In 2022, anti-smog campaigns in Poland, involving measures like replacing old devices and slowing down new apartment constructions, maintained a dominant position in the device replacement market. Estimates suggest that this market held about 65-70% of the total sales volume, significantly impacting heating device sales (SPIUG, 2023). Gas boilers, despite still being the primary choice and holding slightly over 45% of the market share, experienced a 13% decline due to the uncertainties of 2022. Heat pumps claimed the second spot with an almost 35% share, driven by a nearly twofold increase in sales. Solid fuel boilers, primarily using biomass, ranked third with a share exceeding 15%, indicating a 7% drop compared to the previous year (Figure 1). Manufacturers reported a market slump for these devices in the second half of 2022, possibly reflecting the challenging market situation

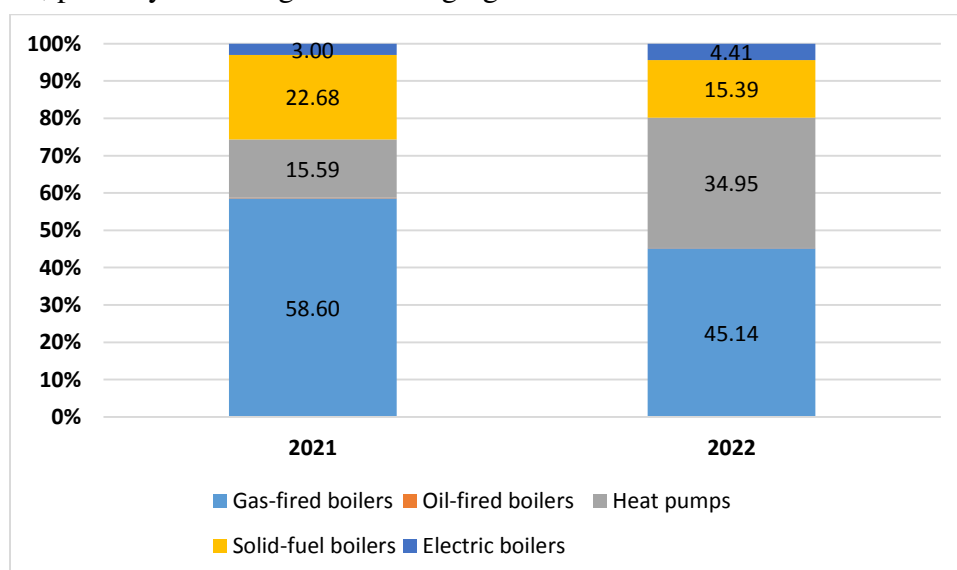


Figure 1. Share each technology in the sales structure of heating appliances in Poland in 2021 and 2022. Source: SPIUG, 2023.

The market for gas-fired instantaneous hot water heaters saw a sudden drop in sales of 32% in 2022 (Figure 2). This confirms earlier observations that this technology for producing domestic hot water is being displaced by other sources of hot water, such as combi boilers (Jedlikowski, Englart, 2018) and heat pumps (Rutkowska et al., 2015; Guźda, Szmolke, 2018; Chudzicki et al., 2019; Lenartowicz, 2020; Panagiotidou et al., 2021; Szczechowiak, 2022; Burzyński, 2023).

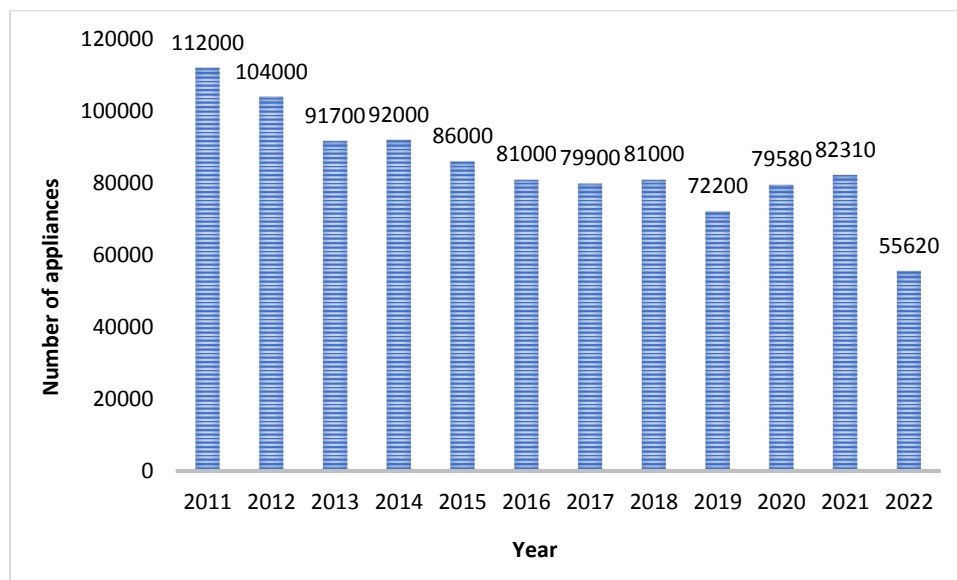


Figure 2. Sales of gas-fired instantaneous hot water heaters 2011-2022.

Source: SPIUG, 2023.

Currently, among all water heaters with a heat pump being produced, there is a growing popularity of models with low heating capacity, small dimensions, and relatively small water tank capacity. The increasing popularity stems from the potential application of these devices in small spaces, such as bathrooms, within residential buildings. Their compact size makes them an attractive option to replace existing gas-fired instantaneous water heaters and electric storage water heaters (Hendiger et al., 2019).

In today's times, the obvious necessity is to heat water for various domestic purposes. Often, residents are not aware of the specific solutions used in their homes; however, the priority is to maintain the appropriate water temperature (Szymański, 2017).

The article presents several interesting facts related to commonly used water heating products. This paper focuses on analyzing the process of managing the production of domestic hot water, citing specific examples and utilizing a gas-fired instantaneous water heater as a model case. This solution represents a new dimension in efficient energy management, eliminating the need to maintain a constant amount of water in the tank and enabling almost instantaneous delivery of hot water when needed.

The purpose of this article is to present the actual efficiency of a gas-fired instantaneous water heater for the production of domestic hot water. The object of the study is a common model of a gas-fired instantaneous water heater located in a flat in Krakow (Termet Ferro Goup,

2024). Measurements with a suitable device were carried out for three basic variants of hot water preparation, defined as showering, washing hands and washing dishes. The results obtained will illustrate under which conditions the water heater operates with the highest efficiency, by how much the efficiency of the appliance has decreased over the years compared with its rated value listed in the data sheet. The values obtained from the measurements for each operating mode can help occupants understand how to prepare water most efficiently with this particular appliance, which will have a real impact on the bills they pay. The user will be provided with information on what percentage of energy they use from the volume of gas burned.

2. General description of the object of the study

2.1. Gas-fired instantaneous water heater

Gas-fired water heaters are typically used in houses and flats that for various reasons do not have hot water supplied from the mains water supply. The commonly used gas-fired water heater is an efficient appliance that allows water to be heated to a temperature selected by the user. Due to the fact that hot water does not appear immediately at the tap, the appliance is only set in operation when the water starts to flow through it. In such a case, it takes a few to several seconds to effectively increase the water temperature. The amount of gas energy that is used depends on the amount of hot water that is needed at a particular time. Simply turning off the tap will automatically turn the appliance off. When the tap is turned on again, the water remaining in the pipes between the heater and the tap will not be heated so it must take a while before the flowing water is heated again (Danielak, 2018).

Gas-fired instantaneous water heaters use natural or liquefied petroleum gas for power. These devices typically have a minimum output of 3 kW and a maximum output of up to 20 kW. The smallest of the heaters typically heat one to two litres of water per minute from a temperature of 10 degrees to 50 degrees Celsius (Podgrzewacze wody, 2023).

2.2. Division of heaters according to type of combustion chamber

Gas-fired instantaneous water heaters can be divided into two types, with either open or closed combustion chamber (Figure 3). They differ in terms of the requirements they must meet to be installed. An open combustion chamber requires a room with at least one external door, or one external window, and a larger room area (Czerski et al., 2013).

Heaters equipped with an open combustion chamber must be connected to a chimney. Heaters with a closed combustion chamber take in the air required for combustion through an air/flue duct which must be routed outside the building. In the same way exhaust fumes are expelled outside (Czerski, Strugała, 2014).

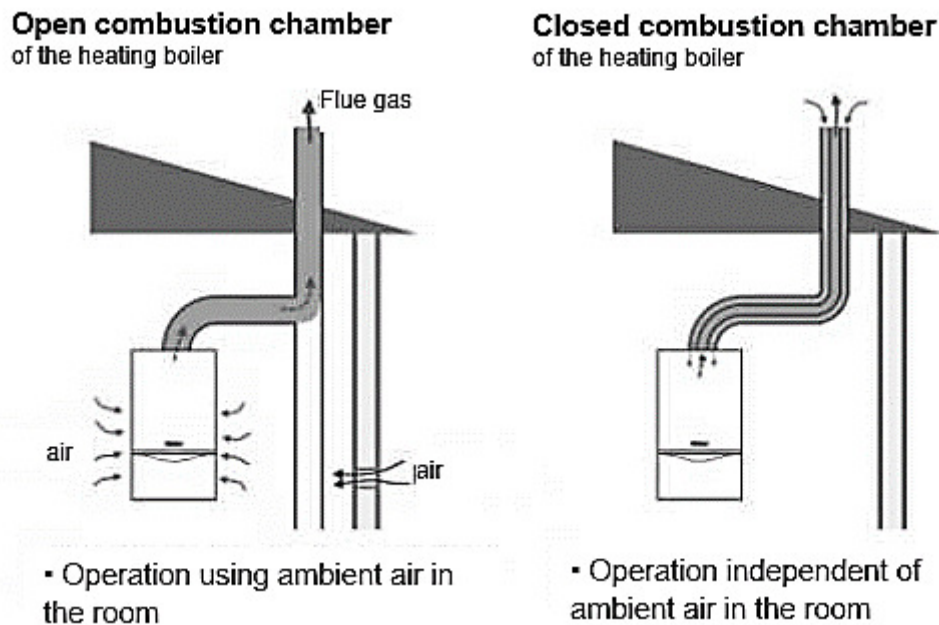


Figure 3. Types of combustion chambers.

Source: Zamknięta komora spalania kotła kondensacyjnego, 2012.

3. Appliances used

3.1. Termaq Electronic G-19-02

The heater manufactured by Termet is characterised by a compact design and an easy to use control panel (Figure 4). Burner power and water flow rate are operated using two knobs. The unit has a copper heat exchanger that ensures a high nominal efficiency of 88%. The thermal power is adjusted depending on the water flow rate, which enables maintaining a constant hot water temperature. Unlike very old heaters, the appliance does not have a pilot light, but electronic battery ignition, which results in annual gas savings of approx. 70 m³. It is equipped with a number of safety features, including protection against gas outflow, heat exchanger overheating protection and lack of chimney draught protection. The appliance operates evenly and quietly, and thus it could be installed in the kitchen above the sink. It can be supplied with gas type 2 Lw-G27 (natural gas GZ-41.5) or 2 Ls-G2.350 (natural gas GZ-35) (Termet, 2024).



Figure 4. Tested gas-fired heater in an enclosure.

Source: own work.

3.2. Compact heat meter CQM-III-K

The CQM-III-K compact heat meter manufactured by Apator is a device comprising a heat meter, an impeller flow meter and a pair of temperature sensors in a single housing (Figure 5). This version of the device allows it to be installed both at the hot water supply and return. It is mainly intended to measure thermal energy in detached houses, flats and offices. The device is battery-powered and thus independent of the mains supply. It can operate with a heating medium up to a temperature of 90°C and a maximum operating pressure of 16 bars. Compact heat meters are specifically designed for measuring the amount of thermal energy consumed, primarily in single-family houses, as well as in multi-family buildings equipped with a vertical central heating installation (Alsabry et al., 2010).



Figure 5. The heat meter used.

Source: own work.

3.3. Residential diaphragm gas meter RF1

This device has been designed to accurately measure the volume of natural gas consumed (Figure 6). It has a measuring unit with a capacity of 2 litres. It is equipped with a twin-chamber displacement diaphragm meter (Serediuk, Warszawa, 2017a, 2017b; Pinkas, 2020). Each of the twin chambers is fitted with a flexible and gas-tight diaphragm. When one of the chambers is filled due to the difference in the inlet and outlet pressures, the gas moves into the other opposite chamber through a port on the valve. This reciprocating movement is transmitted to the mechanical index of the gas meter. The measuring unit is housed in a gas-tight casing. The gas meter is resistant to tampering. It is maintenance-free and requires no servicing, and the manufacturer guarantees long-term durability and measurement accuracy. It is so designed as to be suitable for all modern gas systems as well as those to come in the future. Gas meter safety mark – B (Itron, 2024).



Figure 6. Gas meter.

Source: Itron, 2024.

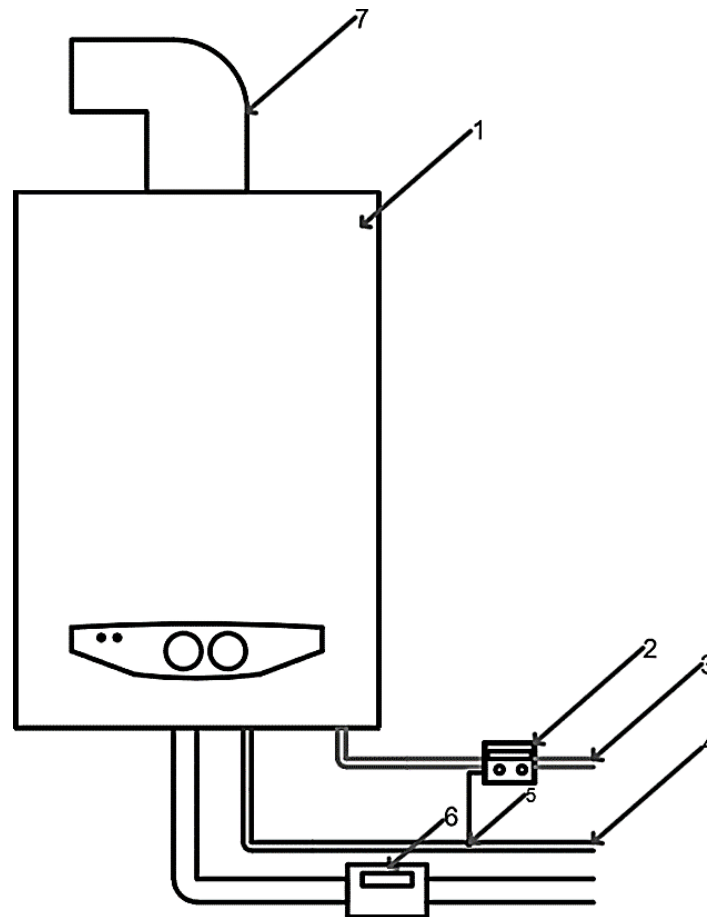
4. Methodology

4.1. Site schematics

Gas-fired instantaneous water heater is a small appliance that can be wall-mounted in order to heat water. The entire process takes place in a small heat exchanger that sits above a gas burner or has heating elements attached. The device is activated when water starts flowing. During the flow, temperature sensors monitor the water temperature at the inlet and outlet of the water heater. This information is crucial for regulating the heating process. Based on the temperature sensor data, the controller adjusts the operation of the gas burner. If the water temperature is below the set value, the burner is activated, supplying heat to the heat exchanger. Subsequently, the water is rapidly heated in the heat exchanger through the action of the burner.

This process is efficient because heat is generated only when water actually flows through the device. As the heating occurs during the water flow, the user has immediate access to hot water without the need to wait for the water to heat up in a tank.

The simplified diagram of the test equipment with necessary devices is presented in Figure 7.



1 – Gas-fired instantaneous water heater TERMAQ ELECTRONIC G-19-02, 2 – Compact heat meter CQM-III-K, 3 – Hot water outlet from the heater, 4 – Cold water inlet to the heater, 5 – Cold water thermometer, 6 – Residential diaphragm gas meter RF1, 7 – Flue gas outlet to chimney.

Figure 7. Simplified diagram of the test equipment.

Source: own work.

The construction of a gas-fired instantaneous water heater involves several key components that enable effective water heating on demand. Below is a general description of the construction of such a device (Figure 8):

- External casing: It serves as the outer protective layer that shields the water heater from atmospheric conditions.
- Sensors: Monitor water temperature and gas pressure to optimize the operation of the heater and ensure safety.
- Water tubes: Water flows through the heater via tubes, which are heated by the heat exchanger.

- Heat exchanger: This is a crucial element of the water heater. It is where the heating gas (such as propane or natural gas) transfers heat to the water flowing through the tubes.
- Gas burner: Responsible for burning the gas, which then transfers heat to the heat exchanger.
- Electronic control unit: Controls the heating process, monitors parameters such as temperature and pressure, and maintains safe operating conditions.
- Safety valves: Integrated safety valves aim to protect the water heater from potential failures, such as overheating or exceeding permissible pressure.
- Control panel: This panel allows the user to control the settings of the heater, such as water temperature.
- Connectors and pipes: Used for the passage of water and gas through the heater.
- Water outlet: Where the user draws heated water.



Figure 8. Actual test equipment.

Source: own work.

Before proceeding with the installation or maintenance of a gas-fired instantaneous water heater, it is crucial to strictly follow the manufacturer's instructions. Additionally, installation and servicing should be carried out by a qualified gas technician in accordance with local regulations and safety standards.

4.2. Taking measurements

In order to take the measurements, a compact heat meter had to be installed in the hot water system in the flat. First of all, the main water valve in the flat had to be turned off and likewise the taps had to be turned off to get rid of the remaining water. Then, in order to gain access to the plumbing connections of the water heater, the housing had to be removed. Using an adjustable spanner, a screw was unscrewed at the water heater where the heat meter was installed. A temperature sensor for the heat meter was mounted on the cold water supply to the heater. The use of waterproof sealant paste together with towels ensured that all connections were tight and no water was leaking anywhere, which otherwise might have adversely affected the measurements. Once access was gained to the gas meter, which was located outside the flat in the stairwell, and the main water valve was opened, it was possible to proceed to write down the values obtained for 3 different modes of simulated hot water use:

- Showering (5 minutes).
- Washing hands (repeated 10 times).
- Washing dishes.

After starting the heat meter in the basic operating mode using the function button, the following parameters (current data / instantaneous values) were accessed:

- Heat – [GJ].
- Medium volume – [m³].
- Supply temperature – [°C].
- Return temperature – [°C].
- temperature differential – [°C].
- Flow rate – [m³/hr].
- Heating capacity – [kW].

Only in the case of heat values it was necessary to switch the heat meter to the service mode (FL2) in order to write down more recent heat digits after the decimal point. After waiting a few minutes, the heat meter automatically switched back to the basic operating mode (Czerski, Strugała, 2014, pp. 2394-2411).

5. Results

Measurements conducted using a compact heat meter and a gas meter for a gas-fired instantaneous water heater constitute a crucial aspect in evaluating the efficiency and energy consumption in water heating systems. The compact heat meter is a dedicated device designed for the precise measurement of the amount of thermal energy transferred during the water

heating process. In turn, the gas meter is utilized to monitor the consumption of gas, which serves as the fuel for heating in the case of gas-fired instantaneous water heaters.

Table 1 shows all the data obtained by using the compact heat meter and the gas meter. These results were used to perform the calculations presented in the following tables.

Table 1.

Values obtained - heat meter readings

Parameters	Domestic activities		Showering (5 min)	Washing hands (10 repeats)	Washing dishes
	Unit	Stage			
Gas meter reading	[m ³]	Initial	944.379	944.5	944.543
		Final	944.5	944.543	944.598
Heat	[GJ]	Initial	12.2169195	12.2202413	12.2214091
		Final	12.2202413	12.2214091	12.2228876
Water consumption	[m ³]	Initial	308.381	308.416	308.431
		Final	308.416	308.431	308.446
Hot water T1	[°C]		35.39	32.57	36.53
Cold water T2	[°C]		12.35	12.89	13.01
Temperature differential ΔT	[°C]		22.89	24.95	23.8
Heating capacity	[kW]		11.03	6.43	9.71
Flow	[m ³ /hr]		0.418	0.241	0.364

Source: own work.

Table 2 shows the gas consumption as a result of heating water for various domestic activities.

Table 2.

Gas consumption for each measurement

Amount of gas consumed	Unit	Showering (5 min)	Washing hands (10 repeats)	Washing dishes
	[m ³]	0.1209	0.0430	0.0549

Source: own work.

Table 3 shows the amount of heat supplied to the water by the water heater. It is illustrated by the difference in the heat meter reading before and after the measurement for each simulation. The results were then converted into MJ.

Table 3.

Amount of heat supplied

Heat	Unit	Showering (5 min)	Washing hands (10 repeats)	Washing dishes
	[MJ]	3.3218	1.1678	1.4784

Source: own work.

The amount of water consumed is shown in Table 4. The result obtained in cubic metres was converted into litres.

Table 4.
Water consumption

Water consumed	Unit	Showering (5 min)	Washing hands (10 repeats)	Washing dishes
	[l]	35	14.99	15.0

Source: own work.

The efficiency of the heater was calculated as the ratio of energy converted to energy supplied using the following formula:

$$\eta = \frac{E_{wy}}{E_{we}} \quad (1)$$

where:

η – efficiency;

E_{wy} – energy converted;

E_{we} – energy supplied.

For the purpose of the calculations, the values for type E methane-rich natural gas (formerly GZ-50) were adopted; according to the tariff, the actual calorific value is approx. 35 MJ/m³ (Czerski, Gebhardt, Strugała, Butrymowicz, 2013, pp. 237-244). The values were then standardised to kilowatt-hours (35 MJ = 9.7222 kWh).

Table 5 shows calculations of the actual efficiency for each of the three simulations.

Table 5.
Efficiency calculated

Parameters	Unit	Showering (5 min)	Washing hands (10 repeats)	Washing dishes
MJ in the volume of gas consumed	[MJ]	4.2349	1.5050	1.9249
Kilowatt-hours in the volume of gas consumed	[kWh]	1.1763	0.4180	0.5347
Energy transferred to water	[kWh]	0.9227	0.3243	0.4106
Efficiency	[%]	78.44	77.59	76.81

Source: own work.

The difference between these three domestic activities is approx. 1%. The highest efficiency was obtained for five-minute showering – 78.44%. Next in order was the efficiency obtained for hand washing – 77.59%. The lowest efficiency was obtained for the dishwashing simulation – 76.81%. It should be noted that all the activities were performed by the occupant of the flat in the same manner as they do them on a daily basis.

6. Summary

The tests and analyses carried out have revealed that the current efficiency differs radically from that indicated on the water heater data sheet. Such a drop in efficiency may be caused e.g. by fouling of the surface of the heat exchanger on the flue gas side and scaling of the exchanger on the heated side. Regular cleaning of the exchanger would probably reduce the

difference between the efficiency declared by the manufacturer and the one achieved during the tests (average efficiency based on 3 measurements – 77.61%). A clean heater will also ensure a sufficiently low level of carbon monoxide in the flue gas, which has a real impact on the safety of the appliance.

As expected, the heater achieved its highest efficiency during a five-minute water consumption simulating the use of a shower. This is when the appliance heats the water steadily, thus operating at its highest power and efficiency. In comparison with the other measurements, it can be concluded that this water heater achieves the highest efficiency at the highest water flow rate and high heating power.

A simulation of water consumption for hand-washing showed that such short but intensive hot water consumption does not significantly reduce the efficiency of the instantaneous water heater. Compared with the simulation of water consumption for dishwashing (a small amount of hot water consumed for a few minutes), the efficiency of hot water heating in the handwashing simulation was almost 1% higher.

The tests proved that the heater did not reach its nominal efficiency during the tests, but on the other hand, simulations of different intensities and durations of water consumption did not drastically change the efficiency of hot water preparation.

According to the measurements, the way in which the water heater is operated does not significantly affect the efficiency values that were obtained. Regular maintenance and keeping the hot water heater in good working order will keep the efficiency high for many years.

The market for gas tankless water heaters experienced declines in all quarters of 2022. It appears that this technology for producing domestic hot water is being displaced by alternative sources for DHW (domestic hot water) generation. Currently, such devices are no longer installed in newly constructed buildings and persist mainly due to replacements in the existing market.

Acknowledgements

The publication presents the result of the Project no 060/ZJE/2023/POT financed from the subsidy granted to the Krakow University of Economics and the statutory research programme at the Faculty of Geology, Geophysics and Environmental Protection, AGH University of Science and Technology in Krakow, Poland, Statutory Work No. 16.16.140.315/05.

References

1. Alsbry, A., Pigalski, W., Maciejewski, T. (2010). Teoretyczne a rzeczywiste zapotrzebowanie energetyczne na centralne ogrzewanie i wentylację mieszkań w budownictwie wielorodzinnym. *Przeгляд Budowlany*, 11, pp. 39-45.
2. Bourke, G., Bansal, P., Raine, R. (2014). Performance of gas tankless (instantaneous) water heaters under various international standards. *Applied energy*, 131, pp. 468-478. <https://doi.org/10.1016/j.apenergy.2014.06.008>.
3. Burzyński, R. (2023). Jak podgrzewać wodę użytkową za pomocą pomp ciepła. *Chłodnictwo i Klimatyzacja*, No. 10, pp. 32-40.
4. Chudzicki, J., Hendiger, J., Ziętek, P. (2019). Dobór pojemności zasobnika do ciepłej wody współpracującego z kompaktową pompą ciepła. *Gaz, Woda i Technika Sanitarna*, No. 7, pp. 242-248.
5. *Ciepło z natury*. Retrieved from: https://www.termet.com.pl/upload/upload/pliki_produkto w/Ulotki%202023/ULOTKA_PODGRZEWACZ_ZAMKNI%C4%98TA%20KOMORA.pdf, 5.01.2024.
6. Czerski, G., Strugała, A. (2014). The energy efficiency of hot water production by gas water heaters with a combustion chamber sealed with respect to the room. *Water*, 6(8), pp. 2394-2411.
7. Czerski, G., Gebhardt, Z., Strugała, A., Butrymowicz, C. (2013). Gas-fired instantaneous water heaters with combustion chamber sealed with respect to the room in multi-storey residential buildings—Results of pilot plants tests. *Energy and buildings*, 57, pp. 237-244.
8. Czerski, G., Tałach, Z., Butrymowicz, Cz. (4.11.2010). *Nowe rozwiązania techniczne w zakresie urządzeń grzewczych z zamkniętą komorą spalania – kierunki poprawy bezpieczeństwa mieszkańców budownictwa wielokondygnacyjnego*. Budownictwo mieszkaniowe. Ochrona przeciwpożarowa, wentylacja naturalna, bezpieczne techniki kominowe. Mysłowice/Wrocław.
9. Danielak, M. (2018). Przepływowe gazowe podgrzewacze cwu-nowe konstrukcje. *Polski Instalator*, No. 9-10, pp. 14-16.
10. Guźda, A., Szmolke, N. (2018). Efektywność pompy ciepła a zużycie CWU. *Budownictwo o zoptymalizowanym potencjale energetycznym*, 7(1), pp. 31-36. DOI: 10.17512/bozpe.2018.1.04.
11. Hendiger, J., Ziętek, P., Sobieraj, M. (2019). Weryfikacja laboratoryjna możliwości stosowania niskopojemnościowych podgrzewaczy wody z pompą ciepła. *Instal*, No. 7/8, pp. 22-28.
12. Huang, X., Sun, M., Kang, Y. (2019). Fireside Corrosion on Heat Exchanger Surfaces and Its Effect on the Performance of Gas-Fired Instantaneous Water Heaters. *Energies*, 12(13), 2583. <https://doi.org/10.3390/en12132583>.

13. *Itron*. Retrieved from: https://gaztechnika.pl/application/files/4215/3856/0181/Gazomierze_miechowe_RF1_GT.pdf, 5.01.2024.
14. Jedlikowski, A., Englart, S. (2018). The comparison of calculation methods of gas demand in the installation with combi boilers. *E3S Web of Conferences, Vol. 44*, p. 00058. EDP Sciences. <https://doi.org/10.1051/e3sconf/20184400058>.
15. Lenartowicz, S. (2020). Jak skutecznie i efektywnie wykorzystać powietrzną pompę ciepła z kotłem. *Chłodnictwo i Klimatyzacja, No. 7*, pp. 36-37.
16. Oleniacz, R., Kasietczuk, M., Kępa, P. (2016). Wpływ rodzaju spalanych paliw i działań termomodernizacyjnych na oddziaływanie budynku jednorodzinnego na jakość powietrza. In: K. Gaj, J. Kuropka (Eds.), *Powietrze atmosferyczne. Jakość-zagrozenia-ochrona* (pp. 253-266). Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej.
17. Panagiotidou, M., Aye, L., Rismanchi, B. (2021). Alternative Heating and Cooling Systems for the Retrofit of Medium-Rise Residential Buildings in Greece. *Energy Technology, 9*(11), 2100377. <https://doi.org/10.1002/ente.202100377>.
18. Pinkas, M. (2020). Analiza porównawcza gazomierzy miechowych i termicznych w realnych warunkach eksploatacji. *Gaz, Woda i Technika Sanitarna, No. 12*, pp. 10-18.
19. *Podgrzewacze wody - rodzaje, zasada działania*. Retrieved from: <https://www.instalacjebudowlane.pl/6829-23-43-podgrzewacze-wody--rodzaje-zasada-dzialania.html>, 20.12.2023.
20. Raluy, R.G., Dias, A.C. (2020). Life cycle assessment of a domestic gas-fired water heater: Influence of fuel used and its origin. *Journal of environmental management, 254*, 109786. <https://doi.org/10.1016/j.jenvman.2019.109786>.
21. Regulation of the Minister of Infrastructure On technical conditions to be met by buildings and their location, *Journal of Laws 2022.0.1225*, i.e.
22. Rodrigues, A.M., Gomes, M.G. (2014). Natural ventilation of a room with an atmospheric-vent water heater in both on-and off-states. *Energy and Buildings, 74*, pp. 53-60.
23. Rutkowska, G., Wichowski, P., Srok, M. (2015). Analiza możliwości wykorzystania pomp ciepła dla budynku mieszkalnego zlokalizowanego w Euroregionie Beskidy. *Europa Regionum, 23*, pp. 223-230.
24. Serediuk, O., Warsza, Z.L. (2017a). Statystyka błędów pomiarowych gazomierzy miechowych po znormalizowanym okresie ich pracy. *Gaz, Woda i Technika Sanitarna, No. 12*, pp. 472-476.
25. Serediuk, O., Warsza, Z.L. (2017b). Zmiany błędów pomiarowych gazomierzy miechowych w eksploatacji. *Przemysł Chemiczny, 96*(8), pp. 1767-1770.
26. SPIUG (2023). *Heating device market in Poland in 2022*. Warsaw: Association of Heating Appliances Manufacturers and Importers.
27. Szczechowiak, E. (2022). Pompy ciepła dla ogrzewania i chłodzenia w aspekcie obniżenia emisji ditlenku węgla. *Przegląd Budowlany, 93*(7-8), pp. 160-166.

28. Szymański, J. (2017). Podgrzewacze i zasobniki ciepłej wody użytkowej-w profesjonalnym i chałupniczym wydaniu. *Polski Instalator, No. 6*, pp. 36-38.
29. *Termet Ferro Goup*. Retrieved from: <https://www.termet.com.pl/produkt/termaq-electronic-g-19-02/26>, 5.01.2024.
30. *Zamknięta komora spalania kotła kondensacyjnego* (2012). Retrieved from: https://www.slideshare.net/eko-blog/zamknieta-komora-spalania-kotla?next_slideshow=1., 20.12.2023.

A MEDIATING ROLE OF WORK ENGAGEMENT IN PSYCHOLOGICAL CONTRACT AND INNOVATIVE WORK BEHAVIOUR: A STUDY OF INFORMATION TECHNOLOGY SECTOR OF PAKISTAN

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Purpose: The goal of this research was to learn how psychological contracts influence workers' innovative work behavior in Pakistan's information technology industry.

Design/methodology/approach: Employees from several software companies in Rawalpindi, Islamabad, participated in the study. Standardized scales were used to obtain data from 234 workers via questionnaires.

Findings: The study's findings showed a favorable correlation between innovative work behavior and the presence of psychological contracts (both transactional and relational).

Originality/value: There remained uncertainty and little study was done on the mediation function of work engagement in the relationship between Psychological Contract and Innovative Work Behavior despite decades of research on the subject. Thus, work engagement was employed as a mediator in this research, and the findings demonstrated that work engagement mediates the relationship between innovative work behavior and the psychological contract in a positive and meaningful way.

Keywords: psychological contract, innovative work behaviour, work engagement, IT sector.

Category of the paper: Research paper.

1. Introduction

Psychological contract can be portrayed as individuals' feelings about the relative duties among themselves and their alliance (Alcover et al., 2017a). Psychological contracts are divided into two types in the literature: that is transactional contract and relationship contract (Soares, Mosquera, 2019). Transactional contracts allude to simply a short-term and constrained

contribution and restricted participation of the employees. Relational contract refers to long-term commitments that include a focus on socioemotional components including relatedness, devotion, support, job stability, and trust in addition to reference to monetary and reciprocal exchanges (Bal, Kooij, 2011; Liu et al., 2020).

The researchers have discovered that diverse sorts of psychological contracts differ in their impact on innovation and creativity. Even more particularly, transactional contracts have been found negative association with innovative work behaviour (Vander Elst et al., 2016). However, relational contracts are substantially and favorably linked to innovative work behavior in the workplace (Afridi et al., 2020). In spite of that, the mechanism linking the two contract types and innovative work behavior remains undecided. The current study seeks to contribute to the existing evidence of a theoretically relevant and meaningful mediator of this relationship. The mediating relations between the psychological contract and innovative work behavior at work have been largely ignored in previous research (Li, Chen, 2018).

On the premise of theory of organizational innovation (Zheng et al., 2017), it hypothesizes that individuals' innovative behaviour is not autonomous, yet another element of consistent procedure of connection between the individual and circumstances experienced. We join these hypothetical perspectives in a mediation model to concentrate the directing effect of psychological atmosphere on the interceding impact of work engagement between psychological contracts and innovative work behavior. As a result, we can better understand the conditions in which psychological contracts encourage creative behavior in the workplace. As a result, we can better understand the conditions in which psychological contracts encourage innovative work behavior in the workplace. This study unquestionably contributes to our theoretical understanding of psychological contracts in two main ways: by mediating the motivating intervening system of work engagement between psychological contracts and innovative work behavior, and by highlighting the interplay between the two.

Despite the large amount of study that has been done on innovative work behavior, there is still a severe lack of literature in this area, leaving many concerns unsolved. There is little evidence in the literature linking the types of psychological contract to innovative work behavior. To be more precise, although there is a negative association between transactional contracts and innovative work behavior, there is a positive association between relational contracts with innovative work behavior. However, it is not apparent how the transactional contract and relational contract, and innovative work behavior are connected to one another throughout the process (Chang et al., 2013).

To fill this research gap by using the three psychological condition theory (Kahn, 1990) of work engagement; engagement is a motivational concept that assumes a part of mediator among the relationship of the transactional contract and innovative work behaviour and relational contract and its positive outcomes. This research summarizes various factors that contribute to innovative work behavior in the organizations today. Moreover, this study provides theoretical basis for further studies on this construct. An important goal of this study is to provide new

evidence supporting the existence of key individuals at the group's center who are assumed to play a pivotal role in the organization's success.

2. Preliminary studies

2.1. Psychological Contract and Innovative Work Behaviour

Both types of psychological contracts have been extensively studied by a wide range of analysts (Bal, Kooij, 2011). However, the two types of psychological contracts are the opposite ends of a continuous legally binding path taken by representatives on behalf of their respective organizations (Hughes, Palmer, 2007). The effects of different legal codes on innovative work behavior shift as one moves along the continuum. Scholars have argued that relational contracts are useful for fostering innovative work behavior. This is because innovation is a comprehensive strategy, and that true creativity emerges only via sustained, focused effort by trained professionals (Stojcic et al., 2018). Some researchers (Thompson, Heron, 2006) have discovered the mediating relations and found that this tool considers attitude or behavior mediators. For instance, (Thompson, Heron, 2006) discovered that the connection between execution pay (a component of transactional contract) and innovative work behavior was mediated, in large part, by emotional obligation.

Thompson and Heron (2006) found that the relationship between execution pay and innovative work behavior was mediated by information sharing practices among delegates in an organization's innovative work (R&D) office, and that the relationship between professional development (a component of the social contract) and innovative work behavior was also mediated by information sharing practices. In light of the viewpoints of a few subgroups identifying with value-based or social contracts, these findings supported a proposed development of psychological contracts theory. Consequently, they do not take a simple stance on the centrality of motivational system between the two types of psychological contracts and innovative work behavior.

Innovative work behavior is defined as deliberate creation, presentation, and use of new ideas inside a work place, gathering or association, to profit part execution, the gathering, or the association (Edmondson, 2018). Researchers have shown that the impact of different types of psychological contracts on innovative work behavior varies. In particular, it has been shown that value-based contracts have a negative association with innovative actions (Liinamaa et al., 2016). In contrast, relational contracts are often associated with innovative actions (Sumo et al., 2016). However, the relationship between the two types of contracts and innovative work behavior is unclear. The available research does not provide sufficient confirmation of the

hypothesized important intermediary individuals in this interaction, leaving room for more research.

Examiners have found that social contracts are helpful in affecting innovative work behavior. This follows the logic that innovation is an all-encompassing process, and that original behavior emerges when individuals focus their efforts over extended periods (Cloutier, Langley, 2020). The certainty of psychological contracts is supported by prior research showing a correlation between the types of psychological contract and innovative work behavior and negative for value-based contracts (Ahmed et al., 2019).

Hypothesis 1: Transactional contract has a significant relationship with Innovative work behaviour.

Hypothesis 2: Relational contract has significant relationship with Innovative work behaviour.

2.2. The Mediating Role of Work Engagement

Work engagement is described by Vigor, commitment, and absorption (Schaufeli et al., 2017). The word "vigor" suggests a high level of vitality, mental flexibility, the motivation to put out effort at work, and the fortitude to persevere despite setbacks. "Dedication" displays the intensity, focus, drive, and probing nature of an individual. "Absorption" involves a feeling of complete obsession and appeased incorporation in one's work to the point of inconvenience of secluding from work (Schaufeli et al., 2017).

According to Kahn (1990), workers' personalities and perspectives on their workplaces create psychological circumstances that have a direct impact on their productivity. Three psychological conditions are vital psychological meaningfulness, safety, and availability. A sense of psychological meaningfulness suggests that personal endeavors are financially rewarding. The key influences on heft originate from the impression of hierarchy and work factors related to projects, components, and work linkages. Value coincides between persons and their relationships as the cornerstone to meaningfulness, according to some analysts (Rich et al., 2010). The most important factor in determining one's level of happiness is one's estimation of the availability of supportive relationships and networks. Psychological availability concerns the individual's feeling that they have the passionate, mental, and physical assets important to contribute to role exhibitions. Speculations of enthusiastic and physical energies and professional stability impact the view of accessibility.

As a consequence, people can't go for break or reveal their true selves since they fear adverse results (Rich et al., 2010). These assumptions of reduced mental security, which in this way decrease the availability and attention of individuals totally in the workplace. Moreover, the mental absence of individuals suggests that employees are just revealing a fraction of their true selves at the office, which may lead to decreased productivity (Kahn, 1990). Finally, the confined commitment of social events in esteem-based contracts shields a man from driving

physical, scholarly, and excited energies into work parts. This addresses singular withdrawal with workplace (Rich et al., 2010).

Taking after these hypothetical arguments, we anticipate that transactional contracts adversely identify with work engagement. The steady and trusting connections they have with their association enable them to go for break, demonstrate their genuine selves, and attempt and maybe fall flat without dreading the negative outcomes (Rich et al., 2010). The socio-enthusiastic components of social contracts give passionate assets to meet the requests of work engagement (Bakker et al., 2005; Demerouti et al., 2001; Kahn, 1990). Moreover, relational contracts create work security (Morrison, Robinson, 1997; Rousseau, 1990) that effects on mental accessibility as it compares to how secure individuals feel about their function (Kahn, 1990). People need a sentiment security to put resources into their work roles (Kahn, 1990). In entirety, social contracts encourage mental significance, security, and accessibility that create showcases of high work engagement.

In this research we propel work engagement as a mediator for the accompanying three reasons. In the first place, innovative work behavior is largely a motivational problem (Pieterse et al., 2010). Work engagement is a motivational build that leads to a positive, satisfying, full of feeling motivational, and business-related perspective that is portrayed by force, devotion, and assimilation (Salanova et al., 2005; Schaufeli, Bakker, 2004). Our attention on the motivational instrument varies from the attitudinal or behavioural systems analysed in past reviews (Thompson, Heron, 2006). Second, when representatives are locked in, they are proactive, demonstrate activity, team up adequately with others (Bakker, Schaufeli, 2008) and put vitality in their work place (Rich et al., 2010). These practices are especially applicable to inventive exercises (Rich et al., 2010; Shalley et al., 2010).

Thirdly, an absence of hypothetical examination on representatives' work engagement despite expanding corporate intrigue (Bakker, Schaufeli, 2008). We contribute to a common theoretical understanding of these issues and provide ideas for improving organizational practices by focusing on the role that preparation plays in employees' dedication to the job. Overall, we argue that work engagement is indicative of a potentially crucial mediator that might broaden our understanding of the links between psychological contract types and innovative work behavior, ruling out the need for additional mediating tools.

Research into innovative work behavior are in early stages, and restricted attention is provided to antecedents. Of surviving reviews, administration, singular critical thinking style, and work-assemble relations (Volery, Tarabashkina, 2021) distributive and procedural reasonableness (Volery, Tarabashkina, 2021) administrator steadiness (Volery, Tarabashkina, 2021) and self-authority, wage, and occupation residency abilities (Carmeli, Weisberg, 2006) are analysed to decide whether they have suggestions for innovation. Be that as it may, restricted endeavours have been made to look at work engagement as a predecessor of ingenuity (Timms et al., 2015).

Associations frequently acquaint advancements with given benefits (Jha, 2016), however embracing developments obliges representatives to contribute generous exertion. Since imaginative practices include making of something new, they oblige representatives to think and end up plainly consumed in their work (retention). Advancement is additionally change-arranged (Nauman, Qamar, 2018). Different representatives in the workplace may oppose changes in view of the frailties and vulnerabilities they bring (Gwyther et al., 2018).

Work engagement, a tenacious positive full of feeling intellectual state described by energy, commitment, and retention (Chakraborty, Ganguly, 2019), adds to the advancement of inventive work conduct. Bakker et al. (2007) discovered positive connections amongst innovation and the three measurements of work engagement: (1) vigor (2) dedication and (3) absorption. The first figure shows the hypothesized theoretical framework.

Hypothesis 3: Work Engagement significantly mediates the relationship between Transactional contract and innovative work behaviour.

Hypothesis 4: Work engagement significantly mediates the relationship between Relational contract and Innovative work behaviour.

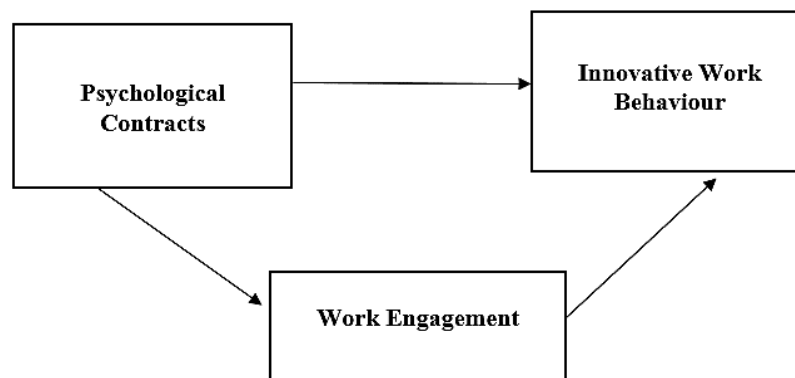


Figure 1. Hypothesized theoretical framework

3. Reserch methodology

3.1. Sample and data collection

Due to the one-time data collection strategy, the current research may be classified as a cross-sectional analysis. From January 1st, 2023, to January 25th, 2023, we collected data for a total of about 25 days. Instead than limiting themselves to either public or only private software developers, researchers gathered information from all types of software developers. Even in the midst of the country's current economic crisis, Pakistan's IT industry is seen as a success story (Pakistan Software Export Board [PSEB]). By the end of 2020, there will be more than 7000 software development firms in Pakistan (National Information Technology

Board [NITB], 2020). There are more than 6,000 software development firms in Rawalpindi and Islamabad combined, according to a study by the Punjab Information Technology Board (Punjab Information Technology Board [PITB], 2023). In the two cities of Islamabad and Rawalpindi, there are over a thousand software development firms. Therefore, the current study's population included all workers from these IT software companies. Due to the generalizability of social exchange theory, this industry was selected as a population of research.

The sample of present review was for the most part comprised of workers of IT programming houses in Islamabad and Rawalpindi. For this, reasons workers of various programming houses were drawn nearer through the individual contacts. The add up to quantities of representative reached and asked for to finish the surveys were 350. Out of these, 255 complete questionnaires were gathered on a commonly concurred time. Out of 255 questionnaires 21 were avoided because of missing information. The remaining 234 questionnaires were utilized as a part of study yielding a reaction rate of 66%. A total of 62.8% of respondents were female. The mean age was 33.45 years, with an average organizational tenure of 7.44 years. The sample was predominantly composed of Islamabad software houses (69.7%); 30.3% were in Rawalpindi.

3.2. Instrumentations

3.2.1. Psychological Contract

Psychological Contract measured by using 18 item scale developed by Millward and Hopkins (1998). Total 18 items are divided in two parts in which 9-item scale of Relational contract and 9-item scale of Transactional contract. Items were assessed on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). A sample item is “my loyalty to the organization is contract specific”. The Cronbach’s alpha value was ‘0.740 for transactional contract and 0.825 for the relational contract.

3.2.2. Work Engagement

Work engagement scale was measured with a 9-item scale created by Schaufeli & Bakker, 2003. Things were evaluated on a 5-point scale extending from 1 (strongly disagree) to 5 (strongly agree). A sample item is “Time flies when I am working”. The Cronbach’s alpha reliability value of work engagement was 0.868.

3.2.3 Innovative Work Behavior

De Jong and Den Hartog (2010) 6 items scale was utilized to quantify the reaction of innovative work behaviour of representatives. Sample items include “In your job, how often do you make suggestions to improve current products or services?” It is measured on a 5-point Likert scale, where 1 show Never, 2 Seldom, 3 Sometimes, 4 Often and 5 shows Almost always. The Cronbach’s alpha value was 0.734.

4. Results and analysis

Traditionally regression analysis in social analysis was mostly carried out by using Barron and Kenny method. Barron and Kenny (1986) method are based on following assumption.

- 1) Relationship among independent factor and Dependent factor essentially be significant.
- 2) Relationship among Independent factor and Mediator variable essentially be significant.
- 3) Relationship among Mediator variables and Dependent factor essentially be significant.

After the satisfaction of these three basic assumptions, you can run mediation analysis. In 4th step by controlling mediator if it reduces the effect of independent factor on Dependent factor then its mean Partial mediation exist. At the point when the current significant affiliation between IV and DV get insignificant then its mean full mediation exists.

Table 1.

Relationship between psychological contract and Innovative work behaviour

Model		Un-Standardized Coefficients		Significance Level	
		B	Std.Error	t-ratio	Sig.
1	(Constant)	0.984	0.228	4.307	0.000
	PC_MEAN	0.783	0.062	12.046	0.000

Dependent Variable: IWB_MEAN: $R^2 = 0.567$, $F = 144.755$, $p = 0.000$.

To test hypotheses, several regression analyses were performed, first, the relationship between the two independent variables that is transactional contract and relational contract and their effect on innovative work behaviour was measured. The results obtained from Table 1 shows the beta values of independent variables (TC & RC) 0.783** at $p < 0.05$ with the value of R^2 is 0.567. This means that there is a direct relation and significant association among these two independent factors (TC & RC) and dependent variable innovative work behaviour. This allows the first two hypotheses to be accepted that are transactional contract has negative and significant relationship with innovative work behaviour and second hypothesis is the relational contract has positive and significant relationship with innovative work behaviour. To examine for mediation procedure suggested by Baron and Kenny (1986) was followed. According to Baron and Kenny (1986), four criteria need to be met to support full mediation. Initially, the independent factors (i.e., Transactional contract and Relational contract) needs to be significantly related to a mediator (i.e., work engagement). Second, Transactional contract and Relational contract needs to be significantly related to innovative work behaviour. Third, Work engagement needs to be significantly related to innovative work behaviour. And finally at the fourth step, the relationship between independent variables and dependent variables must disappear when mediator is introduced into the regression equation predicting dependent variable. If the coefficient between independent variables and dependent variables after introducing mediator into the regression equation remains significant, but is reduced, there is evidence for partial mediation.

Table 2 represents the results of mediation following the steps suggested by Baron and Kenny (1986). At first step, the effect of control variables and mediating variable on dependent factor was tested. At second step the effect of independent variables on dependent was checked and so on.

Mediation Analysis: step-1

The following Table 2 demonstrate relationship between transactional and relational contract and innovative work behaviour.

Table 2.

Relationship between Transactional & Relational Contract and Innovative Work Behaviour

Model	Un-Standardized Coefficients		Significance Level	
	B	Std.Error	t-ratio	Sig.
(Constant)	1.708	0.212	8.051	0.000
Transactional Contract	-0.617	0.050	-12.274	0.000
(Constant)	2.126	.373	5.702	0.000
Relational Contract	0.450	.088	5.113	0.000

Dependant Variable: Innovative Work Behavior: $R^2 = 0.11$, $F = 25.897$, $p = 0.000$.

This table is interpreted as follow. β was having a value of -0.617, means if we better the transactional contract will indicate 61% change in innovative work behaviour which was dependent variable in that case. Significance level in this relationship was 0.000 which was less than 0.05 and significant. Therefore, we accept H1 (Transactional contract has a negative and significant association with Innovative work behaviour). Such discoveries were in alliance to the finding of Brown and Trevino (2006) who noticed significant relation of transactional contract with innovative work behaviour. R^2 has its value 0.11 that shows 11% variation was clarified by relational contract in employee innovative work behaviour. Value of B was 0.450 which justifies that if we increase and make better relational contract with 1%, will make innovative work behaviour increase 45%. The value of significance level between relational contract and innovative work behaviour was 0.000 which was less than 0.05 which shows that this relationship was significant. Therefore, we accepted hypothesis no. 2 (Relational contract has a positive and significant relationship with Innovative work behaviour). Such findings of the research work are like the results of Piccolo et al. (2010) who examined innovative work behaviour is positively influenced by relational contract.

Mediation Analysis step-2

The following Table 3 demonstrate relationship between transactional and relational contract and work engagement.

Table 3.*Relationship between Transactional & Relational Contract and Work Engagement*

Model	Un-Standardized Coefficients		Significance Level	
	B	Std.Error	t-ratio	Sig.
(Constant)	0.869	0.122	7.125	0.000
Transactional Contract	-0.795	0.029	-27.413	0.000
(Constant)	1.338	0.234	5.710	0.000
Relational Contract	0.704	0.055	12.682	0.000

Dependent Variable: Work Engagement: $R^2 = 0.347$, $F = 160.822$, $p = 0.000$.

The value of regression coefficient was 0.795 which explains that if we increase and make better transactional contract with per unit, it will bring 79% change in work engagement. P was having a value $0.000 \leq 0.05$, so here we can say we met the second condition of Barron and Kenny (1986). R^2 was 0.347 which explains that 34% variation was explained by relational contract in work engagement. B having a value of 0.704 that justifies that 1% change in relational contract makes work engagement to change with 70%. So here we can say we met the second condition of Barron and Kenny (1986).

Mediation Analysis: Step-3

IWB. Innovative work behaviour and work engagement's relationship was explained in Table 4.

Table 4.*Relationship between Work engagement and IWB*

Model	Un-Standardized Coefficients		Significance Level	
	B	Std.Error	t-ratio	Sig.
(Constant)	1.734	0.413	4.1959	0.000
Work Engagement	0.542	0.098	5.536	0.000

Dependent Variable: Innovative Work Engagement: $R^2 = 0.13$, $F = 30.650$, $p = 0.000$.

F carries its value as 30.514 with $p = 0.000 \leq 0.05$ which indicates that data was fitting overall model. The value of R^2 was 0.13 shows that 13% fluctuation was clarify by work engagement in innovative work behaviour. B carries a value of 0.542 which indicates if we change work engagement with 1% it will show 54% changes in innovative work behaviour. P value was significant at $\alpha = 0.05$ which means that the association among work engagement and innovative work behaviour was significant. So, here we prove and met the third condition of mediation regression through Barron and Kenny (1986), so we can proceed next analysis.

Mediation Analysis: Step- 4

Table 5 shows the result for regression analysis among transactional contract and innovative work behaviour with the addition of mediating variable work engagement.

Table 5.*Independent - Dependent Relationship with Inclusion of Mediating Variable*

Model	Un-Standardized Coefficients		Significance Level	
	B	Std.Error	t-ratio	Sig.
(Constant)	1.338	0.234	5.710	0.000
Work Engagement	0.704	0.055	12.80	0.000
(Constant)	1.337	0.2321	5.788	0.000
Work Engagement	0.427	0.120	3.558	0.000
Transactional Contract	-0.278	0.107	-2.598	0.000

Dependent Variable: Innovative Work Behavior: $R^2 = 0.31$, $F = 160.822$, $p = 0.000$.

Regression coefficient for transactional contract in the mediation analysis has reduced from 0.617 to 0.278 which explains that the association among transactional contract and innovative work behaviour was partially mediated by work engagement, which was significant at each step. Similarly, both X and M was still significant after controlling M which shows partial mediation. Hence these findings supported hypothesis no. 3 and accepted the mediating effect of work engagement. These discoveries were in resonance with finding of (Manxhari, 2015) that transactional contract develop task related skills, self-efficacy and have high competence in his/her position which is an important for employee to be motivated and adopt innovative work behaviour.

Table 6.*Independent - Dependent Relationship with the Inclusion of Mediator*

Model	Un-Standardized Coefficients		Significance Level	
	B	Std.Error	t-ratio	Sig.
(Constant)	1.734	0.413	4.195	0.000
Work Engagement	0.542	0.098	5.891	0.000
(Constant)	1.734	0.414	4.186	0.000
Work Engagement	0.452	0.215	2.101	0.037
Relation Contract	0.091	0.192	0.0473	0.637

Dependent Variable: Innovative Work Behavior: $R^2 = 0.13$, $p = 0.000$.

Relationship among independent factor and dependent factor innovative work behaviour in the existence of work engagement as a mediating factor was explained in the Table 6. The value of B for relational contract dropped from 0.450 to 0.091 and was close to 0 which clarified that the relationship of relational contract and innovative work behaviour is fully mediated by work engagement. Similarly, both X and M was no more significant after controlling M which indicates full mediation. Hence these findings supported hypothesis no 4 and accepted the mediating effect of work engagement.

5. Recommendations

5.1. Theoretical Implications

The present study has made two distant contributions in the growing body of literature. The first, contribution of this research is that study provides the empirical support for association among employee's engagement and innovative work behaviour. Previous research has examined the effect of different psychological contract dimensions and types like psychological breach of contract. The present study expands the literature by psychological contract and innovative work behaviour and provides supportive evidence for study conducted by (Ma et al., 2013).

The second, commitment of study is by building up work engagement as mediator between psychological contract and innovative work behaviour, the study offer useful insight in understanding of operating mechanism through which psychological contract influence innovative work behaviour. The study has empirically bridged a gap between psychological contract and innovative work behaviour research. These results extend the previous findings of (Kasekende et al., 2015; Chafra, 2016) who found mediating role of work engagement between psychological contract and innovative work behaviour.

A vast majority of early researcher has examined the effect of psychological contraction outcome based on a social learning and social exchange theory (Ma et al., 2013).The distant contribution of the study is that it shed a spotlight on motivational aspect of work engagement and provides empirical evidence for study conducted by (Kasekende et al., 2015; Chafra, 2016) in which they highlight the motivational aspect of work engagement.

5.2. Practical Implications

This study consists of three practical implications. To begin with, relational, as opposed to value-based contracts incite people's innovative behaviour. Different systems develop this legally binding sort. Psychological contracts at first casing structure amid the enlistment methodology (Pawar, 2016). Therefore, techniques as reasonable employment sneak peaks make social shrinks by making a sentiment fit amongst individual and associations. Practical employment sneak peaks clear up what is expected from the general population at the occupation and demonstrate what can be predicted by the firm (Goldstine-Cole, 2017). By suitably outlining practical occupation reviews, firms can affect the advancement of relational contracts. Long term incentives, for example investment opportunities (Flammer, Bansal, 2017) or total level prizes (Galster et al., 2019), can in like manner urge agents to make social contracts with their organizations. Introduction projects and preparing blend delegates into creating solid individual acknowledgment and regard similarity with the firm (Stadtler, Van Wassenhove, 2016). What's more, firms can show double vocation steps as a wellspring of holding group of workers and giving a long-haul professional movement for gifted specialists

and designers who don't search for authoritative obligations (Chakraborty, 2020). Second, work engagement impacts representatives' innovative behaviour. Exhaustively, agents' work engagement creates through the experience of employment self-sufficiency (Alcover et al., 2017b) and proficient improvement opportunities (Xanthopoulou et al., 2007). More especially, executives may develop work engagement in their specialists by rousing them to partake in business related basic leadership, empowering their finding out about new headways, treating them similarly, utilizing open correspondence and demonstrating honest to goodness stresses. (May et al., 2004).

6. Limitations and future directions

The present research has few limitations, such as a small sample size, a cross-sectional nature of data, and a lack of awareness about the research. Future studies should be conducted with larger sample size, longitudinal nature of data, and data from both employees and their immediate supervisor. Additionally, future studies should be conducted in other sectors, such as educational sector, to capture the impact of situational factors. Moreover, the limitation of the study was data were collected from one source only from IT sector employees which may result in problem caused by common method bias (Jordan, Troth, 2020).

Future research can also look at the components of various mediators in order to develop the limit states of the psychological contract idea. For instance, the researchers argued that a strong separation may result in bosses establishing rules around what employees should and shouldn't do (Goffee, Jones, 2015). Cultural respect shapes psychological contracts, therefore the current study also offers future researchers a perspective on how cultural values affect people's behaviors, including independence/cooperation, control assertiveness, and long-term/here and now orientation (Hofstede, 1994). According to Forsyth (2020), collectivist social qualities enable people to create more relational contracts whereas nonconformist social qualities encourage them to create more value-based contracts (Forsyth, 2020).

Future research can combine behavioral components (such as learning/information sharing behavior) with motivational frameworks (such as work engagement) to develop a more complete understanding of the tools necessary to understand the relationship between psychological contract and creative work behavior (Thompson, Heron, 2008). In earlier research on psychological contracts, the single level examination was frequently the focus (A-M Coyle-Shapiro et al., 2019). Other studies could look into shared psychological contracts at the group level (Alcover et al., 2017b). Future research can therefore examine the relationship between individual psychological contracts and inventive behavior or determine whether group level mental contracts have an impact on an individual's creative behavior. Future research or study may also look into the relationship between group level psychological contracts and group advancement.

7. Conclusion

A much work has been done on psychological contract, however a relatively less research has been done on behavioral psychological contract along with important mediator work engagement. In this study for the first time important motivational mediating variable work engagement has been studied, which helped in behavioral outcomes of psychological contract. On psychological contract we get various reviews are accessible, the fascinating thing is that the outcomes are not steady and on many events the bearing of relationship is additionally not the same. Varieties do exist in the extent of these connections, and furthermore in the sign, between the psychological contract and innovative work behaviour results of representatives who encounter it. Hence the role of mediator is the key importance in this study which can provide a reasonable justification. The current study proves that a psychological contract and unmet expectations are the cause of brain drain and low productivity in IT industry. These critical demeanors and practices are fundamentally connected to a Innovative Work Behaviour. At the point when representatives feel that they didn't get what they expected, the reward is not as per their desires, or the arrival is not in value with their sources of info they feel deceived. Hence they can show different attitudes and behaviors, as a result many workers leave the organization showing disloyalty and some of them even leave the country and go abroad for better prospects.

Acknowledgements

We would like to express our deepest gratitude to the late Professor Joanna Bartnicka, whose unwavering dedication, invaluable guidance, and profound expertise significantly influenced the development and completion of this research. Professor Joanna Bartnicka played a pivotal role in shaping our understanding of Management and Quality Sciences and provided invaluable insights that enriched the depth and quality of this work. Despite the immense loss we feel with Professor Joanna Bartnicka's passing, their impact on this research project and our academic journey is immeasurable. We are indebted to their mentorship, intellectual generosity, and enduring commitment to the pursuit of knowledge. This article is dedicated to the memory of Professor Joanna Bartnicka, whose legacy continues to inspire and shape the scientific community. The influence of their teachings and mentorship will resonate in the work of generations to come. May Professor Joanna Bartnicka's contributions be remembered with the highest regard, and may this acknowledgment stand as a small tribute to the profound impact they had on both our academic and personal growth.

Silesian University of Technology (Faculty of Organization and Management), supported this work as a part of Statutory Research 13/030/BK_24/0083 (BK-266/ROZ3/2024).

References

1. Afridi, S.A., Afsar, B., Shahjehan, A., Rehman, Z.U., Haider, M., Ullah, M. (2020). Retracted: Perceived corporate social responsibility and innovative work behavior: The role of employee volunteerism and authenticity. *Corporate Social Responsibility and Environmental Management*, Vol. 27, No. 4, pp.1865-1877.
2. Ahmad, I., Donia, M.B., Khan, A., Waris, M. (2019). Do as I say and do as I do? The mediating role of psychological contract fulfillment in the relationship between ethical leadership and employee extra-role performance. *Personnel review*, Vol. 48, No. 1, pp. 98-117.
3. Alcover, C.M., Rico, R., Turnley, W.H., Bolino, M.C. (2017). Multi-dependence in the formation and development of the distributed psychological contract. *European Journal of Work and Organizational Psychology*, Vol. 26, No. 1, pp. 16-29.
4. Alcover, C.M., Rico, R., Turnley, W.H., Bolino, M.C. (2017). Understanding the changing nature of psychological contracts in 21st century organizations: A multiple-foci exchange relationships approach and proposed framework. *Organizational Psychology Review*, Vol. 7, No. 1, pp. 4-35.
5. Bakker, A.B. (2011). An evidence-based model of work engagement. *Current directions in psychological science*, Vol. 20, No. 4, pp. 265-269.
6. Bakker, A.B., Hakanen, J.J., Demerouti, E., Xanthopoulou, D. (2007). Job resources boost work engagement, particularly when job demands are high. *Journal of educational psychology*, Vol. 99, No. 2, pp. 274.
7. Bal, P.M., Kooij, D. (2011). The relations between work centrality, psychological contracts, and job attitudes: The influence of age. *European Journal of Work and Organizational Psychology*, Vol. 20, No. 4, pp. 497-523.
8. Carmeli, A., Weisberg, J. (2006). Exploring turnover intentions among three professional groups of employees. *Human Resource Development International*, Vol. 9, No. 2, pp. 191-206, doi:10.1080/13678860600616305.
9. Chakraborty, B.R. (2020). *Human Resource Practices Of IDLC Finance Ltd.*
10. Chakraborty, T., Ganguly, M. (2019). Crafting engaged employees through positive work environment: Perspectives of employee engagement. In: *Management techniques for employee engagement in contemporary organizations* (pp. 180-198). IGI Global.
11. Chang, H.T., Hsu, H.M., Liou, J.W., Tsai, C.T. (2013). Psychological contracts and innovative behavior: a moderated path analysis of work engagement and job resources. *Journal of Applied Social Psychology*, Vol. 43, No. 10, pp. 2120-2135.
12. Cloutier, C., Langley, A. (2020). What makes a process theoretical contribution? *Organization Theory*, Vol. 1, No. 1.

13. Coyle-Shapiro, J.A.M., Pereira Costa, S., Doden, W., Chang, C. (2019). Psychological contracts: Past, present, and future. *Annual Review of Organizational Psychology and Organizational Behavior*, Vol. 6, pp.145-169.
14. De Jong, J., Den Hartog, D. (2010). Measuring innovative work behaviour. *Creativity and innovation management*, Vol. 19, No. 1, pp. 23-36.
15. Edmondson, A.C. (2018). *The fearless organization: Creating psychological safety in the workplace for learning, innovation, and growth*. New York: John Wiley & Sons.
16. Erkutlu, H., Chafra, J. (2016). Benevolent leadership and psychological well-being: The moderating effects of psychological safety and psychological contract breach. *Leadership & organization development journal*, Vol. 37, No. 3, pp. 369-386.
17. Flammer, C., Bansal, P. (2017). Does a long-term orientation create value? Evidence from a regression discontinuity. *Strategic Management Journal*, Vol. 38, No. 9, 1827-1847.
18. Forsyth, D. (2020). *Making moral judgments: Psychological perspectives on morality, ethics, and decision-making*. New York: Taylor & Francis, p. 210.
19. Galster, G.C., Santiago, A.M., Smith, R.J., Leroux, J. (2019). Benefit–cost analysis of an innovative program for self-sufficiency and homeownership. *Evaluation review*, Vol. 43, No. 1, pp. 3-40.
20. Goffee, R., Jones, G. (2015). *Why should anyone be led by You? With a new preface by the Authors: What it takes to be an authentic leader*. United States: Harvard Business Review Press.
21. Goldstine-Cole, K. (2017). An Everyone Culture: Becoming a Deliberately Developmental Organization. *Harvard Educational Review*, Vol. 87, No. 1, doi: 10.17763/1943-5045-87.1.150.
22. Gwyther, H., Shaw, R., Dauden, E.A.J., D’Avanzo, B., Kurpas, D., Bujnowska-Fedak, M., Holland, C. (2018). Understanding frailty: a qualitative study of European healthcare policy-makers’ approaches to frailty screening and management. *BMJ open*, Vol. 8, No. 1.
23. Hofstede, G. (1994). Management scientists are human. *Management science*, Vol. 40, No. 1, pp. 4-13.
24. Hughes, L.W., Palmer, D.K. (2007). An investigation of the effects of psychological contract and organization-based self-esteem on organizational commitment in a sample of permanent and contingent workers. *Journal of Leadership & Organizational Studies*, Vol. 14, No. 2, pp. 143-156.
25. Jha, V. (2016). Training and development program and its benefits to employee and organization: A conceptual study. *International Journal of Scientific Research in Science and Technology*, Vol. 2, No. 5, pp. 80-86.
26. Jordan, P.J., Troth, A.C. (2020). Common method bias in applied settings: The dilemma of researching in organizations. *Australian Journal of Management*, Vol. 45, No. 1, pp. 3-14.
27. Kahn, W.A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of management journal*, Vol. 33, No. 4, pp. 692-724.

28. Kasekende, F., Munene, J.C., Ntayi, J.M., Ahiauzu, A. (2015). The interaction effect of social exchanges on the relationship between organizational climate and psychological contract. *Leadership & Organization Development Journal*, Vol. 36, No. 7, pp. 833-848.
29. Kenny, D.A. Baron, R.M. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, Vol. 51, No. 1, pp. 1173-1182.
30. Li, S., Chen, Y. (2018). The relationship between psychological contract breach and employees' counterproductive work behaviors: the mediating effect of organizational cynicism and work alienation. *Frontiers in psychology*, Vol. 9.
31. Liinamaa, J., Viljanen, M., Hurmerinta, A., Ivanova-Gongne, M., Luotola, H., Gustafsson, M. (2016). Performance-based and functional contracting in value-based solution selling. *Industrial Marketing Management*, Vol. 59, pp. 37-49.
32. Liu, Y., Liu, Z.Y., Ren, W.W., Forrest, J.Y.L. (2020). A coordination mechanism through relational contract in a two-echelon supply chain. *Journal of Retailing and Consumer Services*, Vol. 56.
33. Manxhari, S.M. (2015). The Influence of Motivation on Job Performance Case Study: Managers of Small and Medium Enterprises (SMEs), Kosovo. *ILIRIA International Review*, Vol. 5, No. 2, pp. 41-52.
34. May, D.R., Gilson, R.L., Harter, L.M. (2004). The psychological conditions of meaningfulness, safety and availability and the engagement of the human spirit at work. *Journal of occupational and organizational psychology*, Vol. 77, No. 1, pp. 11-37.
35. Millward, L.J., Hopkins, L.J. (1998). Psychological contracts, organizational and job commitment. *Journal of Applied Social Psychology*, Vol. 28, No. 16, pp. 1530-1556.
36. Nauman, R., Qamar, A. (2018). The impact of ethical leadership on employee productivity. *Journal of Management and Human Resource (JMHR)*, Vol. 1, pp. 66-84.
37. Pawar, A. (2016). Employee value proposition: a collaborative methodology for strengthening employer brand strategy. *Journal of Resources Development and Management*, Vol. 16, No. 1, pp. 56-62.
38. Piccolo, R.F., Greenbaum, R., Hartog, D.N.D., Folger, R. (2010). The relationship between ethical leadership and core job characteristics. *Journal of organizational behavior*, Vol. 31, No. 2, pp. 259-278.
39. Rich, B.L., Lepine, J.A., Crawford, E.R. (2010). Job engagement: Antecedents and effects on job performance. *Academy of management journal*, Vol. 53, No. 3, pp. 617- 635.
40. Schaufeli, W.B., Bakker, A.B. (2003). *UWES-utrecht work engagement scale: Test manual*. Department of Psychology, Utrecht University.
41. Schaufeli, W.B., Shimazu, A., Hakanen, J., Salanova, M., De Witte, H. (2017). An ultra-short measure for work engagement. *European Journal of Psychological Assessment*, Vol. 35, No. 4.

42. Soares, M.E., Mosquera, P. (2019). Fostering work engagement: The role of the psychological contract. *Journal of Business Research*, Vol. 101, pp. 469-476.
43. Stadtler, L., Van Wassenhove, L.N. (2016). Coopetition as a paradox: Integrative approaches in a multi-company, cross-sector partnership. *Organization Studies*, Vol. 37, No. 5, pp. 655-685.
44. Stojcic, N., Hashi, I., Orlic, E. (2018). Creativity, innovation effectiveness and productive efficiency in the UK. *European Journal of Innovation Management*, Vol. 21, No. 4, pp. 564-580.
45. Sumo, R., van der Valk, W., van Weele, A., Duysters, G. (2016). How incomplete contracts foster innovation in inter-organizational relationships. *European Management Review*, Vol. 13, No. 3, pp.179-192.
46. Thompson, M., Heron, P. (2006). The difference a manager can make: organizational justice and knowledge worker commitment. *The International Journal of Human Resource Management*, Vol. 6, No. 3, 383-404.
47. Timms, C., Brough, P., O'Driscoll, M., Kalliath, T., Siu, O. L., Sit, C., Lo, D. (2015). Positive pathways to engaging workers: Work–family enrichment as a predictor of work engagement. *Asia Pacific Journal of Human Resources*, Vol. 53, No. 4, 490-510.
48. Vander Elst, T., De Cuyper, N., Baillien, E., Niesen, W., De Witte, H. (2016). Perceived control and psychological contract breach as explanations of the relationships between job insecurity, job strain and coping reactions: Towards a theoretical integration. *Stress and Health*, Vol. 32, No. 2, pp.100-116.
49. Volery, T., Tarabashkina, L. (2021). The impact of organisational support, employee creativity and work centrality on innovative work behaviour. *Journal of Business Research*, Vol. 129, pp. 295-303.
50. Zheng, J., Wu, G., Xie, H. (2017). Impacts of leadership on project-based organizational innovation performance: The mediator of knowledge sharing and moderator of social capital. *Sustainability*, Vol. 9, No. 10, pp. 1893.
51. Zhou, Y., Huang, M., SL Tsang, A., Zhou, N. (2013). Recovery strategy for group service failures: The interaction effects between recovery modes and recovery dimensions. *European Journal of Marketing*, Vol. 47, No. 8, pp. 1133-1156.

PROJECT MONITORING MODEL IN CENTRAL GOVERNMENTAL ADMINISTRATION

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Purpose: The aim of this article is to present the project monitoring model in the central government administration as a set of interrelated, complementary elements that influence the implementation of strategic projects on a nationwide scale and affect tens of millions of Polish citizens.

Design/methodology/approach: Based on a literature review and analysis of the existing system, prospective directions for the monitoring of strategic projects were selected. As a result of this work, a model was created that was assessed for significance and replicability. The most experienced group of experts and practitioners in this field took part in the CAWI survey.

Findings: The high level of significance of all areas of the model has been proven and its universal nature has been confirmed, thanks to the possibility of being used in other administrative units.

Research limitations/implications: Due to limitations resulting from security procedures for research conducted in central government administration units, only closed questions were used in the research. In the future, the study can be carried out on another, larger population, having previously prepared it appropriately.

Practical implications: The practical use of the model in administration units can contribute to increasing transparency, efficiency and automation of planning and implementation of projects.

Social implications: Increasing the quality of implemented projects in accordance with the presented model may have a large, positive impact on the final beneficiaries - society, in terms of effective use of public funds, shortened project implementation time, and obtaining project results consistent with expectations.

Originality/value: The article presents a new model of project monitoring in central government administration, which may be useful for scientists conducting research in the area of project monitoring and management in other countries. The article falls into the area of projectification of the public sector.

Keywords: project management, central government administration, Project Management Office (PMO), significance assessment, feasibility assessment.

Category of the paper: Research paper.

1. Introduction

Government strategic project's implement initiatives that affect the lives of entire nations, including urban development and facilitating communication between cities (Priyanta, Zulkarnain, 2023), preventing large-scale environmental destruction (Fedchenko et al., 2023), and even ensuring the supply of water essential for life and enabling food production (Ariyanti, 2023). In Norway, all government strategic projects whose value exceeds EUR 75 million are subject to a comprehensive governmental quality assurance (Jorgensen et al., 2023). On the other hand, insufficient commitment to following policies and procedures in government-sponsored projects ultimately affects the performance of these projects, just as it negatively affected government construction projects in Ghana, contributing to their failure (Dick-Sagoe et al., 2023). The approaches to project planning and execution vary, with the dominant ones being the waterfall approach and the agile approach. For example, the United States government utilizes elements of the agile approach in around 80% of government projects, despite the lack of regulation of this approach in the law (Aleinikova et al., 2020). Even though still many governments have problems with developing digital government services in an effective and efficient manner (Kupi, McBride, 2021).

In 2017, the Polish government adopted a strategy for the country's development, called the Strategy for Responsible Development. The strategy aimed to plan and implement state-scale investments and required the involvement of multiple administrative units, including all ministries. The government strategy, adopted by the Council of Ministers' resolution, envisioned the implementation of the strategy through project management. At that time, comprehensive implementation of project management in the Polish central administration did not exist. In response to the legal requirement, an organizational unit named the Project Management Department was established in the Ministry of Economic Development in 2017 (Kosieradzka, Janka, 2019). Within a short period, it was observed that the incomplete implementation of project management, limited to only one ministry, hindered the project-based execution of the strategy. As a consequence, between 2018 and 2019, organizational units called Project Management Offices (PMOs) were established in the Chancellery of the Prime Minister and the Ministries. In addition to the new structure, a Strategic Project Monitoring System was developed within the central PMO at the Chancellery of the Prime Minister (Project Management Institute, 2019). The system consisted of 6 areas:

- Procedures: project management and project monitoring.
- Decision-making body: Portfolio Committee.
- IT system: IT tools supporting project management and monitoring.
- Organization: units supporting project management and monitoring processes.
- Initial project portfolio.
- People: Community of individuals involved in project management and monitoring.

Up until that time, no research had been conducted on the system that is used for shaping and implementing projects worth billions of euros (SRD Resolution, 2017).

The aim of this article is to present the Project Monitoring Model in Central governmental Administration and its specific domains, including the approach to model creation, followed by an evaluation of its significance based on research within a defined study group. Additionally, it assesses the potential for replicating the model for application in other public administration units.

The article begins with an introduction indicating the importance of strategic projects in administration and presenting the history of the implementation of project management in the Polish central state administration. In the theoretical background chapter, the author presents an overview of key definitions related to this article and explains their selection. Then it presents examples of implementations from business and public areas. The next chapter presents the process and results of literature review, based on which important areas of development are outlined. Then, the Project Monitoring Model in Central governmental Administration was presented. The analysis of the literature with outlined areas of development and the presentation of the model resulted in the formulation of research hypotheses. Then, the research process, description of the population and research tools were described, and their selection was justified. Finally, the research results were presented, a discussion was held and the research was summarized.

1.1. Theoretical background

The significance term in general is often discussed in the literature on accounting and financial reporting. For example, the IIRC indicates that a significant matter is one that is sufficiently important in terms of its known or potential effect on value creation (IIRC, 2021). A slightly different definition is presented by the IAASB, which states that something is considered significant when it is taken into account in decision-making processes (IAASB, 2013). In other words, decision-making processes are based on significant matters. Researchers from Chile, Uruguay, and Malta have expanded the definition of significance by creating a significance matrix (Geldres-Weiss et al., 2021). For the purpose of this study, significant areas were defined as those that have a significant impact on supporting the implementation and monitoring of projects.

In the source literature, finding a single, coherent definition of a strategic project is challenging. Nevertheless, common characteristics indicated by the authors can be observed. These include, for instance, extended project duration (Maylor, 1996), significant environmental impact (Wankel, DeFillippi, 2005), high levels of innovation (Crawford, 2010), involvement of top-level decision-makers (Dinsmore, 1999), and limited distance to external clients (Arto, Dietrich, 2007). Leading international organizations emphasize the temporary nature of the undertaking and the uniqueness of its outcomes (Internacional Project

Management Association, 2015; Office Of Government Commerce, 2009; Project Management Institute, 2001).

For the purposes of this study, the following definition of a project has been adopted: an organized endeavor segregated from ongoing activities, aimed at implementing a change by creating a unique product or service within a specified time and budget, meeting defined qualitative and quantitative requirements (Janka et al., 2020). This definition was developed and adopted within the Strategic Project Monitoring System operating within the Chancellery of the Prime Minister's Office. In the author assessment, this definition most comprehensively reflects the reality of project implementation in public administration in Poland.

A portfolio comprises a collection of projects, programs, and other endeavors to enable effective management in achieving strategic objectives (Office Of Government Commerce, 2011; Project Management Institute, 2008). The components of a portfolio need not be tightly interrelated (Internacional Project Management Association, 2015). Portfolio elements should be measurable, prioritized, and organized (Project Management Institute, 2013). For this study, the author have adopted the definition of a project portfolio as outlined in the Recommendations for Project Management prepared by the Chancellery of the Prime Minister's Office, which states: 'A portfolio is a collection of programs, projects, and other work selected based on specific criteria, grouped for effective and efficient management and control. A portfolio perspective allows for optimizing and coordinating changes occurring within an institution. The portfolio is a tool enabling the achievement of strategic goals for the entire organization' (Janka et al., 2020).

More than 51 million people worldwide are engaged in project management (Project Management Institute, 2014). Individuals or organizations involved in a project whose influence on the project's outcome can be either positive or negative are project stakeholders (Internacional Project Management Association, 2015; Office Of Government Commerce, 2009; Rose, 2013). This influence can be significant (Aaltonen, Kujala, 2015; Eskerod et al., 2015; Munns, Bjeirmi, 1996; Olander, Landin, 2005; Trocki, Grucza, 2004; Turner, Zolin, 2012; Vargas et al., 2023). Numerous attempts have been made to classify this group (Freeman et al., 2007; Heerkens, 2003; Pinto, 1998). However, for this study, the author have adopted the stakeholder definition presented in the Recommendations for Project Management by the Chancellery of the Prime Minister's Office, which states that stakeholders are individuals particularly interested in the results or progress of a program/project. They may influence the program/project or be affected by it (Janka et al., 2020).

The project management office is crucial for successful and efficient delivery of projects (Correia, Água, 2023; Lundqvist, 2017). The PMO definition proposed by PMI (Project Management Institute, 2008): 'An organizational body or entity assigned various responsibilities related to the centralized and coordinated management of those projects under its domain. The responsibilities of the PMO can range from providing project management support functions to actually being responsible for the direct management of a project'.

In accordance to Axelos (Axelos, 2013), there are three possible meaning of PMO: 1) Project Management Office: supporting individual projects; 2) Programme Management Office: coordinating, identifying dependencies of projects and supporting the transition of outputs to business as usual (BAU); 3) Portfolio Management Office: single point at corporate level where all the change initiatives within an organization are managed. The PMO definition could be extensive because at least 75 unique functions of PMO have been identified (Crawford, 2004).

For the purposes of this work, it was decided to use the PMO definition, tailored to the organization in which the research will be conducted (Janka et al., 2020). The PMO, in this case called the portfolio office, is an organizational unit created to build, prioritize and report the portfolio, support and monitor the implementation of programs and projects, pre-process the collected information, including transmitting it to authorized entities, as well as spreading the project culture. The portfolio office performs the functions of a project monitoring office within the meaning of the strategic project monitoring process.

1.2. Prospective directions of development

Governments in developed countries are modernizing their public management approaches towards project management (Bertot et al., 2016; Blasco et al., 2016; Kosieradzka, Janka, 2019; Vento, 2023). Implementing project management in public administration increases flexibility and leads to more effective goal achievement (Donovan, 2013; Greve et al., 2020). Acquiring collaboration skills in a project environment and reducing errors can improve project management in public administration (Bianchi et al., 2021; Marocco et al., 2023). Resistance to change from traditional working practices often arises due to a lack of in-house skilled professionals and knowledge of the required processes and workflows (Elmualim, Gilder, 2014). There is also an informational function that involves the preparation and management of information in the personnel decision-making process. It includes tasks such as planning, analyzing, supervision, evaluation, control, and decision-making regarding the HR aspects of the controlled activities (Bukłaha, Trzeciak, 2023). According to Ika (Ika, 2012; Ika, Hodgson, 2014), there are four traps in implementing project management in public administration: the trap of applying universal business solutions, the trap of expecting quick results, the trap of insufficient managerial competencies, and the cultural trap. Adopting a flexible approach to project management implementation is recommended, taking into account the specific context of the implementation area.

Another area identified as requiring development is the use of tools to support project monitoring and control (CMMI, 2010; Radvanský et al., 2022; Wanapaisan et al., 2013). The Texas Department of Transportation recognized the need to build and develop tools to support project management and monitoring, and these tools have had positive effects on project implementation (Khwaja et al., 2018).

The selection of projects for implementation in terms of their significance involves the creation of a project portfolio (Gutiérrez, Magnusson, 2014; Jonas, 2010; Killen, Hunt, 2010). It is widely recognized worldwide that project management should be approached as a holistic portfolio rather than individual projects (Lechler, Thomas, 2015; Martinsuo, 2013).

In addition to the concepts of projects and project portfolios, the concept of a program exists (Artto et al., 2009; Geraldi, Lechter, 2012; Lycett et al., 2004; Martinsuo, Hoverfält, 2018; Maylor, 1996; Pellegrinelli, 2011). Researchers from various fields emphasize the importance of program management (Heldal et al., 1997; Ko, Paek, 2008), including ensuring a coherent vision (Meyers et al., 2017) and providing adequate resources (Martinsuo, Ahola, 2022).

The important areas of broadly understood project management indicated in the literature and presented above are not included in the strategic project monitoring system (Project Management Institute, 2019).

1.3. Successful PMO implementations – model solutions

The PMO area is a key area that is subject to research and described in this study. Observing successful PMO implementations and their characteristic features can influence the definition of areas in a new model. It is difficult to find examples of successful project and program management office (PMO) implementations in scientific literature. The analyzed literature mainly focuses on general principles that should guide individuals involved in creating or improving project and program management offices. They lack specific implementation examples and their analysis. Broda (Tauron in the forefront of the competition for the best project management office - Press Center, no date) presents the role of PMO in Tauron as the coordinator of the entire project management process, starting from the creation of an investment strategy to supervising project implementation and reporting on its progress. Palarczyk (BiznesAlert, 2020) emphasizes the importance of having an interdisciplinary team in the PMO, which, in addition to expert competencies, also possesses communication skills and collaborates well with other units in the organization. The implementation of the project and program management office in Tauron S.A. was recognized by the PMO Global Alliance, which assessed Tauron's PMO as one of the two best PMOs in Europe and eighth globally.

Another example can be found in Fujitsu-Siemens (Fujitsu, 2020), a company that implements projects in the broad field of IT, from consulting to the deployment of hardware solutions that support businesses. The organization provides training and ensures that all its employees who provide project management advisory services achieve PMP certification from the Project Management Institute. Additionally, it has developed an internal training program and an internal certification process in project management for its employees. The organization has internally established a PMO and also provides services for creating project and program management offices in three areas: PMO establishment, PMO assessment, and PMO operations. The first area supports the creation of a PMO tailored to the organization's structure and needs, defining key roles and responsibilities in the project process and providing a launch

plan. The second area assesses and confirms the size and competency of the resources needed for the PMO service delivery process within the organization. It also verifies current plans for PMO creation and maintenance, primarily in terms of schedule and risk mitigation. The third area assumes responsibility for the PMO from an external entity, thereby eliminating the risk of insufficient competencies within the organization or enhancing their implementation capabilities.

A relatively young project and program management office is the Government Project Monitoring Office in the Chancellery of the Prime Minister (Kosieradzka, Janka, 2019). It is an organizational unit built on the competencies of the Project Management Department at the Ministry of Development. The Government Project Monitoring Office carries out tasks related to: implementing a unified methodology for monitoring programs and projects and promoting a program and project management culture in public administration, monitoring selected programs and projects implemented based on program and project management methodology, and coordinating the management of selected programs and projects implemented based on program and project management methodology. The office initiated and coordinated the process of creating project and program management offices in each ministry, operating in the project monitoring area in a consistent manner. The unification in the project monitoring area allowed for the creation and launch of a common analytical and reporting environment, providing a source of managerial information for decision-makers.

Ericsson operates globally in many countries across multiple continents. By implementing a standardized project methodology, it monitors the utilization of project resources simultaneously in projects carried out in different countries and is able to allocate resources effectively. It also monitors the implementation of individual project products, which may be prerequisites for projects implemented in other countries. Ericsson examines project maturity within its organization in various countries, which varies at different levels. The project methodology created by Ericsson and administered by the PMO is called PROPS and is currently used throughout the global organization (Mulder, 1997).

1.4. Project monitoring model in central governmental administration

Currently, the most recognized portfolio management standards worldwide are PMI and OGC. The Project Management Institute (PMI) developed the first version of the 'Standard for Portfolio Management' in 2008 (Project Management Institute, 2013), while the Office of Government Commerce (now Axelos) published 'Management of Portfolios (MoP)' in 2011 (Office Of Government Commerce, 2011). Despite a small time difference in the development of the models and their respective areas of application, these standards, composed of dozens of artifacts, have only two common artifacts: 'Portfolio' and 'Portfolio Roadmap' (Lima et al., 2018). This may indicate the need for a completely different perspective on organizing similar temporary initiatives. The environmental context of model utilization can be a determining factor. The PMI standard model was developed in the USA, while the OGC standard model

originated in the UK. Considering the above, it seems reasonable to create a standard model that meets the specific needs of the local environment, in this case, the central government administration area in Poland.

The previously mentioned Strategic Project Monitoring System, developed between 2018 and 2019 within the PMO unit at the Chancellery of the Prime Minister's Office (CPMO) in Poland, depending on PMI principles and adapted to CPMO conditions, was the foundation for creating the model (Figure 1).

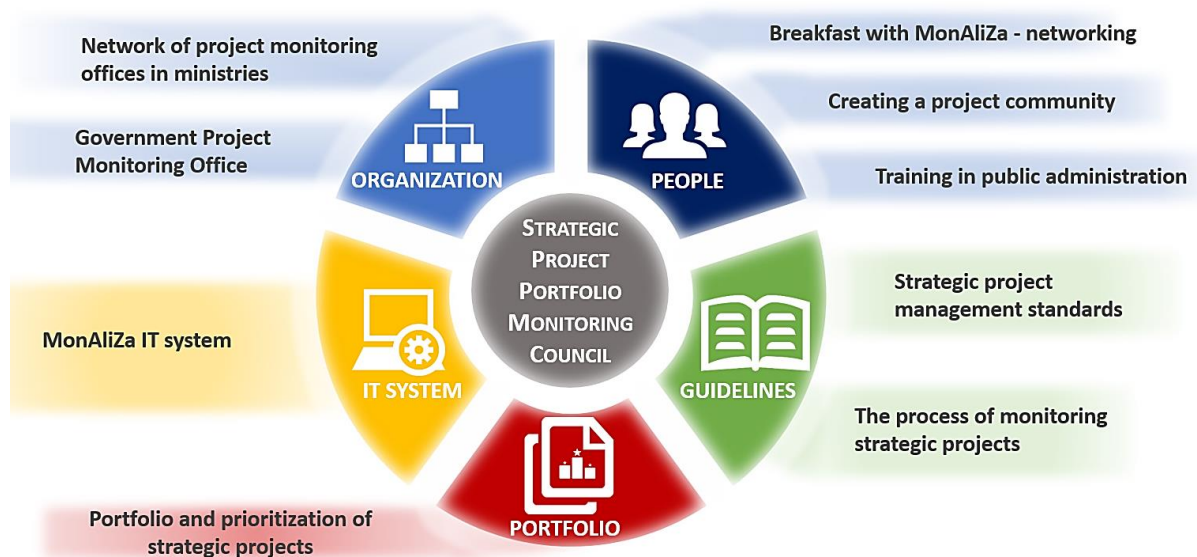


Figure 1. Strategic Project Monitoring System – own study based on the article (Project Management Institute, 2019).

1.5. Hypothesis

Taking into account the results of the literature review, the four development areas outlined, as well as the current areas of the Strategic Project Monitoring System, the following hypothesis can be formulated:

H1: The project monitoring system in the central government administration requires development.

The new model created in this way could be of a general nature and could be replicated in other administrative units, which leads to the formulation of the second hypothesis:

H2: The areas of the project monitoring system are universal and can be used in other administration units.

2. Methods

2.1. Research process

The following research process was proposed:

1. Determination of potential directions for the development of monitoring and project management systems in public administration based on a critical analysis of subject literature, excluding areas of the existing strategic project monitoring system in the central state administration in Poland.
2. Formulation of hypotheses regarding the significance of including potential developmental areas in the system.
3. Formulation of hypotheses regarding the feasibility of implementing potential, new, and existing areas of the strategic project monitoring system in other public administration units.
4. Determination of the research sample.
5. Selection and construction of research tools.
6. Planning and conducting the study.
7. Interpretation of results and substantiation or refutation of the hypotheses.

2.2. Research Population

The study was conducted between September and November 2022 in the central government administration of Poland, which consisted of 18 units of central administration. This includes the Chancellery of the Prime Minister and 17 ministries, each led by a constitutional minister overseeing 37 administrative parts (The Act on Government Administration Parts - Dz.U.2022.2512, 2022). Depending on the specific nature, size, diversity, complexity, and number of projects in the ministries, these units took the form of separate organizational departments, divisions, or autonomous positions. In the case of autonomous positions, they were most commonly created within the office of the minister or the office of the director-general. The number of personnel employed for PMO functions in individual units of the central government administration ranged from 1 to 5 individuals, with a total of 47 personnel. These PMO employees and managers work on a daily basis in the areas of monitoring, support, and sometimes project management, to the fullest extent. Their work is based on the utilization of a strategic project monitoring system. They possess the greatest experience and broadest knowledge in this area within the central government administration. Two other major actor groups in the process, project managers and sponsors, utilize certain elements of the system in their daily work but do not have complete knowledge of its functioning. Additionally, individuals serving as sponsors and project managers also have other duties stemming from their positions. In their case, functional hierarchy takes precedence over the hierarchy resulting from the project monitoring processes, introduced as an internal

regulation of the administrative unit. The situation is different for individuals in the PMO role, where functional hierarchy aligns with the scope of responsibilities related to project monitoring and support processes.

Due to their full-time involvement in project monitoring and support processes, individuals serving as PMOs in the central government administration were chosen as the research population, as they possess the most extensive experience in the area of project monitoring and support among all potential employee groups in the central government administration.

Considering the relatively small population size ($n = 47$) and the experiences of other researchers (du Toit, 2016; Ma et al., 2023), it was decided to conduct the study using a full sample.

2.3. Research Tools

There are various research methods and tools (Raikou, Konstantopoulou, 2021) that could be utilized to examine the significance and potential replication of the areas. Due to the geographic diversification of the research group and the possibility of conducting the study concurrently, a survey method was chosen using a computer-assisted web interviewing (CAWI) questionnaire. Additionally, this type of study ensured anonymity for the respondents, which should increase the likelihood of receiving honest responses (Babbie, 2010). Questions regarding the age and gender of the participants were not included to prevent the identification of the respondents in the small population. Before conducting the study, the research tool selection and the tool itself had to be approved by decision-makers in the Chancellery of the Prime Minister. Ultimately, the questionnaire (Table 2 in appendix) consisted of 26 closed-ended questions, including 15 Likert scale questions ranging from 1 to 7 (Sukma et al., 2022) for questions Q5-Q8 and Q10-Q20, as well as two Likert scale questions ranging from 1 to 5 (Lakanmaa et al., 2015) for questions Q25-Q26. The questionnaire consisted of four parts: demographic information, assessment of the significance of proposed model areas, assessment of the feasibility of implementing specific model areas, and self-assessment of knowledge in the areas of project monitoring. Responses to questions regarding significance assessment and feasibility assessment were given on a Likert scale from 1 to 7, while responses to self-assessment questions were given on a Likert scale from 1 to 5. There are multiple interpretations of Likert scale response ranges. A common approach is to divide the scale into three groups, assigning them values of low, medium, and high (García-Gutiérrez et al., 2023; Haut et al., 2023; Villalobos et al., 2022), or negative, neutral, and positive (De Chastelain Finnigan et al., 2022; Hosseinzadeh, Rafiei, 2019; Joslin et al., 2020; Kaye et al., 2022). The significance assessment and feasibility assessment questions were grouped as follows:

- Responses 1-3: Negative.
- Responses 4-5: Neutral.
- Responses 6-7: Positive.

The self-assessment questions were grouped as follows:

- Responses 1-2: Low self-assessment.
- Response 3: Medium self-assessment.
- Responses 4-5: High self-assessment.

The dependent variable in this study was defined as the measure of the significance of proposed model areas not included in the system (Development of key stakeholders' competencies, Development of tools supporting project monitoring and management processes, Conscious building and management of project portfolios, and Ensuring a consistent vision and resources in program management). The second dependent variable was the assessment of the feasibility of implementing the eleven model areas in other administrative units. For these variables, a 7-point Likert scale was used, where 1 indicated strong disagreement, and 7 indicated strong agreement.

The questionnaire also included independent variables that can be grouped as follows:

- Job nature (current relevance to PMO, current role, frequency of working with the current system).
- Experience (total professional experience, professional experience in administration, experience with the current system, certification, education).

The questionnaire included one question regarding the need to introduce a new area into the current system, which had not been previously defined.

2.4. Data Collection

The questionnaire survey was conducted over a period of two months in three rounds of reminders. The questionnaire was distributed to PMO employees in 18 central government administration units, including the Chancellery of the Prime Minister and 17 ministries. A total of 17 fully completed questionnaires were obtained.

3. Results

All respondents had at least 5 years of professional experience, with over 88% having more than 10 years of experience. Over 88% of the respondents had been working in public administration for over 5 years, and 76% for over 10 years. 94% of the respondents declared having a certification confirming their project management skills. All respondents rated their skills in both project management and project monitoring at least 3 points on a 5-point Likert scale, with 1 being a beginner and 5 being an expert. The dominant rating in both self-assessment areas was 4. 88% of the respondents had been using the current system for at least a year and 41% for over 3 years. Over 70% of the respondents stated that they used elements of the system multiple times every month in their work.

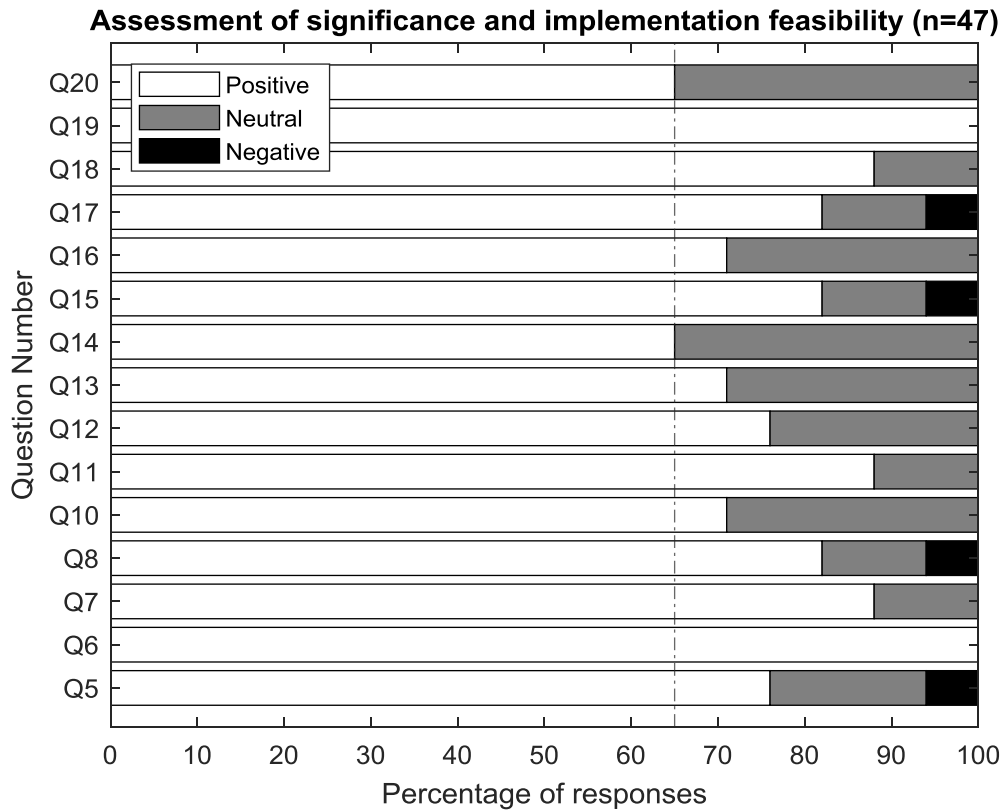


Figure 3. Survey results Q5-Q8 and Q10-Q20.

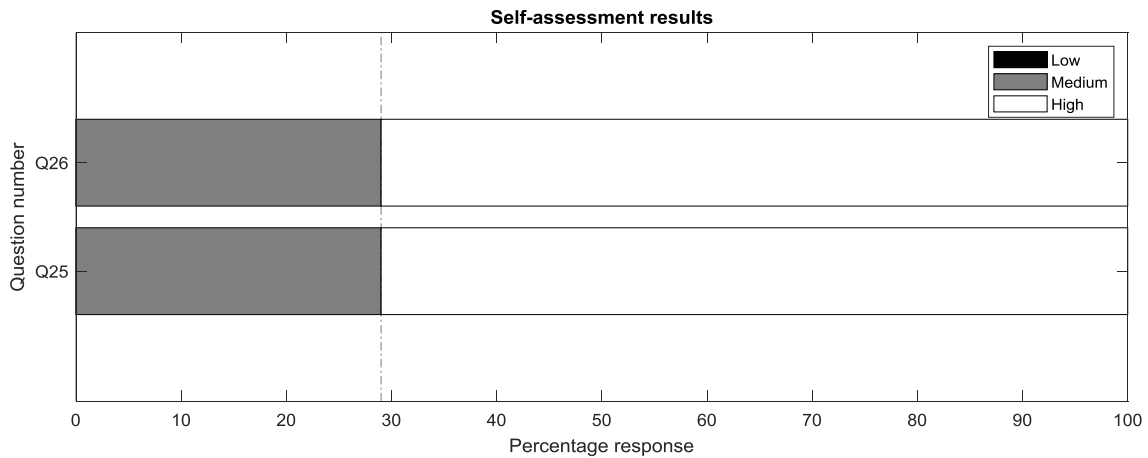


Figure 4. Self-assessment results.

The main survey results are presented in Figures 3 and 4, and the statistics for the Likert scale responses are presented in Table 1. For the first group of questions regarding the significance of new areas (Q5-Q8) on a 1-7 Likert scale, the obtained results ranged from a mean of 6.06 to 6.76, with standard deviations ranging from 0.44 to 1.52. For the second group of questions regarding the feasibility of implementing model areas in other administrative units (Q10-Q20) on the same scale, the obtained results ranged from a mean of 5.94 to 6.65, with standard deviations ranging from 0.49 to 1.14. In the first group, the percentage of positive ratings (ratings 6 and 7) ranged from 76.5% to 100%, and in the second group, from 64.7% to 100%, with average values of 86.8% and 78.1% respectively. Positive ratings were observed from the 38th percentile for all questions in both groups. The Shapiro-Wilk test resulted in

a p-value < 0.05 for 12 out of 15 questions, indicating that using techniques assuming the normality of data on this dataset would be inappropriate.

Table 1.

Descriptive statistics (Q25-26 Likert scale 1-5)*

Question no.	SD	Mean	Median	Min	Max	% answers 6 and 7	38th percentile
Q5	1,52	6,06	7	1	7	76,5%	6.000
Q6	0,44	6,76	7	6	7	100,0%	7.000
Q7	0,71	6,59	7	5	7	88,2%	7.000
Q8	1,27	6,12	6	2	7	82,4%	6.000
Q10	0,97	6,06	6	4	7	70,6%	6.000
Q11	0,70	6,35	6	5	7	88,2%	6.000
Q12	1,14	6,06	6	4	7	76,5%	6.000
Q13	1,03	6,24	7	4	7	70,6%	6.080
Q14	1,09	5,94	6	4	7	64,7%	6.000
Q15	1,10	6,29	7	3	7	82,4%	6.080
Q16	1,01	6,18	7	4	7	70,6%	6.000
Q17	1,14	6,06	6	3	7	82,4%	6.000
Q18	0,72	6,47	7	5	7	88,2%	6.080
Q19	0,49	6,65	7	6	7	100,0%	7.000
Q20	1,00	6,00	6	4	7	64,7%	6.000
Q25	0,75	3,94	4	3	5	70,6%*	
Q26	0,79	4,00	4	3	5	70,6%*	

Source: own work based on research results.

4. Discussion

Due to the small population size, the limited options for research methods do not allow for a comprehensive examination of the significance of the areas mentioned in the literature and their potential implementation in other administrative units. Nevertheless, considering the characteristics of the population of individuals working in the PMO field in central government administration, including their professional and overall administrative experience, experience with the current system, and confirmed expertise, the obtained results can be used as input data for further research.

Hypothesis H1: ‘The project monitoring system in the central government administration requires development.’ can be confirmed by obtaining positive ratings in the corresponding questions at an average level of 86.8%. Similarly, in the case of hypothesis H2: ‘The areas of the project monitoring system are universal and can be used in other administration units’, positive ratings were obtained at an average level of 78.1%, which could confirm the hypothesis H2. An interesting finding confirming the emerging perspective for further research in this area is the affirmative response of 65% of the respondents regarding the need to supplement the system with an area not previously indicated.

Limitations in central administrative units, which prevented the inclusion of open-ended questions in the survey, made it impossible to identify the areas the respondents had in mind. The next stage of research can be conducted on a representative sample of project managers and project sponsors. However, at the time of conducting the current study, representatives of these groups did not have sufficient knowledge about all the areas of the current Strategic Project Monitoring System to be able to respond to the questionnaire. Therefore, these studies should be preceded by a cycle of training for both proposed groups. This is undoubtedly an interesting area for further research exploration.

The Project Monitoring Model in Central governmental Administration should support critical decision-making and data-driven management. It is a perspective on management that has been rapidly developing in recent times (Wirtz, Müller, 2019; Young et al., 2019). The utilization of artificial intelligence in decision-making support processes may be another area of scientific exploration within the model. However, as research by other scholars has shown (Mergel et al., 2023), the implementation and study of AI require addressing the knowledge gap among public management managers. It has been observed that despite numerous research studies and scientific publications in the e-administration field, the implementation of new models and systems only took place during the COVID-19 pandemic, when the provision of services in the traditional way was not possible. Building awareness regarding risks and mitigation strategies among public management managers can contribute to accelerating the implementation of new technologies in administration. Such an approach is consistent with the People in Project Monitoring Model in Central governmental Administration area group.

Based on the results of analysis, four new areas not included in the Strategic Project Monitoring System share similarities with the system's elements. It was observed that the 'Processes' area could encompass project monitoring and management procedures, as well as defining, monitoring, and managing portfolios and programs, thus creating a new group. In the context of the 'Organization' area, besides defining the roles of units supporting project management and monitoring, the role of a decision-making body in the portfolio of programs and projects can also be defined. Furthermore, processes executed within their area of operations can be specified for this group. Grouping the areas related to the creation and maintenance of IT systems, along with their development, would allow the consolidation of all IT-related activities in one group. Lastly, integrating the areas of building a community of individuals involved in project monitoring and management processes, along with their development through training, would enable the creation of a distinct group focused on human resource management.

The model would encompass the scopes of the six previously defined areas and four new areas, which could be grouped as follows:

- Processes: defining, monitoring, and managing portfolios, programs, and projects.
- Organization: roles and processes of PMOs and the Strategic Project Portfolio Board.

- Tools: creating, maintaining, and evolving IT systems that support the processes.
- People: building and developing the collective competence of individuals in portfolio, program, and project monitoring and management.

The graphic interpretation of the project monitoring model in central governmental administration is presented in Figure 2. The layered model illustrates relationships between dimensions within the model's domains. Model elements are situated at the intersections of these dimensions. The model comprises 22 elements grouped into 4 categories. Additionally, each element is assigned to one or two domains. For instance, in the first quadrant, one may find the program management process, portfolio definition process, or project monitoring process. In the fourth quadrant, examples may encompass PMO process organization or the Strategic Project Portfolio Council's role organization. It is noteworthy that basic roles such as project manager or program manager are absent in the fourth quadrant deliberately. Within the central governmental administration in Poland, individuals in these roles occupy positions within the administrative hierarchy. In other words, the roles of project and program managers complement the duties of specific positions and do not require separate job descriptions or distinct operational processes. Conversely, this differs for PMOs and the Strategic Project Portfolio Council. Individuals in PMO roles undertake comprehensive responsibilities, necessitating separate regulations, job descriptions, and process descriptions. The Strategic Project Portfolio Council operates under the Prime Minister's regulation, imposing the obligation for Ministers to participate in the decision-making body. This also demands separate regulations and the definition of operational processes. In the third quadrant, an example could be the development of supporting tools, while in the second quadrant, it might involve establishing a project community or enhancing the competencies of portfolio managers.

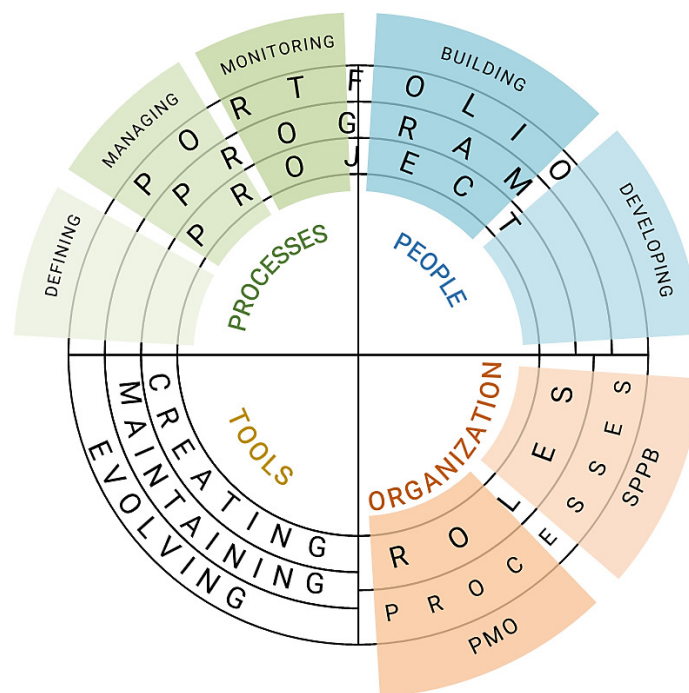


Figure 2. Project Monitoring Model in Central governmental Administration.

The proposed groups of areas are not independent entities. The influence of each group on the others has been observed. For example, building the portfolio definition procedure involves dividing the activities among various actors, including defining the actions of the Strategic Project Portfolio Board, which, among other things, is responsible for accepting the adopted portfolio. Another example of a relationship can be seen in the definition of PMO processes, which will utilize IT systems to carry out these processes. Additionally, defined programs and projects may require the development or enhancement of specific competencies among individuals responsible for their implementation and monitoring.

5. Summary

The results of a literature review in the examined area continue to indicate a significant disparity in the quantity of research on project monitoring in public administration compared to the business world. Subsequent stages of literature research have helped identify predominant clusters of interest areas. Recent research shows that project monitoring is one of the key competencies of project managers (Wyskwariski, 2022). Another scientist indicates that the next directions in the development of the project monitoring area may include, among others, the use of modern IT tools to monitor work progress in real time, the implementation of cloud-based project management systems enabling easy monitoring of tasks and schedules, or the use of Agile methodologies in project monitoring, which allows for flexible response to changes and quick adaptation to new conditions (Wolniak, 2022). The significance of individual domains within the Project Monitoring Model in Central governmental Administration, as well as the feasibility of implementing the model in other administrative units, has been confirmed through research. The presented study was limited to closed questions due to objective premises, which consequently did not lead to the articulation of areas of the model that were not quantified by the author. In other words, expanding the research with in-depth interviews could identify additional new areas, domains or elements that could be included in the model. Referring to hypothesis H1 'The project monitoring system in the central government administration requires development' in other countries, public administration project monitoring models have shown varying levels of effectiveness, with advancements in digitalization and predictive analytics improving the quality of decision-making support. However, challenges persist, including data acquisition from non-standardized devices, transforming raw data into useful indicators, and providing robust and intuitive interfaces. Ukrainian scientists underlined that modernization of public administration in Ukraine has expanded methods of analysis and evaluation, but the system still lacks openness, customer focus, and proactivity (Lyudmila, Anzhela, 2022). The Brazilian Public Administration reforms have introduced corporate governance and accountability concepts, but the monitoring system's

appropriateness is still under examination (Montenegro, Celente, 2016). Other Brazilian researchers claim that the implementation of monitoring and evaluation systems can improve government results, but challenges include data acquisition, data transformation, and interface design. Moreover the data is often acquired from thousands of non-standardized devices scattered across the country, sometimes with limited internet connectivity (Trois et al., 2017). Other Polish scientists underlined the importance of risk management in public project monitoring. Institutions implementing projects are obliged to carry out management control. It is necessary for project managers and unit managers to understand the importance of risk for achieving the objectives of the organization's projects and the potential benefits that can be obtained after its effective implementation (Kuczyńska, Nepelski, 2021).

In the context of hypothesis H2 'The areas of the project monitoring system are universal and can be used in other administration units', other researchers indicate many challenges related to the implementation of project monitoring models, including, for example, despite reforms, some public administrations, such as the Italian Public Administration, remain linked to a bureaucratic model, indicating the need for careful adaptation of project management models to the specific context of public administration (Tomo, 2018). Support for unblocking replication possibilities may be the collaboration between the public and private sectors can be improved through the use of project management, and a shift from traditional organizational setups to project-based operations can improve the quality of social services (Avny, 2022). Finally, the implementation of project monitoring tools can support public administration reforms, but the success of these reforms can be influenced by factors such as the duration of the relevant parliamentary term (Drahošová, Čajková, 2022). The model presented in this article should be subject to further research to confirm its relevance for use in central government administration. The research could be extended to identify further areas of development or redefinition of the model. The results could be achieved by conducting in-depth interviews with representatives of key system stakeholders. Consequently, the model presented in this article can evolve into a comprehensive system supporting broad project management in public administration. These are the pioneering studies in this field in Poland, representing the initial endeavor to create an integrated project management system within the entire Polish administration. Nevertheless, experienced public administration professionals highlight the ongoing, unmet need for developing the model in further yet unarticulated areas. Therefore, the next stage of research may be extended interviews with representatives of key stakeholder groups, e.g. a representative of the PMO, a representative of project managers and a representative of decision-making bodies. This represents a continuous improvement process, requiring adaptation to evolving legal, social, and economic requirements.

Acknowledgments

Special thanks to all the employees within the PMO domain in the central government administration in Poland, whose dedication made the research possible.

Disclosure statement

No potential conflict of interest was reported by the author.

Declaration of interest statement

The author reports there are no competing interests to declare.

References

1. Aaltonen, K., Kujala, J. (2015). Stakeholder dynamics during the project front-end: the case of nuclear waste repository projects. *Project Management Journal*, 46(6), 15-41. <https://doi.org/10.1002/pmj.21549>
2. Aleinikova, O., Kravchenko, S., Hurochkina, V., Zvonar, V., Brechko, O., Buryk, Z. (2020). Project Management Technologies in Public Administration. *Journal of Management Information and Decision Sciences*, 23(5), 564-576.
3. Ariyanti, V. (2023). A readiness assessment of an Indonesian pilot project: Case study Kedungputri, a premium irrigation area, Central Java. *Irrigation and Drainage*. <https://doi.org/10.1002/ird.2796>
4. Artto, K.A., Dietrich, P.H. (2007). Strategic Business Management through Multiple Projects. In: *The Wiley Guide to Managing Projects*. <https://doi.org/10.1002/9780470172391.ch7>
5. Artto, K., Martinsuo, M., Gemünden, H.G., Murtoaro, J. (2009). Foundations of program management: A bibliometric view. *International Journal of Project Management*, 27(1), 1-18. <https://doi.org/10.1016/j.ijproman.2007.10.007>
6. Avny, A. (2022). Public Administration in the Post-modern Era. *Journal of Economics & Management Research*, 1-6. [https://doi.org/10.47363/JESMR/2022\(3\)166](https://doi.org/10.47363/JESMR/2022(3)166)

7. Axelos. (2013). *Portfolio, Programme and Project Offices*. The Stationery Office.
8. Babbie, E. (2010). Practice of Social Research. *Practice of*, Vol. 54, Iss. 2. <https://www.worldcat.org/title/662584565>
9. Bertot, J., Estevez, E., Janowski, T. (2016). Universal and contextualized public services: Digital public service innovation framework. *Government Information Quarterly*, 33(2), 211-222. <https://doi.org/10.1016/J.GIQ.2016.05.004>
10. Bianchi, C., Nasi, G., Rivenbark, W.C. (2021). Implementing collaborative governance: models, experiences, and challenges. *Public Management Review*, 23(11), 1581-1589. <https://doi.org/10.1080/14719037.2021.1878777>
11. BiznesAlert (2020). *Tauron appreciated for its level of project management*. <https://biznesalert.pl/tauron-nagroda-zarzadzanie-energetyka/>
12. Blasco, A., Jung, O.S., Lakhani, K.R., Menietti, M. (2016). *Motivating Effort in Contributing to Public Goods Inside Organizations: Field Experimental Evidence*. <https://papers.ssrn.com/abstract=2769721>
13. Bukłaha, E., Trzeciak, M. (2023). HR controlling in project management - selected issues. *Scientific Papers of Silesian University of Technology Organization and Management*, 185.
14. CMMI (2010). *Capability Maturity Model Integration*. Software Engineering Institute Carnegie Mellon University. <https://resources.sei.cmu.edu/library/asset-view.cfm?assetid=9661>
15. Correia, A., Água, P.B. (2023). Innovation, strategy, and transformation frameworks for the modern enterprise. In: *Innovation, Strategy, and Transformation Frameworks for the Modern Enterprise*. <https://doi.org/10.4018/979-8-3693-0458-7>
16. Crawford, J.K. (2010). The Strategic Project Office. In: *The Strategic Project Office*. <https://doi.org/10.1201/b10153>
17. Crawford, L. (2004). Patterns of support for corporate delivery capabilities. *PMSA Global Knowledge*, 1-13.
18. De Chastelain Finnigan, K., Anzum, F., Rokne, J., Gavrilova, M.L. (2022). *Weighted Lexicon-based Sentiment Analysis for Women Career Traits in Information Technology*. Proceedings of 2022 IEEE 21st International Conference on Cognitive Informatics and Cognitive Computing, ICCI*CC 2022, 91-98. <https://doi.org/10.1109/ICCICC57084.2022.10101520>
19. Dick-Sagoe, C., Lee, K.Y., Odoom, D., Boateng, P.O. (2023). Stakeholder perceptions on causes and effects of public project failures in Ghana. *Humanities and Social Sciences Communications*, 10(1). <https://doi.org/10.1057/s41599-022-01497-7>
20. Dinsmore, P.C. (1999). *Winning in Business with Enterprise Project Management*. American Management Association.
21. Donovan, B. (2013). Policing the Agile Expressway. *Project Management Journal*, 2(1).
22. Drahošová, S., Čajková, A. (2022). *Stop bureaucracy reforms — case study in public administration in Slovakia*, 244-255. <https://doi.org/10.56889/HUHS2803>

23. du Toit, J. (2016). Can we augment web responses with telephonic responses to a graduate destination survey? *Assessment and Evaluation in Higher Education*, 41(4), 560-574. <https://doi.org/10.1080/02602938.2015.1033613>
24. Elmualim, A., Gilder, J. (2014). BIM: Innovation in design management, influence and challenges of implementation. *Architectural Engineering and Design Management*, 10(3-4), 183-199. <https://doi.org/10.1080/17452007.2013.821399>
25. Eskerod, P., Huemann, M., Savage, G. (2015). Project stakeholder management-past and present. *Project Management Journal*, 46(6), 6-14. <https://doi.org/10.1002/pmj.21555>
26. Fedchenko, E., Gusarova, L., Timkin, T., Gryzunova, N., Bilczak, M., Frumina, S. (2023). Methodology for an Audit of Institutional Projects in the Energy Sector. *Energies*, 16(8). <https://doi.org/10.3390/en16083535>
27. Freeman, R.E., Martin, K., Parmar, B. (2007). Stakeholder capitalism. *Journal of Business Ethics*. <https://doi.org/10.1007/s10551-007-9517-y>
28. Fujitsu (2020). *Client Challenges Taking Control of IT-Enabled Investments Project Management Expertise*.
29. García-Gutiérrez, F.M., Pino-Zavaleta, F., Romero-Robles, M.A., Patiño-Villena, A.F., Jauregui-Cornejo, A.S., Benites-Bullón, A., Gómez-Mendoza, A., Alarcon-Ruiz, C.A., Huapaya-Huertas, O. (2023). Self-reported perceptions and knowledge of telemedicine in medical students and professionals who enrolled in an online course in Peru. *BMC Medical Education*, 23(1). <https://doi.org/10.1186/s12909-023-04058-x>
30. Geldres-Weiss, V.V., Gambetta, N., Massa, N.P., Geldres-Weiss, S.L. (2021). Materiality Matrix Use in Aligning and Determining a Firm's Sustainable Business Model Archetype and Triple Bottom Line Impact on Stakeholders. *Sustainability*, Vol. 13, 13(3), 1065. <https://doi.org/10.3390/SU13031065>
31. Gerald, J., Lechter, T. (2012). Gantt charts revisited: A critical analysis of its roots and implications to the management of projects today. *International Journal of Managing Projects in Business*, 5(4), 578-594. <https://doi.org/10.1108/17538371211268889>
32. Greve, C., Ejersbo, N., Lægreid, P., Rykkja, L.H. (2020). Unpacking Nordic Administrative Reforms: Agile and Adaptive Governments. *International Journal of Public Administration*, 43(8), 697-710. <https://doi.org/10.1080/01900692.2019.1645688>
33. Gutiérrez, E., Magnusson, M. (2014). Dealing with legitimacy: A key challenge for Project Portfolio Management decision makers. *International Journal of Project Management*, 32(1), 30-39. <https://doi.org/10.1016/J.IJPROMAN.2013.01.002>
34. Haut, E.R., Kirby, J.P., Bailey, J.A., Phuong, J., Gavitt, B., Remick, K.N., Staudenmayer, K., Cannon, J.W., Price, M.A., Bulger, E.M., Arabian, S.S., Winchell, R. (2023). Developing a National Trauma Research Action Plan: Results from the trauma systems and informatics panel Delphi survey. *Journal of Trauma and Acute Care Surgery*, 94(4), 584-591. <https://doi.org/10.1097/TA.0000000000003867>
35. Heerkens, G. (2003). *How to manage projects*. RM.

36. Heldal, E., Cruz, J.R., Arnadottir, T., Tardencilla, A., Enarson, D.A. (1997). Successful management of a National Tuberculosis Programme under conditions of war. *International Journal of Tuberculosis and Lung Disease*, 1(1), 16-24.
37. Hosseinzadeh, K., Rafiei, H. (2019). Nursing Student Attitudes toward Euthanasia: A Cross-Sectional Study. *Nursing Ethics*, 26(2), 496-503. <https://doi.org/10.1177/0969733017718393>
38. IAASB (2013). *International Standard on Auditing*.
39. IIRC (2021). The international Integrated Reporting framework. *The International <IR> Framework*, 37.
40. Ika, L.A. (2012). Project Management for Development in Africa: Why Projects are Failing and What Can be Done about It. *Project Management Journal*, 43(4), 27-41. <https://doi.org/10.1002/PMJ.21281>
41. Ika, L.A., Hodgson, D. (2014). Learning from international development projects: Blending Critical Project Studies and Critical Development Studies. *International Journal of Project Management*, 32(7), 1182-1196. <https://doi.org/10.1016/J.IJPROMAN.2014.01.004>
42. Internacional Project Management Association. (2015). IPMA Competence Baseline. *Internacional Project Management Association*.
43. Janka, T., Szyborska, M., Kwiatek, K., Nocoń, M., Duma, J., Charchuła, P., Karpińska, A. (2020). *Recommendations for managing strategic projects*.
44. Jonas, D. (2010). Empowering project portfolio managers: How management involvement impacts project portfolio management performance. *International Journal of Project Management*, 28(8), 818-831. <https://doi.org/10.1016/J.IJPROMAN.2010.07.002>
45. Jorgensen, M., Welde, M., Halkjelsvik, T. (2023). Evaluation of Probabilistic Project Cost Estimates. *IEEE Transactions on Engineering Management*, 70(10), 3481-3496. <https://doi.org/10.1109/TEM.2021.3067050>
46. Joslin, B., Langman, C., Nishi, L., Ghossein, C. (2020). Assessing success in transitioning of young adults from pediatric to adult kidney practice. *BMC Nephrology*, 21(1). <https://doi.org/10.1186/s12882-019-1665-7>
47. Kaye, L.K., Darker, G.M., Rodriguez-Cuadrado, S., Wall, H.J., Malone, S.A. (2022). The Emoji Spatial Stroop Task: Exploring the impact of vertical positioning of emoji on emotional processing. *Computers in Human Behavior*, 132. <https://doi.org/10.1016/j.chb.2022.107267>
48. Khwaja, N., O'Brien, W.J., Martinez, M., Sankaran, B., O'Connor, J.T., Hale, W.B. (2018). Innovations in Project Delivery Method Selection Approach in the Texas Department of Transportation. *Journal of Management in Engineering*, 34(6). [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000645](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000645)
49. Killen, C.P., Hunt, R.A. (2010). Dynamic capability through project portfolio management in service and manufacturing industries. *International Journal of Managing Projects in Business*, 3(1), 157-169. <https://doi.org/10.1108/17538371011014062>

50. Ko, O.-Y., Paek, J.-H. (2008). Korea experience project management consortium on the U.S. Forces Korea Relocation Program. *Journal of Asian Architecture and Building Engineering*, 7(1), 85-92. <https://doi.org/10.3130/jaabe.7.85>
51. Kosieradzka, A., Janka, T. (2019). The New Approach to the Strategic Project Management in the Polish Public Administration. *Foundations of Management*. <https://doi.org/10.2478/fman-2019-0012>
52. Kuczyńska, E., Nepelski, M. (2021). Project Management in Public Administration. Risks and Challenges. *Internal Security*, 13(2), 23-24. <https://doi.org/10.5604/01.3001.0015.6555>
53. Kupi, M., McBride, K. (2021). Agile Development for Digital Government Services: Challenges and Success Factors. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, Vol. 12849, LNCS. https://doi.org/10.1007/978-3-030-82824-0_11
54. Lakanmaa, R.-L., Suominen, T., Ritmala-Castrén, M., Vahlberg, T., Leino-Kilpi, H. (2015). Basic competence of intensive care unit nurses: Cross-sectional survey study. *BioMed Research International*, <https://doi.org/10.1155/2015/536724>
55. Lechler, T.G., Thomas, J.L. (2015). Examining new product development project termination decision quality at the portfolio level: Consequences of dysfunctional executive advocacy. *International Journal of Project Management*, 33(7), 1452-1463. <https://doi.org/10.1016/J.IJROMAN.2015.04.001>
56. Lima, A., Fernandes, G., Machado, R.J. (2018). Mapping between PMI and OGC Artefacts for Project Portfolio Management. *9th International Conference on Intelligent Systems 2018: Theory, Research and Innovation in Applications, IS 2018 - Proceedings*, 754-762. <https://doi.org/10.1109/IS.2018.8710566>
57. Lundqvist, S. (2017). Are PMOs really that momentous for public authorities? *International Journal of Information Systems and Project Management*, 5(3), 45-64. <https://doi.org/10.12821/ijispm050303>
58. Lycett, M., Rassau, A., Danson, J. (2004). Programme management: A critical review. *International Journal of Project Management*, 22(4), 289-299. <https://doi.org/10.1016/j.ijproman.2003.06.001>
59. Lyudmila, P., Anzhela, H. (2022). Main directions for improving public administration mechanisms in Ukraine. *International Journal of Advanced and Applied Sciences*, 9(8), 41-48. <https://doi.org/10.21833/IJAAS.2022.08.005>
60. Ma, W., Hong, S., Reed, W.R., Duan, J., Luu, P. (2023). Yield effects of agricultural cooperative membership in developing countries: A meta-analysis. *Annals of Public and Cooperative Economics*. <https://doi.org/10.1111/apce.12411>
61. Marocco, M., Cacciaguerra, E., Garofolo, I. (2023). An operational framework for implementing digital systems in public administrations' processes in the design phase, 1-20. <https://doi.org/10.1080/17452007.2023.2187752>
62. Martinsuo, M. (2013). Project portfolio management in practice and in context.

- International Journal of Project Management*, 31(6), 794-803. <https://doi.org/10.1016/J.IJPROMAN.2012.10.013>
63. Martinsuo, M., Ahola, T. (2022). Multi-project management in inter-organizational contexts. *International Journal of Project Management*, 40(7), 813-826. <https://doi.org/10.1016/j.ijproman.2022.09.003>
64. Martinsuo, M., Hoverfält, P. (2018). Change program management: Toward a capability for managing value-oriented, integrated multi-project change in its context. *International Journal of Project Management*, 36(1), 134-146. <https://doi.org/10.1016/j.ijproman.2017.04.018>
65. Maylor, H. (1996). *Project management*. Pitman Publishing.
66. Mergel, I., Dickinson, H., Stenvall, J., Gasco, M. (2023). Implementing AI in the public sector. *Public Management Review*, 1-13. <https://doi.org/10.1080/14719037.2023.2231950>
67. Meyers, D.J., Filkins, M., Bangura, A.H., Sharma, R., Baruwal, A., Pande, S., Halliday, S., Schwarz, D., Schwarz, R.K., Maru, D.S.R. (2017). Management challenges in mHealth: Failures of a mobile community health worker surveillance programme in rural Nepal. *BMJ Innovations*, 3(1), 19-25. <https://doi.org/10.1136/bmjinnov-2015-000102>
68. Montenegro, T.M., Celente, A.L.I. (2016). The Public-Sector Auditing as an Accountability Instrument – A Case Study in the Brazilian Navy. *Revista de Gestão e Projetos*, 7(3), 29-47. <https://doi.org/10.5585/GEP.V7I3.345>
69. Mulder, L. (1997). The importance of a common project management method in the corporate environment. *R and D Management*, 27(3), 189-196. <https://doi.org/10.1111/1467-9310.00056>
70. Munns, A.K., Bjeirmi, B.F. (1996). The role of project management in achieving project success. *International Journal of Project Management*. [https://doi.org/10.1016/0263-7863\(95\)00057-7](https://doi.org/10.1016/0263-7863(95)00057-7)
71. Office Of Government Commerce (2009). *Managing Successful Projects With Prince2, Vol. 6, Iss. 10*.
72. Office Of Government Commerce (2011). *Management of portfolios*. AXELOS. [https://books.google.pl/books?hl=pl&lr=&id=JwvwHxnt9TEC&oi=fnd&pg=PP7&dq=management+of+portfolios&ots=oBzki5Y5kR&sig=M5fi3T2UasIpHDQcv1vS_zymFTY&redir_esc=y#v=onepage&q=management of portfolios&f=false](https://books.google.pl/books?hl=pl&lr=&id=JwvwHxnt9TEC&oi=fnd&pg=PP7&dq=management+of+portfolios&ots=oBzki5Y5kR&sig=M5fi3T2UasIpHDQcv1vS_zymFTY&redir_esc=y#v=onepage&q=management%20of%20portfolios&f=false)
73. Olander, S., Landin, A. (2005). Evaluation of stakeholder influence in the implementation of construction projects. *International Journal of Project Management*, 23(4), 321-328. <https://doi.org/10.1016/j.ijproman.2005.02.002>
74. Pellegrinelli, S. (2011). What's in a name: Project or programme? *International Journal of Project Management*, 29(2), 232-240. <https://doi.org/10.1016/J.IJPROMAN.2010.02.009>
75. Pinto, J.K. (1998). *Power and politics in project management*. Project Management Institute.
76. SRD Resolution, 206 (in Polish: “Uchwała Rady Ministrów w sprawie przyjęcia Strategii

- na rzecz Odpowiedzialnego Rozwoju do roku 2020 (z perspektywą do 2030 r.)” (2017). <http://prawo.sejm.gov.pl/isap.nsf/download.xsp/WMP20170000260/O/M20170260.pdf>
77. The Act on Government Administration Parts - Dz.U.2022.2512 (2022). <https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20220002512>
78. Priyanta, M., Zulkarnain, C.S.A. (2023). Sustainable Infrastructure Legal Policy in Indonesia: A National Strategic Project Approach for National Development. *Sriwijaya Law Review*, 7(1), 1-18. <https://doi.org/10.28946/slrev.Vol7.Iss1.1108>.pp1-18
79. Project Management Institute (2001). Management de projet un référentiel de connaissances. *AFNOR*, 8.
80. Project Management Institute (2008). Project Management Body of Knowledge (PMBOK® Guide). In: *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Fourth Edition*. <https://doi.org/10.1007/s13398-014-0173-7.2>
81. Project Management Institute (2013). *The Standard for Portfolio Management - Third Edition*. [www.PMI.org](http://www.pmi.org)
82. Project Management Institute (2014). *Project Management Institute Annual Report 2014*. <http://www.pmi.org/default.aspx>
83. Project Management Institute (2019, June). *Strefa PMI*. [https://doi.org/ISSN 2353-3137](https://doi.org/ISSN%202353-3137)
84. Radvanský, M., Lichner, I., Frank, K. (2022). Performance management of European Structural and Investment Funds—The case of Slovakia. *Public Money & Management*. <https://doi.org/10.1080/09540962.2022.2144542>
85. Raikou, N., Konstantopoulou, G. (2021). Tracing emerging adulthood on university students: the case of medicine school at a greek university. *European Journal of Social Sciences Studies*, 6(4), <https://doi.org/10.46827/EJSS.V6I4.1074>
86. Rose, K.H. (2013). A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Fifth Edition. *Project Management Journal*, 44(3), e1-e1. <https://doi.org/10.1002/pmj.21345>
87. Sukma, D.R., Hardianto, R., Studi Kehutanan, P., Kehutanan, F., Lancang Kuning, U. (2022). Perencanaan Wisata Air Terjun Aek Martua Dengan Konsep Media Digital. *Jurnal Karya Ilmiah Multidisiplin (JURKIM)*, 2(1), 36-41. <https://doi.org/10.31849/JURKIM.V2I1.9169>
88. Tomo, A. (2018). Bureaucracy, Post-Bureaucracy, or Anarchy? Evidence from the Italian Public Administration. *International Journal of Public Administration*, 42(6), 482-496. <https://doi.org/10.1080/01900692.2018.1485045>
89. Trocki, M., Gruzca, B. (2004). *Analiza interesariuszy*. Bizzare.
90. Trois, C., Weingaertner, D., Pasqualin, D., Maciel, E., Almeida, E., Silva, F., Tissot, H., Bona, L.C.E., Castilho, M., Didonet, M., Sunye, M. (2017). Transparency meets management: A monitoring and evaluating tool for governmental projects. *Proceedings of IEEE/ACS International Conference on Computer Systems and Applications, AICCSA, 2017-October*, 1429-1435. <https://doi.org/10.1109/AICCSA.2017.17>

91. Turner, R., Zolin, R. (2012). Forecasting success on large projects: Developing reliable scales to predict multiple perspectives by multiple stakeholders over multiple time frames. *Project Management Journal*, 43(5), 87-99. <https://doi.org/10.1002/pmj.21289>
92. Vargas, C., Brimblecombe, J., Allender, S., Whelan, J. (2023). Co-creation of health-enabling initiatives in food retail: academic perspectives. *BMC Public Health*, 23(1). <https://doi.org/10.1186/s12889-023-15771-z>
93. Vento, I. (2023). The consequences of the temporary employment of project managers for public innovation: An analysis of EU projects in Finland. *Public Money & Management*, 43(4), 349-356. <https://doi.org/10.1080/09540962.2021.1971868>
94. Villalobos, K., Ishino, F.A.M., McNeel, T.S., Williams, F. (2022). Examining the relationship of sociodemographic factors, neighborhood cohesion and abnormal sleep duration among U.S. foreign-born subpopulations in the National Health Interview Survey. *BMC Public Health*, 22(1). <https://doi.org/10.1186/s12889-022-13523-z>
95. Wanapaisan, S., Suwannasart, T., Methawachananont, A. (2013). An approach for monitoring software development using timesheet and project plan. *Lecture Notes in Engineering and Computer Science*, 2202, 511-515.
96. Wankel, C., DeFillippi, B. (2005). Educating managers through real world projects. In: *Research in management education and development*.
97. Wirtz, B.W., Müller, W.M. (2019). An integrated artificial intelligence framework for public management. *Public Management Review*, 21(7), 1076-1100. <https://doi.org/10.1080/14719037.2018.1549268>
98. Wolniak, R. (2022). Project Management Standards. *Scientific Papers of Silesian University of Technology Organization and Management*, 160, 639. <https://doi.org/10.29119/1641-3466.2022.160.41>
99. Wyskarski, M. (2022). Responsibilities of project managers. A text mining analysis of job advertisements. *Scientific Papers of Silesian University of Technology Organization and Management*, 161.
100. Young, M.M., Bullock, J.B., Leczy, J.D. (2019). Artificial Discretion as a Tool of Governance: A Framework for Understanding the Impact of Artificial Intelligence on Public Administration. *Perspectives on Public Management and Governance*, 2(4), 301-313. <https://doi.org/10.1093/PPMGOV/GVZ014>

Appendix

Table 2.
Questionnaire

No	Question	Possible answers
Q1	Have you participated in the management and/or monitoring of projects in the past 4 years?	yes / no
Q2	Have you utilized the Strategic Project Monitoring System, such as the MonAliZa system, MonAliZa Breakfasts, Strategic Project Monitoring Council meetings, periodic project reporting, project portfolio construction and management, or project management as?	Project manager / PMO employee / Project sponsor / Other role
Q3	How long have you been using the Strategic Project Monitoring System, such as the IT system MonAliZa, MonAliZa Breakfasts, Strategic Project Monitoring Council meetings, periodic project reporting, project portfolio construction and management, or project management?	Less than 1 year / 1-2 years / 2-3 years / more than 3 years
Q4	How frequently do you use the Strategic Project Monitoring System, such as the IT system MonAliZa, MonAliZa Breakfasts, Strategic Project Monitoring Council meetings, periodic project reporting, project portfolio construction and management, or project management?	once a year / once a quarter / once a month / many times during month
Q5	Please assess the following areas in terms of their usefulness and potential for enhancing the existing system by indicating the extent to which you agree with the statements below: The development of tools supporting project monitoring and management is crucial for enhancing the existing system, including the adaptation and advancement of the IT system MonAliZa to meet user and stakeholder expectations.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q6	The development of key stakeholder competencies is crucial for enhancing the existing system, including the provision of dedicated training for Project Leaders, individuals in PMO roles, and other stakeholders.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q7	The conscious construction and management of project portfolios is crucial for enhancing the existing system, particularly in the process of building project portfolios in the next budget perspective.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q8	Ensuring a cohesive vision and resources in program management is crucial for enhancing the existing system, such as defining program managers, establishing program structures, providing resources for projects within the program, and clearly communicating the purpose of the program's existence.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q9	In your opinion, should the strategic project monitoring system be supplemented with other areas not mentioned in the above question?	yes / no
Q10	Please assess the indicated areas below in terms of their potential for implementation in other administrative units where these areas have not been implemented yet, by indicating the extent to which you agree with the statements below: Project management procedures can be implemented.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q11	Project monitoring procedures can be implemented.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q12	A project monitoring council, as a decision-making body, can be established.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q13	IT tools supporting project management and monitoring, such as the MonAliZa system, can be implemented.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q14	Organizational units supporting project management and monitoring processes can be created.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree

Q15	A project list for implementation, i.e., project portfolio creation, can be developed.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q16	Procedures for creating and managing project portfolios can be implemented.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q17	Procedures for program management can be implemented.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q18	A training cycle for individuals involved in project management and monitoring processes can be implemented.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q19	A community of individuals involved in project management and monitoring processes can be established.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q20	Tailor-made IT tools supporting project management and monitoring, potentially involving external firms, can be developed and implemented.	Likert scale 1-7 1 - strongly disagree 7 - strongly agree
Q21	Your education	primary / vocational / secondary / higher
Q22	Do you have professional experience in administration?	Less than 1 year / 1-2 years / 3-5 years / 5-10 years / more than 10 years
Q23	Do you have overall professional experience?	Less than 1 year / 1-2 years / 3-5 years / 5-10 years / more than 10 years
Q24	Do you hold a certification/s in project management?	yes / no
Q25	Please rate your level of knowledge in project management on a scale of 1 to 5, where 1 is a beginner and 5 is an expert.	Likert scale 1-5 1 - beginner 5 - expert
Q26	Please rate your level of knowledge in project monitoring on a scale of 1 to 5, where 1 is a beginner and 5 is an expert.	Likert scale 1-5 1 - beginner 5 - expert

SMART CITY 4.0 DEVELOPMENT AS A SOLUTION FOR NETZERO ECONOMY

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Purpose: Research of determinands Smart City development in NETZero Economy environment.

Design/methodology/approach: This research shows the theory of 4T potentials, covering areas like technology, trust, talent and tolerance.

Findings: This study attempts to identify results of 4T implementation in chosen cities of GZM Metropolity to identify, acquire, and develop Smart City areas and possibly synergy.

Research limitations/implications: The author tries to identify by the research of local politics the innovative potential of a learning city and to diagnose the innovative potential of cities in the context of an energy efficiency, entrepreneurship, innovativeness of residents, and entities that support innovativeness. The problem is lack of implemented the politics of development in research area in the cities.

Practical implications: The author shows the examples that the local governments of selected cities are not prepared to use the synergies resulting from the possibilities offered by Smart City in the technology areas.

Social implications: The author shows the examples that the local governments of selected cities are not prepared to use the synergies resulting from the possibilities offered by Smart City in the Social like Trust, Trust or Tolerance.

Originality/value: Using 4T Theory in research because this study attempts to identify results of 4T implementation in chosen cities of GZM Metropolity to identify, acquire, and develop Smart City areas and possibly synergy in NETZero Economy development.

Keywords: city management, 4T capitals, smart city, NetZero, energy efficiency.

Category of the paper: Research Paper.

1. Introduction

Nowadays, concepts like Smart Cities and the Innovative NetZero Economy are extremely trendy. In the contemporary landscape, there is a growing demand to establish and integrate communities, including virtual ones, that unite people around common interests. Traditionally, communities were perceived as enduring, stable entities built on strong bonds. However, the evolving nature of work and the prevalence of disinformation reveal the necessity for fresh

approaches and tools. Presently, communities are formed for specific durations and adapt in line with their predefined goals and organizational objectives. They are fundamentally rooted in addressing a fundamental human need - the need for a sense of belonging.

Temporary engagement of teams comprising individuals with diverse perspectives, stemming from their roles in the organizational structure, expertise, or experience, unlocks the potential for synergy within the Circular Economy. This leads to the realization of the "2+2=5" effect, particularly in the context of multitasking. Communities structured in this manner can fully harness the inherent potential in interdisciplinary and cross-border collaboration. In essence, diversity unleashes synergy and paves the way for consensus, ultimately fostering the development of high-quality solutions that surpass expected outcomes.

Creativity can be described as the synergy resulting from the interaction of different talents, nurtured within a conducive environment (Kaufman, Beghetto, 2013). The creative development of cities must be accompanied by effective knowledge and talent development, as these form a social capital vital for building a creative community. The primary challenge for local governments is to anchor development in the creative contributions of residents. In a Smart City, often referred to as the "third generation", residents actively participate in co-creating their cities. In the case of the fourth generation, cities embrace sustainable development in collaboration with their residents. This transition is evident when social initiatives, such as equality, social inclusion, and cost-effective construction, play a significant role in urban projects (Korneluk et al., 2019; Makiela et al., 2022).

Every modern city undeniably constitutes a complex ecosystem, encompassing various elements that connect people, the environment, and technology. The distinguishing feature of rapidly evolving cities is their intelligent urban infrastructure, designed to serve both residents and administration effectively (Krzakiewicz, Cyfert, 2019). While creating Smart City 4.0, it's essential to consider the intricate web of interconnections that yield tangible benefits.

It can be posited that networking facilitates the optimization of synergy within the city. Consequently, one could hypothesize that only municipalities incorporating networking elements can genuinely progress towards sustainable development. In the final analysis, the author posits that the local governments of certain cities may not be adequately prepared to harness the synergies offered by Smart Cities.

In today's landscape, the prominence of Smart Cities and the Innovative NetZero Economy has skyrocketed, underscoring the need for a structured exploration of their intersection. This introduction aims to provide a comprehensive overview, encompassing the research questions, objectives, and hypotheses that will guide our inquiry.

Research Questions

The fundamental queries guiding this research include:

1. What are the key determinants influencing Smart City development within the NETZero Economy environment?

2. How can the 4T potentials (technology, trust, talent, and tolerance) be effectively implemented and leveraged in selected cities of the GZM Metropoly?
3. To what extent do local politics influence the innovative potential of a learning city in the context of energy efficiency, entrepreneurship, and innovativeness of residents?

Objectives

Building upon these questions, the overarching objectives of this study are as follows:

1. Identify and analyze the results of 4T implementation in chosen cities of the GZM Metropoly.
2. Acquire insights into the innovative potential of cities, focusing on energy efficiency, entrepreneurship, and innovativeness.
3. Diagnose the impact of local politics on the development of a learning city within the NETZero Economy context.

Hypotheses

Formulating hypotheses aids in structuring our expectations and predictions. Hence, this study posits the following hypotheses:

1. The effective implementation of 4T potentials in selected cities of the GZM Metropoly will lead to the identification and development of Smart City areas, fostering synergy.
2. Cities with proactive local politics will exhibit higher levels of innovative potential, specifically in the areas of energy efficiency, entrepreneurship, and resident innovativeness.
3. The lack of implemented development policies in the research areas of cities will be a significant impediment to realizing the full potential of Smart City initiatives.

By addressing these research questions, objectives, and hypotheses, this study aims to contribute a structured and focused analysis of Smart City 4.0 development within the challenging context of the NETZero Economy.

While the literature review captures the evolution of Smart Cities, a more comprehensive analysis could explore recent studies focusing on Smart City 4.0 and its connection to Economy 4.0 principles. The review should emphasize the latest advancements and challenges in smart city development, possibly incorporating recent case studies from diverse global contexts.

Moreover, the literature review briefly mentions the "network society" and "learning regions". A deeper exploration of these concepts and their specific implications for Smart City 4.0 would enrich the theoretical foundation. Additionally, referencing emerging technologies (such as the Internet of Things, artificial intelligence) and their role in shaping Smart Cities could enhance the review's relevance.

1. **Community Dynamics:** The text discusses the changing nature of communities but could benefit from an in-depth exploration of how these changes impact the dynamics of Smart Cities. Analyzing the role of community engagement, citizen participation, and inclusivity in Smart City development would provide practical insights.

2. **Circular Economy and Multitasking:** The "2+2=5" effect is intriguing but could be further elucidated with practical examples or case studies illustrating how multitasking within the Circular Economy leads to enhanced synergy.
3. **Technology Integration:** The intelligent urban infrastructure is crucial, but a more detailed analysis of the specific technologies (e.g., IoT, blockchain) and their integration into Smart City 4.0 could provide a clearer picture of the technological landscape.
4. **Governance Challenges:** The statement about local governments' unpreparedness warrants a deeper examination of the governance challenges hindering the effective implementation of Smart City initiatives. Case studies illustrating successful governance models would offer valuable insights.
5. **Global Perspectives:** The literature review focuses on theories and concepts; incorporating global perspectives and examples from diverse regions would enrich the analysis. Comparing Smart City initiatives in different continents could highlight variations in approaches and outcomes.
6. **Sustainability Metrics:** Discussing specific metrics for evaluating the sustainability of Smart City 4.0 initiatives would enhance the practical implications. For instance, metrics related to environmental impact, social equity, and economic resilience could be explored.
7. **Innovative Financing Models:** A brief exploration of innovative financing models for Smart City projects could be included in the practical implications, shedding light on how cities can overcome financial barriers.
8. **Policy Recommendations:** Concluding the practical implications with specific policy recommendations for local governments would provide a roadmap for addressing the identified challenges.

The conclusion should succinctly summarize the key findings, emphasize the significance of the study, and propose avenues for future research, ensuring a clear call to action for policymakers, researchers, and urban planners.

2. Literature review

The concept of the Smart City emerged as a result of research on intelligent urban environments (Caragliu, Del Bo, Nijkamp, 2006; Katz, Bradley, 2013). The term "smart city" is defined as a form of intellectual capacity related to innovative socio-technical and socio-economic development aspects. It is characterized by six dimensions (Toppeta, 2014): a smart economy, smart mobility, smart environment, smart people, smart life, and smart management. Komninos introduced three phases of smart city development: Smart City 1.0, Smart City 2.0, and Smart City 3.0 (Komninos, 2008; 2020). These phases are open-ended, as we are currently

witnessing the emergence of the next phase - Smart Cities 4.0, inspired by the principles of Economy 4.0 (Morawski, 2021).

- Smart City 1.0 signifies the early stage of smart city development. Modern technology adoption was primarily driven by ICT companies, often implementing solutions without considering their actual relevance or necessity for cities.
- Smart City 2.0 marks a phase where public administration plays a dominant role in the development of smart cities. Local authorities initiate the use of modern technologies with the aim of improving the quality of life for residents.
- Smart City 3.0 represents a new approach to smart city creation, observed since around 2015. Many progressive cities actively involve their residents in the development process. Local authorities focus on creating opportunities for residents to leverage their diverse potential, encouraging the use of modern technologies and promoting resident-led technological solutions. Smart City 3.0 aligns with the sharing economy trend and necessitates a shift in the mindset of municipal authorities, as well as a change in communication approaches.
- Smart City 4.0 represents a networked city consciously working toward sustainable development. This new level of smart city development leverages opportunities presented by sustainable development and extensive networking, drawing from concepts such as the network society and learning regions.

Research Gap

While the study provides valuable insights into the determinants of Smart City development within the NETZero Economy, it leaves certain research gaps that warrant further exploration. The identified limitations and implications suggest areas where future research can contribute to a more comprehensive understanding of the subject.

Research Limitations

The primary research limitation highlighted in the study is the lack of implemented development policies in the research areas of the cities. This limitation raises questions about the specific challenges and barriers faced by local governments in implementing Smart City initiatives. Understanding the reasons behind the absence of development policies is crucial for devising effective strategies and interventions.

Additional Research Questions

To address the research gap, future studies could delve into the following additional questions:

1. What are the specific challenges and obstacles faced by local governments in implementing Smart City development policies?
2. How do the political, economic, and social contexts of cities influence their readiness to harness the synergies offered by Smart Cities?
3. Are there common patterns or differences in the preparedness of cities within the GZM Metropolis, and what factors contribute to these variations?

Expanding the literature review to include studies that specifically focus on the challenges of policy implementation in Smart City development would contribute to a more nuanced understanding of the field. Moreover, incorporating research on the political, economic, and social determinants of Smart City readiness can enrich the theoretical framework.

In conclusion, while the current study lays a foundation for understanding Smart City development in the NETZero Economy, further research is needed to address the identified research gap. By focusing on policy implementation challenges, socio-political contexts, and variations within the GZM Metropoly, future studies can contribute valuable insights to the evolving field of Smart Cities. Additionally, expanding the literature review to include the suggested topics and referencing the relevant literature examples can enhance the theoretical framework of the study.

In the realm of smart city development, theories like the network society and the concept of learning regions play a significant role. Major urban areas and "networked" technopoles hold a substantial economic, cultural, and political advantage in adapting to ongoing changes. Cities must strategize to attract and retain entities driving smart growth, including highly qualified residents, knowledge-based institutions, innovative enterprises, and supportive investors. Additionally, cities need to enhance the quality of life for diverse social groups and continuously assess how changes in quality of life relate to their available resources.

In the realm of urban development, the Smart City concept can find support in various theories, including the concept of a network society and the idea of a learning region (Komninos, 2020). Metropolises and networked technopoles possess significant economic, cultural, and political advantages over other regions that are undergoing similar transformations (Jones, 2012). The primary challenge for cities, which are dynamic and evolving entities, lies in developing strategies that can attract and retain entities that drive intelligent growth within the city. These entities encompass highly qualified residents with a rich knowledge base, institutions and enterprises that generate and apply knowledge, investors who introduce innovative economic models, and visitors who foster personal connections between the city's community and its environment (Makiela et al., 2021).

Cities committed to smart development also confront the task of enhancing the quality of life for diverse social groups. It's essential to continuously evaluate the correlation between changes in the quality of life and the potential offered by the 4T resources (Florida, 2012; Jourdan, 2008). Florida examined synergistic effects in a regional development model, where selected indicators included the "tolerance" component, represented by the Gay index, Bohemia index, Melting-pot index, and Coolness index. For the "talent" component, he considered indicators such as the population with at least a bachelor's degree (BA), the population of super-creative core classes, and individuals engaged in creative professions. The "technology" component included the Tech pole index. His research suggests that a combination of factors related to a tolerant community, creative professions, and a high level of technological development can energize city development. Metropolises that excel in these four components,

characterized by trust, tolerance, talent, and technology, attract highly skilled and creative professionals, individuals from the world of culture and art, as well as investors. Consequently, these places have emerged as the most rapidly developing cities, adapting to the swiftly changing reality.

2.1. Smart City synergies

Synergy represents the positive effects arising from the interaction of various factors, with the resulting outcome surpassing the combined effect of individual efforts. To illustrate synergy, one can think of the collaboration or interaction of two or more factors or forces in a way that amplifies their combined impact beyond what each could achieve individually. In terms of people, synergy denotes the collaborative interaction of groups that generates a heightened cumulative effect compared to the separate efforts of these groups. Beyond synergy, the concept of synergism, described in the literature (Lenartowicz, 2017), exists. Synergy characterizes the effects of action, while synergism constitutes a theoretical approach to this phenomenon within the realm of science. Lenartowicz suggests that synergism is "a new way of looking at the world and humanity within it"; it serves as a generalization of the concept of synergy, complete with a theoretical foundation and a universal scientific methodology. Its subject matter encompasses the principles of self-organization in the world.

Synergy can pertain to the spatial organization of cities, shaping the spatial order of cities and metropolises, creating an organized arrangement of components that form a harmonious whole. Additionally, synergy can extend to the conduct of social dialogues aimed at implementing planning and investment initiatives within cities. Activating this "lever" requires conscious leadership. As Bieńkowski, a researcher, has noted in his scientific work (Bieńkowski, 1945), the importance of achieving the goals of an institution and the deep and sustained involvement of each participant - be it a member of an organized community, a resident, or an entrepreneur - in achieving these goals underscores the significance of leadership styles and management techniques. Therefore, it can be posited that the development of a city primarily depends on its managers, but not solely on them.

Synergy, which refers to the positive effects generated by the interaction of various factors, is crucial in achieving outcomes greater than the sum of individual efforts. It is particularly relevant in city planning and urban development. The term "synergism" encompasses a theoretical approach to the phenomenon of synergy and the laws of self-organization in the world.

Synergy in cities can manifest in the form of spatial organization and the conduct of social dialogues to implement planning and investment initiatives. It requires conscious leadership and collaboration. Networking is a critical tool for achieving economic and investment goals, especially with regard to sustainability. The Smart City concept aligns with global demographic trends, urbanization, and sustainability efforts, creating space for creative problem-solving and

social experimentation. To build Smart Cities, challenges must be defined, priorities established, and a strategy focusing on creativity, innovation, and flexibility must be adopted.

In unifying the Smart City concept, six key areas have been identified, and cities aspiring to be smart should refer to and develop these areas as the main networking processes.

2.2. Smart City Networking

Networking, as a tool for creating synergy, is currently the most effective method for achieving specific economic or investment objectives, with a strong emphasis on the natural environment and its impact. The support system for networking includes various elements such as the ongoing drive for innovation, the implementation of the Smart City concept, the fourth industrial revolution, and the Digital Economy (Borowiecki et al., 2021; Kinelski, 2019; Makięła, 2015).

Numerous organizations, not limited to municipal authorities and citizens, play a role in the development of cities. Non-profit organizations are active contributors to social life and play a substantial role in a networked society. They bring together volunteers who share common values and ideals. The Smart City concept responds to global demographic trends, urbanization, and the pursuit of sustainable development (Zygiaris, 2013). Demographic shifts, climate change, and disruptions in the world economy have prompted cities to create opportunities for creative social experiments and the resolution of modern-day challenges (Korneluk et al., 2019).

To establish so-called "Smart Cities", it is essential to begin by identifying challenges and defining priorities for their optimal solutions (Fojud, 2022; Zygiaris, 2013). While the term "Smart City" has multiple interpretations in the literature, most researchers associate it with a city that adopts a development strategy centered on creativity, openness to innovation, and adaptability to rapidly changing external and internal conditions (Giffinger, 2007). The Smart City concept represents an innovative approach to modernizing and networking contemporary cities, posing challenges for urban planners, regional authorities, local government officials, and residents (Prokopowicz, 2016). Discussions about the definition of Smart Cities encompass not only formal aspects but also the integration of new technologies to create sustainable urban environments (Angoneze-Grela, 2021).

Researchers generally concur that fostering networking and leveraging synergies are crucial components of the Smart City concept. To standardize the notion of a Smart City, four key level of developing have been identified. Cities aspiring to be "smart" should refer to and develop these areas as the primary networking processes, as depicted in Figure 1.

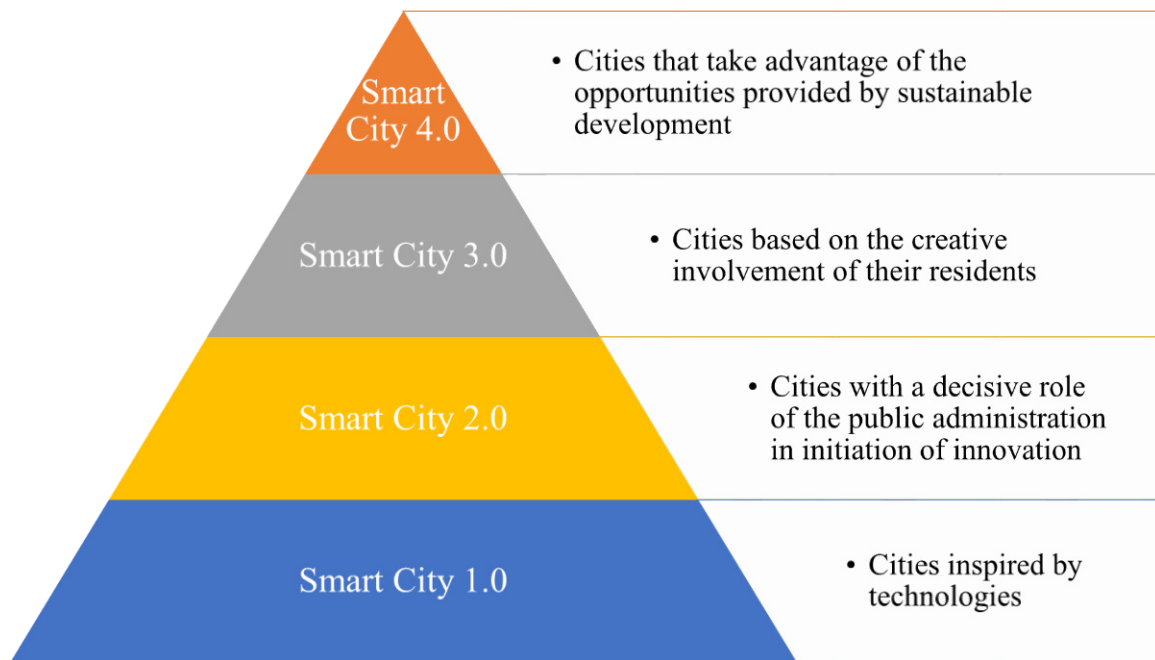


Figure 1. Levels of development of smart cities.

Source: Prepared by the author based on (Korneluk et al., 2019; Makiela, 2015; Makiela, 2014).

To correctly grasp the Smart City concept, it is essential to link it with innovation, not solely technology. However, in the processes of managing smart cities, emerging technologies play a pivotal role, aiding municipal authorities in addressing the challenges of a modern society marked by a growing urban population and escalating demands for digitization (Muangmee et al., 2021; Mucha-Kuś et al., 2021; Przybyłowski, 2017).

In addition to advanced technologies, the significance of intangible assets is on the rise, encompassing technology, talent, tolerance, and trust. The Smart City concept rests on four core pillars - the 4T potentials: Technology, Talent, Tolerance, and Trust, wherein a city's progress shapes its intelligence, entrepreneurship, and innovation (Stuss, 2021).

The active participation of the 4T elements in smart city management stands as a determinant of residents' quality of life and the city's competitive standing in the metropolitan landscape. Apart from technology's role in supporting development, other factors are of paramount importance in achieving sustainable growth:

1. Tolerance: The management of diversity and tolerance is a fascinating area within the realm of management science. Tolerance allows for a nonjudgmental acceptance of individuals, appreciating their unique characteristics, including age, origin, race, and sexual orientation (Mor Barak, 2014). The concept of diversity management initially focused on equal opportunities for ethnic and social minorities and then expanded to encompass equal treatment in employment, as well as interactions with customers, service recipients, and various social groups. A city that fosters openness and tolerance is better positioned for development and a higher level of social inclusion compared to one lacking these attributes.

2. **Talent:** Knowledge management forms the foundation of modern organizational management. Whether examining the market performance of large global or local organizations, their strategies, development directions, product offerings, and marketing, knowledge emerges as a determining factor in contemporary thinking. According to Morawski's research on enterprises (Morawski, 2021), the "suppliers" of intellectual capital are creative residents, managed through special programs and methods rooted in the concept of human capital within the city as an organization. Depending on their objectives and personnel programs, these individuals are identified as talented artists, creative leaders, dedicated volunteers, and more. Continuous, comprehensive innovation and creativity development and the integration of key residents into the city are particularly critical.
3. **Trust:** The level of risk in cities and regions is on the rise, especially in developing countries where urban development may lack proper organization. Therefore, new technologies present an opportunity to enhance urban safety. An increasing number of cities have implemented ICT-based systems to bolster citizen security, with video surveillance systems being a primary example.

Cities are transitioning from their traditional urban characteristics to embrace innovative 'green', 'smart', and 'open' approaches, striving to achieve environmental and social sustainability (Zygiaris, 2013). To correctly grasp the Smart City concept, it is essential to link it with innovation, not solely technology. However, in the processes of managing smart cities, emerging technologies play a pivotal role, aiding municipal authorities in addressing the challenges of a modern society marked by a growing urban population and escalating demands for digitization (Muangmee et al., 2021; Mucha-Kuś et al., 2021; Przybyłowski, 2017).

2.3. NETZero Economy and synergies

Within the context of a Smart City, the Circular Economy concept emerges as a central focus, representing a significant shift towards urban living that is more sustainable and resource-efficient. Smart City endeavors embrace the principles of the Circular Economy, ensuring that resources are used effectively, and waste is minimized through various strategies and technological advancements. This not only contributes to environmental sustainability but also aligns with the overarching objectives of a Smart City, which prioritize innovation and efficiency.

The relationship between Smart City and Circular Economy initiatives is closely intertwined, with the former creating an environment conducive to the latter's growth. The Smart City framework incorporates cutting-edge technologies, data-driven solutions, and advanced infrastructure to facilitate the circular flow of resources. It emphasizes designing products and materials with reuse, recycling, and longevity in mind, while promoting more sustainable consumption practices. In this context, the Circular Economy principles are deeply embedded within the Smart City framework. Resources are conserved, waste is minimized,

and materials are repurposed, ultimately reducing the environmental impact of urban living. Innovative technologies, such as Internet of Things (IoT) sensors, data analytics, and smart waste management systems, play a critical role in optimizing resource usage and enhancing the overall efficiency of city operations.

The synergy between the Circular Economy and Smart City principles not only supports environmental sustainability but also enhances the quality of life for city residents. It fosters a more efficient and resilient urban ecosystem, which, in turn, attracts forward-thinking organizations and individuals. Moreover, the collaborative and inclusive nature of a Smart City encourages active community participation and the development of innovative solutions to further the goals of the Circular Economy.

In summary, the Smart City environment provides an ideal foundation for the integration of Circular Economy principles. By incorporating resource efficiency, waste reduction, and sustainability into its core framework, the Smart City sets the stage for a more resilient, innovative, and environmentally friendly urban landscape, all while enhancing the well-being of its residents.

3. Smart City and Circular Economy in decarbonisation processes – research process

This research primarily revolves around the examination of local policies that encompass the attributes linked to the 4T capitals within the context of decarbonization and the NetZero initiative. These attributes are evaluated in two key contexts: diagnostic provisions, which provide insight into the current state of affairs, and the content that shapes the envisioned future of the city, with a strong emphasis on reducing carbon emissions and achieving a NetZero status.

The main objective of this study is to assess the innovative potential and the ability to create synergy among a group of selected cities located within a large metropolitan area. This assessment is carried out within the framework of the Smart City concept and the 4T capitals. This approach is closely aligned with the overarching goal of decarbonization, which aims to reduce the carbon footprint and ultimately reach a state of NetZero emissions.

The pursuit of synergy primarily involves city authorities seeking novel models and tools to promote sustainable development. This effort aims to improve the accessibility of municipal services and amenities for residents while simultaneously enhancing their impact on the future trajectory of their cities. All of this contributes to the goals of decarbonization and achieving NetZero status.

At its core, this study aims to uncover how the governing bodies of the selected cities integrate the concepts of Smart City, 4T capitals, decarbonization, and NetZero goals into their local policies. The research methodology includes surveys of residents and municipal employees, as well as a comprehensive analysis of local documents.

Following Creswell's research methodology (Creswell, 2013), the following research problems were formulated:

- Identifying the innovative potential of a learning city and diagnosing the innovative potential of cities in terms of entrepreneurship, the innovativeness of residents, and entities that support innovativeness.
- Identifying the outcomes of synergy in the GZM areas.
- Identifying, acquiring, and developing Smart City areas.

The research process is illustrated in Figure 2.

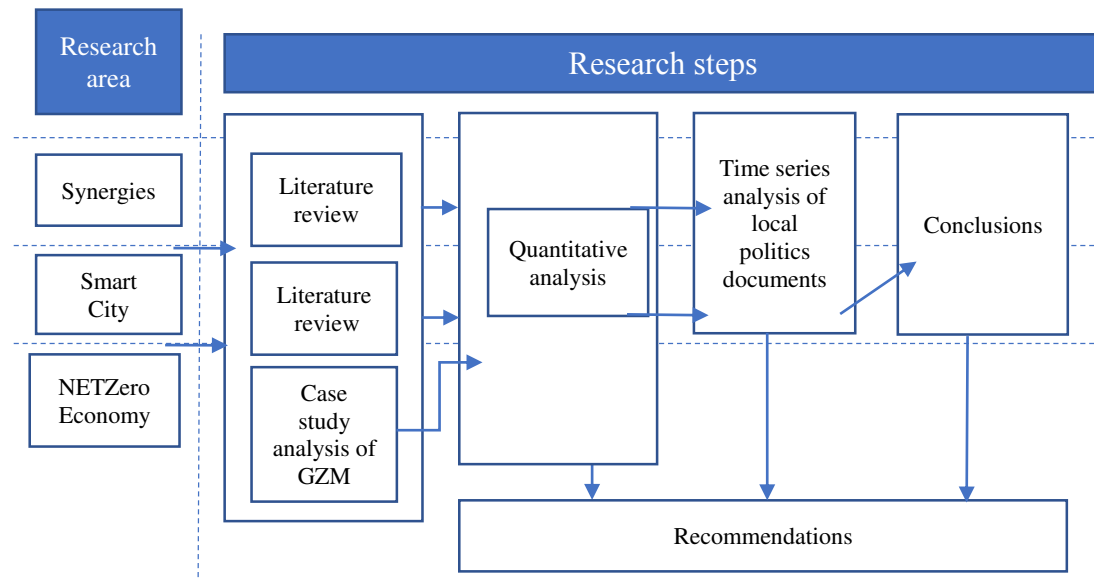


Figure 2. Research process.

Source: Prepared by the author.

For certain researchers, the utilization of information and communication technologies (ICT) in city development and management stands as a pivotal element in shaping smart cities (Toppeta, 2014). However, it's important to bear in mind that the concept of 4T capitals offers more extensive possibilities and effectiveness than merely relying on modern technologies.

The perspective being discussed underscores the significance of pursuing a long-term development policy, particularly one that brings about strategic changes through active participation in decision-making processes by city stakeholders. Within the cities of the Metropolis GZM, which were examined as part of this research project, there exists a growing and intricate system of local documents, including strategic, programmatic, design, and analytical documents. The primary goal of this study is to acknowledge the importance of the Smart City concept and the 4T concept in shaping development policies and city management.

The fundamental research method employed to characterize and assess the development policies of selected GZM cities within the context of 4T capitals and the Smart City concept involves analyzing source materials, primarily in the form of strategic and programmatic documents from individual municipalities. Supplementary methods encompass interviews with local officials and participant observation, where the study author actively engaged in the development processes of some of the documents under analysis.

The study primarily relies on the analysis of local strategic documents, with urban development strategies being the primary focus of the analysis, along with local or communal revitalization programs and collaboration initiatives with non-governmental organizations (NGOs) as additional analytical documents. These document types were chosen due to their comprehensive nature, long-term perspective, and, most importantly, their central role within local planning systems. Each type of document considered aims to activate local entities, particularly by leveraging and enhancing the values embedded in the 4T concept.

4. Results of the research local governments documentation

A total of 40 local policies underwent thorough examination. The primary aim was to determine whether the local governments of the chosen cities are adequately prepared to harness the synergies arising from the opportunities offered by Smart City initiatives. Cities must take a forward-thinking approach and articulate their strategies in dedicated local documents. The emergence of Smart City 4.0 is intricately linked with successive industrial revolutions characterized by robotics, artificial intelligence, nanotechnology, the Internet of Things, and autonomous vehicles. These profound technological shifts (Rutten, Gelissen, 2008; Saługa, 2021) bear significant social and economic implications for cities and the environment, aligning with the principles of sustainable development that set high standards for residents (Kinelski et al., 2021).

The concept of a Smart City, as an innovative, entrepreneurial, attractive, and competitive urban environment that nurtures creative individuals, reflects a prevailing research trend. This trend suggests that knowledge is the most potent resource driving economic development, with innovation, stemming from knowledge, serving as the primary engine for growth and economic progress (Bartkowiak et al., 2019; Krzakiewicz, Bartkowiak, 2021). The implementation of innovations leads to modernization, increased efficiency, competitiveness, and subsequently, greater income generation. Analyzing the conditions and advantages of a pro-innovative city development strategy necessitates a comprehensive understanding of the innovation concept, extending beyond the scope of urban research.

Effective city and municipal project management, known as smart management, often relies on available tools, notably information technology (IT). This approach entails the utilization of tools that expedite the diagnosis and achievement of objectives more efficiently. Local authorities can enhance security through ICT systems, thereby fostering safer, more sustainable, and prosperous cities. Collaboration between experts from various disciplines, along with the right partnerships, is crucial to accumulate the requisite experience.

The primary focus of this research centers on the analysis of local policies that encompass provisions characterizing the 4T capitals. These provisions are examined within two key contexts: diagnostic provisions, which offer insight into the existing state of affairs, and the content shaping the desired future of the city, typically included in implementation visions, goals, or project initiatives. This dual perspective enables the creation of a comprehensive overview by considering both the diagnostic aspects and the elements that mold the city's intended future. The indicators associated with this subject are presented in Table 1.

Table 1.

Synthesis of direct reference to 4T capitals in development strategies of selected cities of the Metropolis GZM

City	Smart City 4T Capitals - areas of development			
	Talent	Tolerance	Technology	Trust
Mikołów	High Level	Medium Level	High Level	High Level
Siemianowice-Śląskie	Medium Level	Low Level	High Level	Low Level
Pyskowice	Medium Level	Low Level	High Level	Low Level
Dąbrowa Górnicza	Medium Level	Low Level	Medium Level	Low Level
Gliwice	Low Level	Low Level	High Level	Low Level

The conclusions derived from the aforementioned compilation can be approached from both subjective and objective perspectives. When considering the subjective approach, it becomes possible to create a ranking of the analyzed cities. In this ranking, Mikołów claimed the top spot, followed by Siemianowice Śląskie and Pyskowice, which were classified at the same level. Dąbrowa Górnicza secured the subsequent position, and the ranking concluded with Gliwice. It's important to note that this assessment primarily focused on strategy documents.

Since these documents were not created according to uniform guidelines, variations in assessments were also influenced by the differing processes of document formulation and the adoption of specific methodologies. Consequently, these variations extended to the level of detail and the length of the documents. For instance, Mikołów's strategic document was notably comprehensive, spanning 238 pages. In contrast, strategic documents from Siemianowice Śląskie and Gliwice consisted of approximately 50 pages and featured a more concise diagnosis or summarized conclusions from the diagnosis, instead of detailed descriptions.

5. Conclusions

The outcomes of the analyzed policies underscore a notable gap in the readiness of local governments within the chosen cities to effectively capitalize on the synergies presented by Smart City initiatives. While there have been commendable efforts towards enhancing residents' overall comfort and satisfaction, there exists a critical need to extend this approach to encompass other stakeholders within the municipality.

In the context of addressing the research questions posed earlier, it is evident that the identified research gap concerning the innovative potential of a learning city and the impact of local politics on energy efficiency, entrepreneurship, and innovativeness has been substantiated. The lack of implemented development policies in the research areas of cities emerges as a significant impediment to realizing the full potential of Smart City initiatives. Consequently, the research questions pertaining to the determinants of Smart City development in the NETZero Economy environment, the effective implementation of 4T potentials in selected cities of the GZM Metropoly, and the influence of local politics on the innovative potential of a learning city have been addressed and substantiated through the findings. Determinants of Smart City development within the NETZero Economy environment: The study's outcomes reveal a gap in the innovative potential of a learning city, indicating a need for more comprehensive development policies in the researched areas. Effective implementation of 4T potentials in selected cities of the GZM Metropoly: The lack of synergy in the analyzed cities, attributed to the absence of implemented development policies, confirms the challenges in effectively implementing the 4T potentials. Influence of local politics on the innovative potential of a learning city: The identified gap in development policies underscores the significant influence of local politics on energy efficiency, entrepreneurship, and innovativeness, emphasizing the need for more proactive political engagement.

In addition to the research questions, the study's hypotheses have been thoroughly examined and validated through the findings.

1. The effective implementation of 4T potentials in selected cities of the GZM Metropoly will lead to the identification and development of Smart City areas, fostering synergy. The research substantiates this hypothesis by showcasing the existing gap in implementing development policies, indicating a lack of synergy in the analyzed cities.
2. Cities with proactive local politics will exhibit higher levels of innovative potential, specifically in the areas of energy efficiency, entrepreneurship, and resident innovativeness. The study's findings support this hypothesis by highlighting the lack of implemented development policies in the research areas of cities, underscoring the influence of local politics as a significant impediment.

3. The lack of implemented development policies in the research areas of cities will be a significant impediment to realizing the full potential of Smart City initiatives. This hypothesis is strongly supported by the research outcomes, demonstrating a clear association between the absence of development policies and the unpreparedness of local governments to leverage the possibilities offered by Smart City initiatives.

A pivotal aspect of the development process, as highlighted in response to the identified research gaps, is the reliance on a competent and skilled workforce with a modern mindset and a commitment to growth. Empowering employees with suitable tools and work flexibility is identified as vital for maximizing their expertise, addressing the lack of preparedness in implementing the politics of development in the cities under study. The interconnected networks, both in terms of socio-economic and environmental-spatial dimensions, emerge as crucial elements for societal progress and efficient management, substantiating the importance of talent, tolerance, technology, and trust in Smart City development.

As part of the research limitations, it is acknowledged that the lack of consistent references to Smart City and 4T in analyzed documents from Polish municipalities has shaped the conclusion. This limitation also contributes to the proposal for further research. To enhance the understanding of Smart City concepts and 4T capitals, a suggested avenue for future research involves an indirect analysis focused on the 4T capitals through factors and provisions that specify and elaborate on them. In the pursuit of NetZero objectives, the research highlights the multidimensional nature of further exploration. This includes an in-depth examination of strategic documents, investigation into revitalization and collaboration programs with non-governmental organizations, and addressing challenges in talent management within the public sector. The senior management's active support for talent identification initiatives is emphasized as crucial for competitiveness with the private sector, aligning with the broader research objectives. A critical factor in the success of resident engagement and the realization of synergistic effects lies in fostering a civil society within the community involved in the project. Direct interactions among individuals who share common values, trust each other, and exhibit a high level of tolerance are identified as essential components. These interactions enhance citizens' awareness of their rights and responsibilities, actively participating in shaping their immediate and broader surroundings. The engagement of civil society is recognized as integral to the synergy of management, design, construction, and user activities.

While technology plays a prominent role in the development goals of the analyzed cities, the identified gap in addressing issues related to trust and tolerance suggests a need for a more comprehensive approach. The lack of correlation between the extent to which the surveyed municipalities address the 4T aspects and their size, character, or potential indicates a complex challenge in translating Smart City concepts into operational documents. Given the current geopolitical landscape, the research proposes an additional area of exploration focusing on security. The intricate link between security and trust emerges as a crucial element in the Smart City equation, further underscoring the importance of trust and security in the pursuit of Smart

City and NetZero objectives. Trust and security are recognized as pivotal considerations for the success of Smart City initiatives in the evolving urban landscape.

In summary, the identified research gaps have been effectively addressed and substantiated through the study's findings, providing valuable insights into the challenges and opportunities for Smart City development within the NETZero Economy context. The hypotheses formulated at the outset of the research have been rigorously examined and confirmed, contributing to a more comprehensive understanding of the factors influencing Smart City initiatives in the analyzed cities. The research has not only filled the existing research gap but also paved the way for future investigations into the dynamic and evolving landscape of Smart City development.

References

1. Angoneze-Grela, E. (2021). Porto alegre sustainable innovation zone – The strategy of smart city development as exemplified by the Brazilian city in relation to poznań (Poland). *Space&FORM*, 48. Szczecin, 105-128.
2. Azkuna, I. (2012). *Smart Cities Study: International study on the situation of ICT, innovation and Knowledge in cities*. The Committee of Digital and Knowledge based Cities of UCLG, Bilbao (Innovation and Knowledge in cities).
3. Bartkowiak, P., Rutkowski, I.P., Bartkowiak, A. (2019). A model approach to the maturity and the level of risk in the product innovation process. *Studia i Prace WNEiZ*, 55. Szczecin, 129-142.
4. Bieńkowski, S. (1945). *Psychologia kierownictwa, Vol. I*. Kraków: Instytut Naukowy Organizacji i Kierownictwa.
5. Borowiecki, R., Siuta-tokarska, B., Maroń, J., Suder, M., Thier, A., Żmija, K. (2021). Developing digital economy and society in the light of the issue of digital convergence of the markets in the European Union countries. *Energies*, 14(9).
6. Caragliu, A., Del Bo, C., Nijkamp, A. (2006). *Smart cities in Europe*. Amsterdam University, Faculty of Economics, Business Administration and Econometrics.
7. Creswell, J. (2013). *Projektowanie badań naukowych. Metody jakościowe, ilościowe i mieszane*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
8. Florida, R. (2012). *The rise of the creative class. Richard Florida – Revisited*. Toronto: University of Toronto - Rotman School of Management.
9. Fojud, A. (2022). *Dlaczego smart city warto tłumaczyć jako użyteczne miasto?* <http://smartcityforum.pl/artykul/dlaczego-smart-city-warto-tlumaczyc-jako-uzyteczne-miasto/>, 26.08.2022.

10. Giffinger, R. (2007). Smart cities Ranking of European medium-sized cities. *Urban and Mobility Services, Vol. 16, Issue October*. Vienna: Research Institute for Housing.
11. Han, J. (2019). *Research on Talent Agglomeration in the Background of Knowledge Economy*. Fourth International Conference on Economic and Business Management (FEBM 2019). Dordrecht: Atlantis Press, 237-242.
12. Jones, D.S. (2012). *Masters of the Universe: Hayek, Friedman, and the birth of neoliberal politics*. Princeton University Press, 418.
13. Jourdan, S. (2008). *Richard Florida, Cities and the creative class. Méditerranée*. New York/London: Routledge, 198.
14. Katz, B., Bradley, J. (2013). *The Metropolitan Revolution: How Cities and Metros Are Fixing Our Broken Politics and Fragile Economy*. Washington, D.C.: Brooking Institution Press.
15. Kaufman, J.C., Beghetto, R.A. (2013). Do People recognize the four Cs? Examining layperson conceptions of creativity. *Psychology of Aesthetics, Creativity, and the Arts, APA, 7(3)*. Washington D.C., 229-236.
16. Kinelski, G. (2019). *Competitiveness and Efficiency Management Through Cognitive Technologies in the Digital Economy*. Toruń: Adam Marszałek.
17. Kinelski, G., Stęchły, J., Sienicki, A., Czornik, K., Borkowski, P. (2021). Application of smart technologies in metropolis GZM to reduce harmful emissions in district heating systems. *Energies, 14(22)*. Basel.
18. Komninos, N. (2008). Intelligent cities and globalisation of innovation networks. In: *Intelligent Cities and Globalisation of Innovation Networks*.
19. Komninos, N. (2020). *Smart Cities and Connected Intelligence Platforms, Ecosystems and Network Effects*. London: Routledge Taylor Francis Group.
20. Korneluk, K., Bielawska, M., Zygadło, S., Dominiak, B., Kruczek, A. (2019). *Human Smart City Przewodnik dla samorządów*. Warszawa: ThinkIt Consulting Sp. z o.o., Ministerstwo Inwestycji i Rozwoju, 8-9.
21. Krzakiewicz, K., Bartkowiak, P. (2021). *Imitation as a Competitive Strategy*. Proceedings of the International Scientific Conference Hradec Economic Days 2021, Hradec Kralove, 11.
22. Krzakiewicz, K., Cyfert, S. (2019). Strategic orientations of the organization - entrepreneurial, market and organizational learning. *Management, Sciendo, 23(1)*.
23. Lee, J.H., Hancock, M.G., Hu, M.-C. (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change, 89*, 80-99.
24. Lenartowicz, K. (2017). Synergetyka a planowanie urbanistyczne i projektowanie architektoniczne. *Budownictwo i Architektura, 16(1)*. Lublin.

25. Makiela, Z.J., Stuss, M.M., Mucha-Kuś, K., Kinelski, G., Budziński, M., Michałek, J. (2022). Smart City 4.0: Sustainable Urban Development in the Metropolis GZM. *Sustainability, Vol. 14(6)*. Basel, 3516.
26. Makiela, Z. (2015). *Entrepreneurship and Innovation as a Factor in the Competitiveness of Local Authority Units. Development, Innovation and Business Potential in View of Economic Changes*. Kraków: Foundation of the Cracow University of Economics, 47-55.
27. Makiela, Z., Stuss, M.M., Borowiecki, R. (2021). Sustainability, technology and innovation 4.0. In: *Sustainability, Technology and Innovation 4.0*. London: Routledge.
28. Morawski, M. (2021). *Gospodarka 4.0 na przykładzie przedsiębiorstw w Polsce*. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej.
29. Muangmee, C., Dacko-Pikiewicz, Z., Meekaewkunchorn, N., Kassakorn, N., Khalid, B. (2021). Green entrepreneurial orientation and green innovation in small and medium-sized enterprises (SMEs). *Social Sciences, 10(4)*. Basel, 136.
30. Mucha-Kuś, K., Sołtysik, M., Zamasz, K., Szczepańska-Woszczyzna, K. (2021). Coopetitive Nature of Energy Communities—The Energy Transition Context. *Energies, 14(4)*. Basel, 931.
31. Prokopowicz, A. (2016). Walka o mądre i inteligentne miasta. *Inteligentne Miasta i Regiony, 1*. Warszawa, 34.
32. Przybyłowski, A. (2017). Miasto przyszłości w aspekcie równoważenia mobilności. *Studia KPZK*. Gdynia: PAN, 177.
33. Rutten, R., Gelissen, J. (2008). Technology, talent, diversity and the wealth of European regions. *European Planning Studies, 16(7)*. London, 985-1006.
34. Saługa, P.W., Zamasz, K., Dacko-Pikiewicz, Z., Szczepańska-Woszczyzna, K., Malec, M. (2021). Risk-adjusted discount rate and its components for onshore wind farms at the feasibility stage. *Energies, 14(20)*. Basel.
35. Stuss, M.M. (2021). *Zarządzanie talentami. Koncepcje, modele i praktyki*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
36. Toppeta, D. (2014). *The Smart City Vision: How Innovation and ICT Can Build Smart, "Livable", Sustainable Cities*. Report of The Innovation Knowledge Foundation (2010). Milan: The Innovation Knowledge Foundation.
37. Zygiaris, S. (2013). Smart City Reference Model: Assisting Planners to Conceptualize the Building of Smart City Innovation Ecosystems. *Journal of the Knowledge Economy, 4(2)*, Portland: Springer, 217-231.

REQUIREMENTS AS FOR WORK ON BOARD A SHIP FROM THE PERSPECTIVE OF MARITIME FIELD STUDENTS AND SEAFARERS

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Purpose: The study aims to identify the opportunities for improving the employment offers by identifying differences in the requirements as for work on a ship formulated by maritime university students and seafarers.

Design/methodology/approach: To achieve the goal, the Kano method was applied, to determine the relationship between the level of requirements fulfilled to work on a ship and the students' and seafarers' level of satisfaction.

Findings: It was found that there are differences in how students and seafarers perceive the same requirements for working on a ship. As the perception of these requirements depends on the seafaring experience, shipowners should differentiate the terms and conditions of employment formulated in job offers to the targeted group of potential employees.

Research limitations/implications: The survey was conducted among students of only one Polish maritime university and, moreover, only seafarers of Polish nationality participated. Hence, future research in this area may include the identification of the requirements for work on board set by students and seafarers of other countries, as well as the identification of differences in the requirements for future work at sea set by students at the beginning and at the end of their education.

Practical implications: The study results obtained may prove helpful to shipowners in adjusting the job offers to the target group recruited. Such knowledge can help shipowner companies to effectively prevent the crisis related to the shortage of highly skilled seafarers and the subsequent disruption of the supply chain. In addition, it can also provide guidance for maritime universities to design academic programs customized to the expectations of both shipowners and future seafarers.

Originality/value: Research dedicated to assessing the impact of meeting shipboard job requirements on seafarers' satisfaction and dissatisfaction has not yet been conducted. In addition, the paper makes an innovative attempt to confront the requirements for work at sea formulated by seafarers with the requirements of students as future shipboard employees. The survey used the Kano method, a management-specific method not previously used in the maritime industry. The addressees of the results of the survey can be maritime universities, shipowners and maritime industry employees.

Keywords: Kano method, maritime industry, seafarers' requirements, students' requirements, working on board.

Category of the paper: Research paper.

1. Introduction

The international shipping industry is the backbone of global economy. Without shipping, global trade, mass transportation of raw materials, food or industrial goods would be impossible. Freight transportation by sea accounts for about 90% of global trade (Mitroussi, 2008; International Chamber of Shipping, 2021). This trade continues to grow, providing benefits to consumers around the world, resulting inter alia from competitive transportation costs. The constant increase in the efficiency of the international shipping industry as a mode of transportation and the high level of economic liberalization allows for the continuous intensive development of this industry. One of the key prerequisites for the maritime sector to operate efficiently includes a skilled and experienced maritime workforce that constitutes the ships' crews. The shipping data (e.g., volume and types of shipments, number of ships and seafarers and their characteristics) are constantly monitored by, inter alia, the international shipowners' associations BIMCO (Baltic and International Maritime Council) and ICS (International Chamber of Shipping), and their conclusions and observations are made available in the Seafarer Workforce Report (International Chamber of Shipping, 2021), published every few years.

According to the Seafarer Workforce Report, there are 1.89 million seafarers in the global merchant fleet, handling a total of more than 74 000 ships. The 2021 data indicate that more than half of the global population of seafarers working on merchant ships engaged in international trade were ratings (1 035 180 people), and the remaining 857 540 people were officers (Operational Level and Management Level) (International Chamber of Shipping, 2021). Currently, we can observe an increase in the global supply of ratings, primarily from countries such as the Philippines, the Russian Federation, Indonesia, China and India. At the same time, there is an ever-increasing shortage of qualified seafarers (Operational Level and Management Level), who are facing ever greater requirements as for their knowledge and skills resulting, inter alia, from the advancing digitalization and decarbonization in shipping. The competence and licenses required of seafarers depend on their function on the ship. In international shipping, there are various positions distinguished by the level of responsibility, including the auxiliary, operational and management levels (Directive..., 2022; Rozporządzenie..., 2018). From 2015 to 2021, we could observe a nearly 12% increase in the demand for merchant marine officers (Operational Level and Management Level), which, with the continuation of the current trend, could result in an officer shortage of up to 90 000

officers in 2026; while the greatest demand refers to the management level technical department officers.

In recent years, the efficient operation of logistics processes, including the maritime labour market, has been significantly affected by the pandemic. A significant number of seafarers have given up their jobs at sea, causing those who have continued to work in this sector to work well into the retirement age. Therefore, there is a growing need to identify ways to encourage young entrants to choose and develop a career at sea. The opportunities to address the issue of seafarer shortage also involve the greater feminization of the seafaring profession. The report described above highlights the increasing share of women in the maritime profession. At present, we can observe a steady increase in the share of women working aboard ships (by a total of about 50% since 2015), but this group still accounts for only 1.28% of the global maritime personnel labour market (International Chamber of Shipping, 2021; Kołodziej, 2016). Acquiring competencies specific to the seafarer profession is time-consuming and requires numerous sacrifices, and learning the specifics of the profession often discourages future seafarers from further professional development in this field. In accordance with the legal requirements (primarily the provisions of the STCW Convention), seafarers are required to have specialized education, complete a traineeship, undergo a number of training courses, and obtain certificates and licenses confirming their competence to work on a ship (Directive..., 2022; Rozporządzenie..., 2018; STCW Convention, 2017). In addition, the required training and certificates must be regularly renewed, and seafarers' knowledge should be constantly expanded and supplemented. The documents that all seafarers are required to hold include a maritime health certificate, a safety training certificate, a seaman's book, as well as a certificate confirming the acquired qualifications (such as a seaman's, engineer's, cook's, watch officer's or master's certificate) and a passport (STCW Convention, 2017). Furthermore, depending on the position, type of vessel and the shipowner's requirements, it may be necessary to hold specialized certificates, such as: Certificate of Advanced Training for Ships Operating in Polar Waters or Certificate of Basic Training in Liquefied Gas Tanker (Directive..., 2022; Rozporządzenie..., 2018). Moreover, seafarers are obliged to acquire knowledge of new technological solutions introduced on ships with the technological development occurring in the industry.

Hence, a number of requirements are formulated for all seafarers, depending on the position they occupy, in order to obtain and maintain the maritime diploma. At the same time, seafarers also face a number of requirements (needs and expectations) guiding them when choosing a shipowner or a type of ship and opting for a career in the maritime industry. The type and importance of these requirements most often derive from the seafarers' previous experience related to work on a ship and cooperation with shipowner companies. These requirements include the needs or expectations established (written down in a contract between the seafarer and the shipowner), are customary or mandatory (resulting from legislation) (International Organization for Standardization, 2015).

A similar trend is observed among seafarer candidates - students at maritime universities. Having no work experience, they have a certain idea of working on a ship and the requirements that will or will not be met in their future work, which undoubtedly affects the level of their satisfaction and subsequent choices related to work at sea and professional development (Lau, Ng, 2015; Kalvaitienė, Senčila, 2019). Consequently, it is challenging for today's shipowner companies to identify the requirements of both students and seafarers regarding work on a ship, and to shape and develop employment offers that are customized to the recruited group, to the largest degree.

The identification and implementation of solutions aimed to impede the ever-increasing shortage of highly skilled seafarers is currently a major challenge for shipowner companies. The crewing companies should ensure working conditions that meet the seafarers' specific requirements, and at the same time encourage the current and future students to start working for a given shipowner company. The increase in the number of seafarers with high competence may result from offering such employment conditions that will encourage young students to acquire maritime education and work in the shipping industry. Thus, the proper management of an organization requires the shipowners' (crewing) knowledge on the requirements of their stakeholders, primarily current and future employees (Caesar, Cahoon, 2015). This is confirmed by the results of previous studies devoted to seafarers' needs and expectations of work aboard a ship.

Yildirim, Toygar and Çolakoğlu (2022) indicated that inadequate working conditions adversely affect seafarers' physical and mental health, resulting in increased resignations from this type of work. The authors also point out that high salary is an important factor in encouraging people to choose the seafaring profession, but it is not the essential one. It seems that adequate remuneration is motivating, but not sufficient. In that case, shipowners should develop a strategy taking into consideration other requirements that are no less important to seafarers to increase the number of people interested in working at sea.

The knowledge necessary to develop such a strategy can be derived from information on the requirements that most affect the seafarers' satisfaction. At the same time, this information can provide guidance for improving the quality of crewing services in terms of employment conditions and ensuring a suitable working environment on board.

In view of the growing crisis in the labour market in global maritime logistics, related to the shortage of workers, it also seems valuable to provide information on the requirements of maritime university students as for their future work at sea. This knowledge can help both universities and training organizations, as well as the employees of crewing companies define appropriate HR policies. This relationship was also recognized by Caesar and Cahoon (2015), who indicated that due to the limited knowledge of maritime education and training organizations on their students, students' expectations and career ambitions, it is difficult to effectively retain them on ships. According to the authors, this situation results from the lack

of information on the students' career ambitions, which, in turn, may be the reason why students give up working on ships and choose other career paths.

Whereas Sencila and Kalvaitiene (2018) pointed out the relationship between the generations working together on a ship and the differences in their competencies. They observed that intergenerational differences have both a positive and negative impact on work on board. According to the students who participated in the study, the older generations passed on their professional knowledge and career opportunities, but also a number of negative aspects of a seafarer's career such as long-time separations from the family and isolation. Tezcan, Erdem and Oğuz (2020), on the other hand, pointed out that it is necessary to improve the reputation of the seafaring profession by improving the working conditions while preventing workforce abuse, in accordance with the regulations of the Maritime Labor Convention (MLC), which stipulates seafarers' rights to decent working conditions on ships. The MLC is the organization that develops guidelines for the minimum labour standards and seafarers' rights, such as employment conditions, accommodation, recreation options, food, health and safety, medical care and insurance (Maritime Labour Convention, 2006).

The results of other authors' work presented here indicate the global nature of this issue. However, studies to date have largely focused on identifying requirements as for competencies or employment conditions. In contrast, there has been no attempt to assess the impact of meeting these requirements on seafarers' satisfaction and dissatisfaction and closely related thereto, on their interest in continuing to work at sea. In addition, there have been no studies to date that confront the requirements for work at sea formulated by seafarers (who evaluate employment offers through their previous experience with work on board) with the requirements of students as the future employees working on a ship.

Thus, regardless of the type of seafaring personnel expected by shipowners, it is necessary to take all measures to make students and/or seafarers willing to work and develop professionally on a ship. In the face of growing workforce shortages, it seems rational to look for both highly qualified personnel, who should be encouraged to further develop their professional career, as well as students who, by gaining experience, will quickly acquire the necessary qualifications and competencies and take up the job. Therefore, it is reasonable to conduct the study to compare the requirements of students and seafarers and to assess to what extent meeting these requirements influences their satisfaction and consequently encourages them to continue their professional development in the maritime industry (Kłopotek, Dmowski, Szkiel, 2023).

2. Methods

The pilot study aimed to identify opportunities for improving the employment offers, in a particular branch of the logistics industry, which is undoubtedly the maritime transportation, by identifying differences in the requirements as for work on a ship, formulated by maritime university students and seafarers.

In order to fulfil the purpose of this study, it was decided to apply the Kano method, appropriate for management and previously not applied in this area (Howsawi et al., 2020; Yadav et al., 2017; Yao, Chuang, Hsu, 2018), which is used to determine the relationship between the product or service level of performance and the level of customer satisfaction. Since the Kano method is based on the assumption that individual requirements do not affect the level of satisfaction of the person surveyed to the same extent, an attempt was made to use this method to identify and categorize the requirements of seafarers and maritime university students towards work on board. An additional advantage (strength) of this method is that it can be used to analyse the change in requirements over time. After a certain period of time, requirement initially considered attractive may become one-dimensional and subsequently mandatory, making it necessary to repeat the survey over the next few years (Kłopotek, Dmowski, Szkiel, 2021; Rashid et al., 2011; Ulewicz, 2016; Wiśniewska, 2009).

By assessing the seafarers' well-being associated with the fulfilment or no fulfilment of particular requirements, the Kano method allows to categorize these requirements (Wiśniewska, 2009; Matzler, Hinterhuber, 1998; Thipwong, Wong, Huang, 2020). Depending on the category, the fulfilment or non-fulfilment of a given requirement affects the level of student's and seafarer's satisfaction with work on board in a different way. Therefore, depending on the category where a given requirement is assigned, a shipowner can take appropriate measures to increase the satisfaction of the future and current employees (Table 1).

Table 1.
Product feature categories according to the Kano model

Type of feature	Characteristics	Recommendations for the company
M – Must-be	The presence of this characteristic is required by the consumer. The presence of the attribute does not make the customer happy, but its absence causes a significant increase in customer dissatisfaction.	These features must necessarily be included in the product.
O – One dimensional	The presence of this feature is expected by the customer. The greater the realisation of this feature, the greater the customer satisfaction and vice versa.	These features should be developed in the product/service and their level should not be lower than in competing products.
A – Attractive	This is a feature that the customer does not expect, but it turns out to be useful to them. The presence of this feature will increase customer satisfaction, but its absence will not cause dissatisfaction.	All these features should not be included in the product/service at the same time. It should be ensured that a few selected features are realised at the maximum level.

Cont. table 1.

I – Indifferent	It is a feature that, whether present or absent, will not result in customer satisfaction or dissatisfaction.	These should be avoided in the product/service.
Q – Questionable	There is a contradiction - customers want the feature to be present as well as not to be present.	No recommendations.
R – Reverse	It is a characteristic whose absence causes customer satisfaction, while its presence causes customer dissatisfaction.	They should not be included in the product.

Source: Rashid et al., 2011; Wiśniewska, 2009.

After categorizing the features, to identify the differences, indices were calculated to indicate where among the two respondent groups the fulfilment or non-fulfilment of a given requirement results in a higher increase in the level of satisfaction or dissatisfaction: size of satisfaction and size of dissatisfaction of students and seafarers (Figure 1).

$$\text{Size of satisfaction} = \frac{A+O}{A+O+M+I} \quad \text{Size of dissatisfaction} = \frac{O+M}{(A+O+M+I) \times (-1)}$$

Figure 1. The method of counting the magnitude of satisfaction and dissatisfaction is presented.

Source: Wiśniewska, 2009.

These indices indicate how strongly the fulfilment of a given requirement can affect the student's/seafarer's satisfaction or, if not fulfilled, their dissatisfaction. The positive coefficient (level of satisfaction) ranges from 0 to 1, and the negative index (level of dissatisfaction) ranges from 0 to -1. The closer the value is to 1, the greater the influence of the level of requirement fulfilment on satisfaction, and the closer the value is to -1, the greater the influence of the requirement non-fulfilment on dissatisfaction (Matzler, Hinterhuber, 1998).

The subjects of this study included students at a Polish maritime university who had no experience with work on a ship, and seafarers with different positions depending on their experience. In turn, the subject matter of this study included the requirements for working on board, the identification of which constituted the first of the six stages of the Kano method. The requirements were identified using face-to-face interviews, conducted with five seafarers with a minimum of seven years' experience of work at sea on various ships and positions, familiar with the shipowner cooperation principles and working conditions on board. As many as 35 requirements were obtained (Table 2), which were used in the second stage of study, which involved developing a questionnaire. The seafarers' requirements concerned such aspects as employment conditions, ship and shipowner features, remuneration and other benefits.

Table 2.

Identified requirements for working on board

Requirement no.	Requirement for working on board
1	Form of employment (through an agency or directly through the shipowner's office)
2	Shipowner's country of origin
3	Number of shipowner's vessels
4	Type of agreement (contract/other)
5	Contract duration
6	Amount of earnings compared to the competition

Cont. table 2.

7	possibility to negotiate the rates/terms of the contract
8	Pension contributions paid by the shipowner
9	Payroll taxes paid by the shipowner
10	Regular, stable medical assistance (insurance)
11	Regular, stable medical assistance for family members (insurance)
12	Currency of remuneration paid
13	Travel costs to and from the ship paid by the shipowner
14	Possibility to collect advance payments
15	Apprenticeship benefits and incentive bonuses
16	Fast-track path of promotion
17	Training to improve competences and all related costs covered by the company
18	Timeliness of crew substitutions (as per the contract)
19	Regular rotation contracts (permanent crew on the ship)
20	Type of vessel
21	Size of vessel
22	Frequency of port calls
23	Age of vessel
24	Access to mobile phone network and the Internet
25	Variety and palatability of meals
26	Access to the products you need, e.g., food, cosmetics, domestic detergents
27	Level of ship's protection against maritime piracy
28	Social conditions on board, e.g., gym, multimedia room
29	Efficiency of ship equipment
30	Crew country of origin
31	Briefings for officers in the shipowner's office
32	Positive feedback among friends and on the Internet
33	Possibility to disembark during ship's stay in port
34	Possibility to get alternative employment, e.g., in the shipowner's office
35	Effective cooperation with the shipowner's office

Source: own elaboration.

The author's questionnaire for each of the identified requirements contained two contrasting questions. The first was designed to assess the student's/seafarer's well-being if the requirement was fulfilled, and the second was designed to assess their well-being if the requirement was not fulfilled.

The selection of a respondent group was non-random on purpose (Walliman, 2022). A total of 144 respondents took part in the questionnaire-based survey, 75 of whom were students of maritime area of study at Gdynia Maritime University who do not yet have any experience with work on a ship, and 69 were active seafarers. All of the students surveyed belonged to the under-30 group. On the other hand, those with experience belonged to both the under-30 group (46 people) and the 31-40 age group (17 people). From among the respondents, only 6 belonged to the over 41 group. Only 22 women participated in the survey, accounting for 15% of the total group surveyed. The low participation of women in the survey is related to the fact that the seafarer profession and the choice of fields of study preparing for this profession is still more popular among men.

Comparing the answers given by students and seafarers made it possible to indicate whether there are differences in the perception of the same requirements depending on experience in work on board. With this end in view, the Pareto method was applied, which made it possible to classify the categorized requirements into three groups taking into account differences in the

values of satisfaction and dissatisfaction indices (Kowalik, 2018). This provided grounds for indicating to shipowners the proposals for measures aimed to increase the attractiveness of job offers and ensure acquiring students as the future employees and retaining the experienced seafarers.

3. Results and discussion

The results of the survey made it possible to categorize the requirements of students and seafarers as for work on a ship (Table 3), as well as indicate the influence of the level of fulfilment of each requirement on the level of satisfaction and dissatisfaction of the current and future seafarers. This formed grounds for identifying similarities and differences in perceiving the requirements for work on board, which made it possible to identify directions for improving the employment offer that the shipowner companies should consider when recruiting new and retaining current employees.

Table 3.

Categorisation of student and seafarer requirements for working on board

R. no.	Requirement for working on board	Category by students	Category by seafarers
1	Form of employment (through an agency or directly through the shipowner's office)	I	A
2	Shipowner's country of origin	A	A
3	Number of shipowner's vessels	I	A
4	Type of agreement (contract/other)	A	Q
5	Contract duration	A	A
6	Amount of earnings compared to the competition	O	A
7	possibility to negotiate the rates/terms of the contract	A	A
8	Pension contributions paid by the shipowner	A	A
9	Payroll taxes paid by the shipowner	R	R
10	Regular, stable medical assistance (insurance)	M	A
11	Regular, stable medical assistance for family members (insurance)	A	A
12	Currency of remuneration paid	A	A
13	Travel costs to and from the ship paid by the shipowner	A	M
14	Possibility to collect advance payments	I	I
15	Apprenticeship benefits and incentive bonuses	A	A
16	Fast-track path of promotion	A	A
17	Training to improve competences and all related costs covered by the company	A	A
18	Timeliness of crew substitutions (as per the contract)	O	M
19	Regular rotation contracts (permanent crew on the ship)	A	A
20	Type of vessel	A	A
21	Size of vessel	A	A
22	Frequency of port calls	I	I
23	Age of vessel	I	I
24	Access to mobile phone network and the Internet	A	M
25	Variety and palatability of meals	A	M

Cont. table 3.

26	Access to the products you need, e.g., food, cosmetics, domestic detergents	A	A
27	Level of ship's protection against maritime piracy	O	M
28	Social conditions on board, e.g., gym, multimedia room	A	A
29	Efficiency of ship equipment	O	A
30	Crew country of origin	Q	I
31	Briefings for officers in the shipowner's office	I	I
32	Positive feedback among friends and on the Internet	O	O
33	Possibility to disembark during ship's stay in port	A	A
34	Possibility to get alternative employment, e.g., in the shipowner's office	A	A
35	Effective cooperation with the shipowner's office	O	M

Source: own elaboration.

After categorizing, a subsequent stage of study referred to calculating the level of students' and seafarers' satisfaction and dissatisfaction for each requirement (Figure 2 and Figure 3).

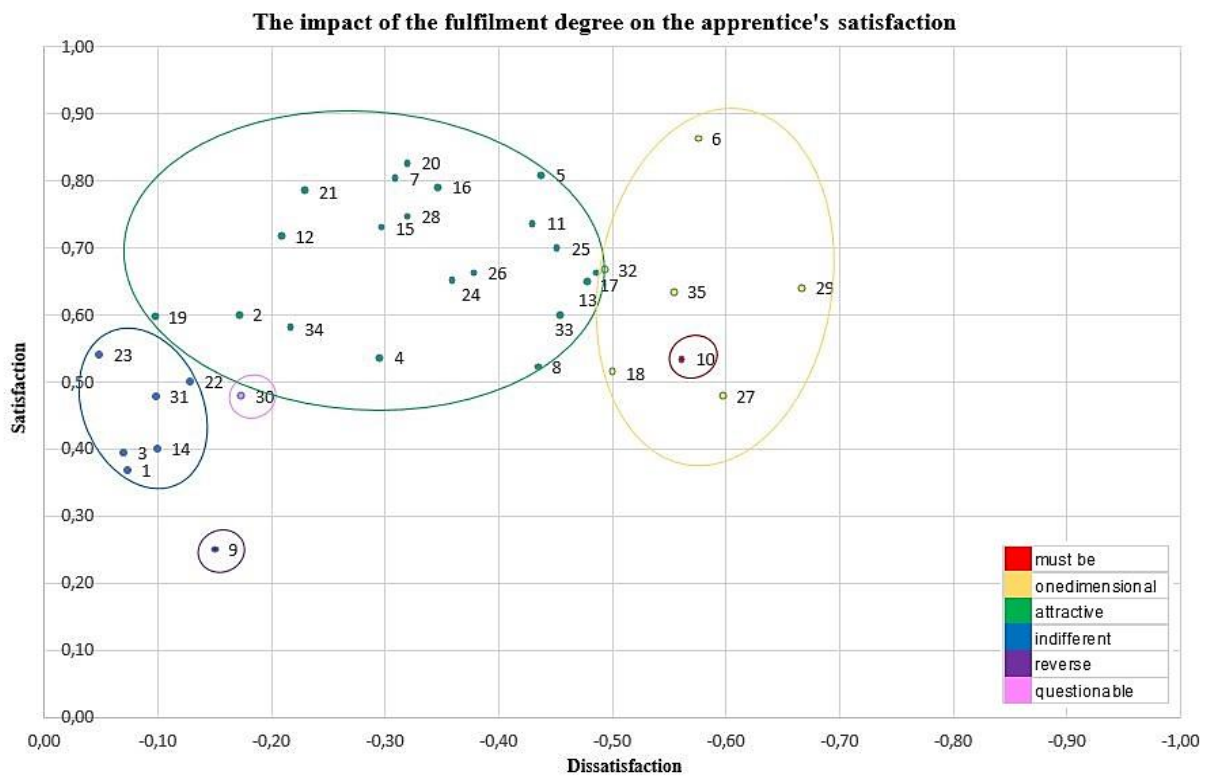


Figure 2. Categorisation of students' expectations of future work on board.

Source: own elaboration.

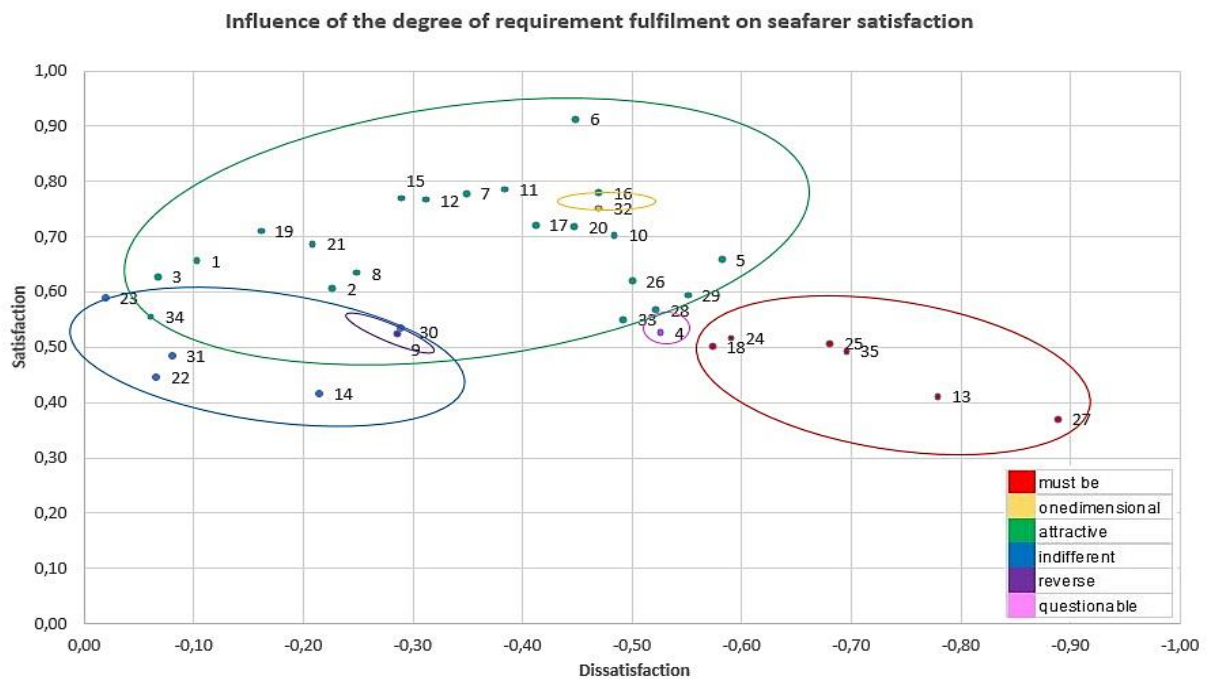


Figure 3. Categorisation of seafarers' requirements for work on board.

Source: own elaboration.

For both students and seafarers, the most numerous category referred to attractive requirements (green). For both respondent groups, more than half of all identified requirements fell into this category. These are the requirements that respondents do not expect to be fulfilled, but they prove useful to them. Hence, their fulfilment will result in increased satisfaction, but their non-fulfilment will be imperceptible (due to the lack of such expectations) and will not result in dissatisfaction, and consequently will not affect the rejection of a given job offer. Depending on a target group, the shipowner should offer to meet these requirements, but not all of them at the same time, due to the fact that their fulfilment may determine the competitiveness of the employment conditions offered and may cause the job offer of a given shipowner stand out against other shipowners' offers. Over time, these requirements may become one-dimensional and then mandatory requirements. Therefore, in order to attract potential employees, a shipowner will have to include in the employment offer the fulfilment of further requirements that will be attractive to students and/or seafarers. Therefore, to regularly surprise employees, the shipowner should ensure a gradual fulfilment of a few selected requirements at the maximum level. The requirements with the highest satisfaction rate should be fulfilled first, as they have the highest impact on the respondents' satisfaction. The requirements that are attractive to students include, for example, the preferred type of ship, length of contract, fast-track path of promotion, possibility to negotiate rates and type of contract. For seafarers, on the other hand, these are the attractive requirements: e.g. higher wages compared to the competition, ongoing medical support, form of employment and reliability of ship equipment.

A significant difference was observed with regard to the category of requirements - must be (red). For students, only one such requirement was identified, while for seafarers there are as many as 6 mandatory requirements. Failure to meet the requirements belonging to this group will significantly increase the respondents' dissatisfaction. The requirements that seafarers consider mandatory have a different meaning (attractive or one-dimensional) for students, but it is likely that after the first contract, these will also become mandatory requirements for students. This confirms the principle of requirement category variability over time. Therefore, shipowners should ultimately offer to meet these requirements when recruiting both groups of employees. It was found that only permanent stable medical support (health insurance during the contract and during the stay at home - requirement No. 10) is a mandatory requirement for students. This means that failure to cover students with medical support is likely to result in a significant increase in their dissatisfaction, which may result in rejecting a given shipowner as a potential employer, which constitutes an undesirable situation for a crewing company. Hence, shipowner companies should consider providing health insurance for seafarers not only aboard the ship, but also outside the contract - while they stay at home. However, for seafarers with experience this is an attractive requirement. This means that health insurance outside the contract would increase their satisfaction with the job offer. But seafarers are aware that such insurance is not common, hence its absence does not affect their dissatisfaction and rejection of the offer. The requirements considered by seafarers as mandatory include access to mobile phone network and the Internet (no.24), variety and palatability of meals (no.25), timeliness of crew substitutions (as per the contract) (no.18), effective cooperation with the shipowner's office (no.35), travel costs to and from the ship paid by the company (no.13) and the level of ship's protection (no.27).

Another category of requirements indicating significant differences includes one-dimensional requirements (yellow), i.e. those that are expected by respondents, and the relationship between the level of their fulfilment and satisfaction is directly proportional. The one-dimensional requirements, the fulfilment of which will have the greatest influence on the level of student satisfaction, include the requirements related to the amount of remuneration compared to the competition (no.6), positive reviews among friends and on the Internet (no.32), efficiency of the ship's equipment (no.29), effective cooperation with the shipowner's office (no.35), timeliness of crew substitutions (as per the contract - no.18), and the level of ship's security (effective protection against sea piracy in dangerous areas - no.27). The greater the level of fulfilment of these requirements, the greater the student's satisfaction, and vice versa. When seeking future employment on a ship, students will pay the most attention to having their requirements in this particular area fulfilled. Therefore, these requirements should be included in the job offer and continuously developed by the shipowner, and the level of their fulfilment should be no lower than that of other shipowners. However, the fulfilment of these requirements has a significant impact on the choice of a given shipowner as a potential employer mainly for students, since for seafarers these requirements are

mandatory (their fulfilment is taken for granted by seafarers), and therefore their fulfilment does not increase the seafarers' satisfaction. A one-dimensional requirement for students and seafarers includes the shipowner positive reviews among friends and on the Internet (no.32). Thus, it can be concluded that when looking for employment opportunities, seafaring personnel take into account the opinion of people who already have some experience of working with a particular shipowner company. Social media is becoming an increasingly popular place to share employer information. For example, sharing information about the shipowner's successes and developments on social media can influence the attractiveness of a job offer for both current and future employees.

In contrast, the reverse requirement (purple), i.e. undesirable for both respondent groups, refers to payroll taxes paid by the shipowner (no.9). This means that unfavourable tax conditions can negatively affect the employer's evaluation or result in rejecting the job offer. Therefore, shipowners should provide optimal conditions for taxed payroll.

Another group consists of requirements in the indifferent (blue) category, which are similarly perceived by both respondent groups. This category (in both respondent groups) includes the age of the ship (no.23), frequency of port calls (no.22), briefings for officers at the shipowner's office (no.31) and the possibility to collect advance payments (no.14). Meeting these requirements will not affect the employees' satisfaction. These features are not relevant in the context of employment on a ship, and therefore do not affect the choice of a given shipowner as a potential employer. However, a difference was observed in the requirement related to the number of shipowner's vessels (no.3). For students, this feature is indifferent and not important, but seafarers find it attractive. They are aware that with a greater number of ships comes a greater number of potential employment opportunities with a given shipowner, such as potential promotion. Therefore, it makes the job offer more attractive, and as a result, increases job satisfaction. The situation is similar with regard to the requirement as for the form of employment (through an agency or directly through the shipowner's office - no.1). For students, this feature is indifferent, but seafarers notice the benefits resulting from being employed directly by the shipowner. Whereas for seafarers the origin of the crew is an indifferent feature, while students perceive it as questionable (pink). This means that it is difficult to say unequivocally whether the fact that crew members come from one or different countries affects the level of students' satisfaction - this may vary depending on the specific situation on board. This may result from the fact that students do not yet have experience of working with people of different nationalities, so they are not yet in a position to assess whether it is really important to them. Therefore, it is difficult to indicate what actions the shipowner should take in this regard. Currently, most ships are operated by international crews, so it is probably sufficient to inform a prospective employee whether the crew the candidate will be working with is international or exclusively from the candidate's country. However, for seafarers, presumably focused on their duties, the origin of other crew members is irrelevant. For them, on the other hand, the type of contract is a questionable feature. More important are the details of employment, i.e. the terms of contract.

One of the aspects analysed included the differences in assigning the requirements to different categories with onboard experience for students and seafarers. Whereas the second important aspect involved analysing the differences in the values of satisfaction and dissatisfaction indices in order to determine whether fulfilling or not fulfilling a given requirement would have a greater impact on the students' or seafarers' satisfaction and dissatisfaction (Figure 4 and Figure 5).

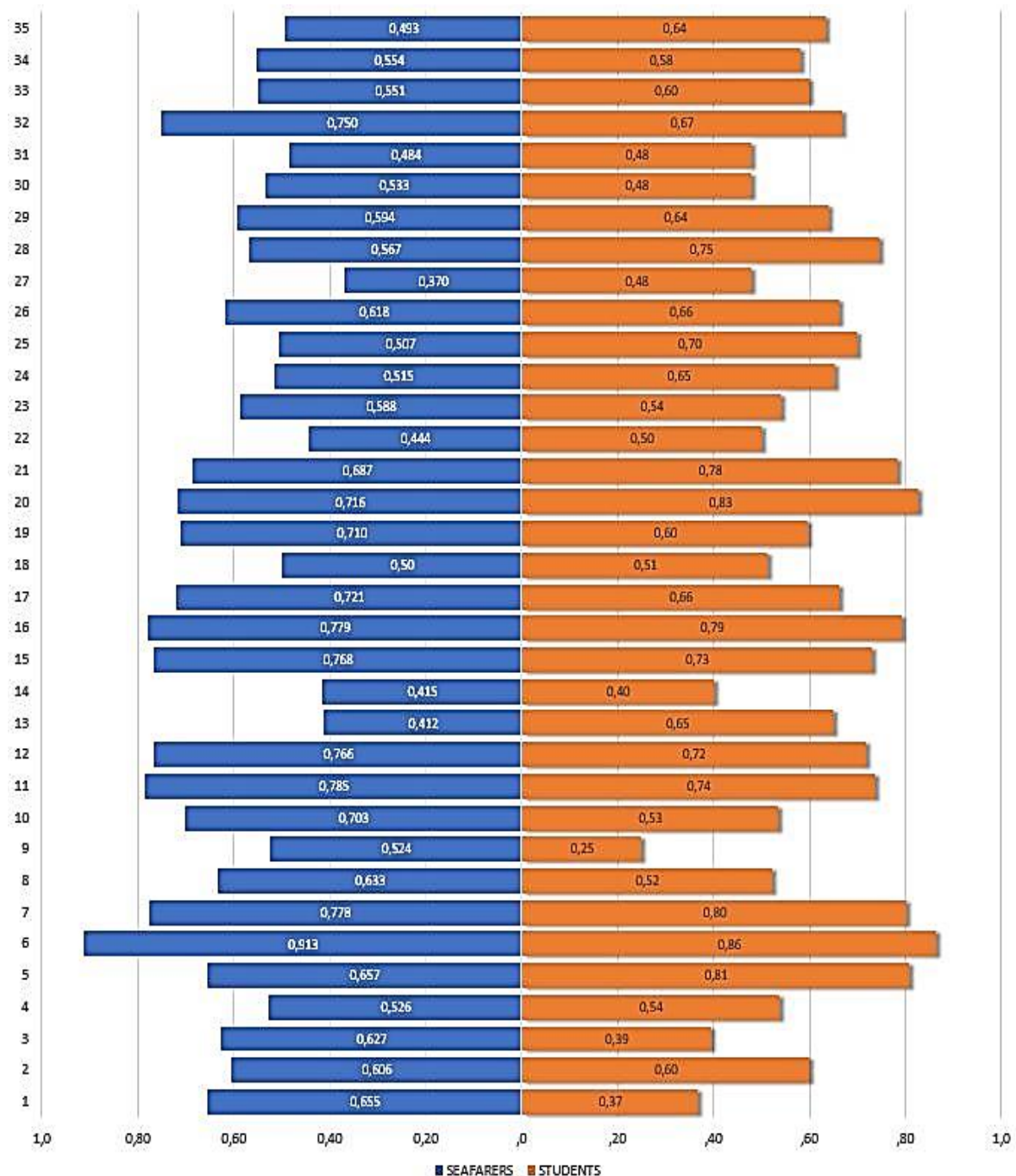


Figure 4. Differences in satisfaction rates between students and seafarers in relation to work on board requirements.

Source: own elaboration.

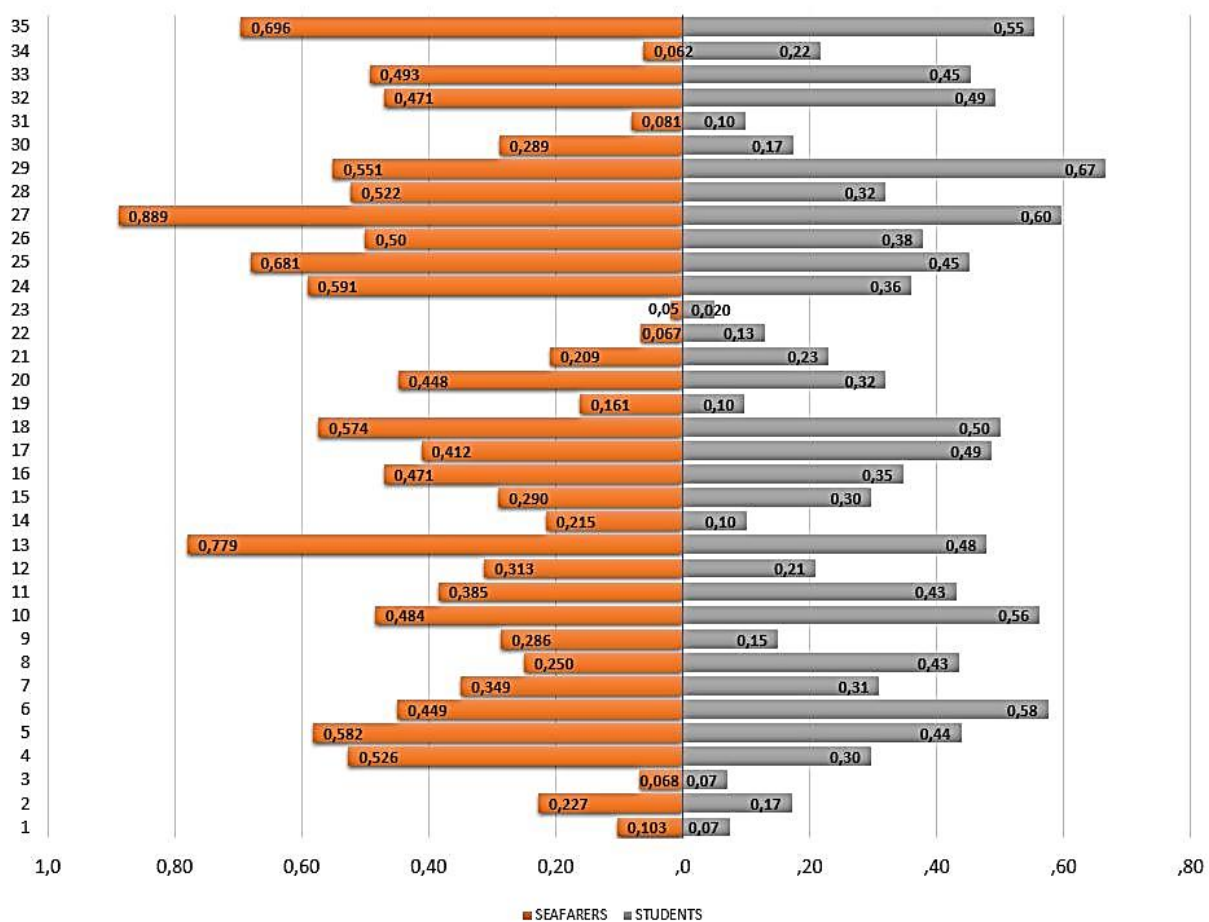


Figure 5. Differences in dissatisfaction rates between students and seafarers in relation to work on board requirements.

Source: own elaboration.

To take appropriate actions to address the labour shortage crisis on the ships, the shipowner needs to identify its target group (people under recruitment) and customize its employment offer to meet its requirements. Depending on whether the shipowner plans to hire workers with no work experience, or to retain or hire seafarers already experienced in work on board, the shipowner should take different actions. The choice of a given shipowner will be influenced by meeting first the students' and seafarers' requirements that are mandatory for them and those whose fulfilment has the highest impact on their satisfaction.

As indicated, the assignment of requirements to different categories varies, depending on the respondents' experience on board. The fulfilment or non-fulfilment of individual requirements affects the satisfaction or dissatisfaction of the two respondent groups to varying degrees. The application of the Pareto method made it possible to group the requirements as for work on a ship by differences in the volume of students' and seafarers' satisfaction (Figure 6) and dissatisfaction (Figure 7) rates. The yellow colour indicates those requirements that changed a category depending on the respondents' experience of work on board.

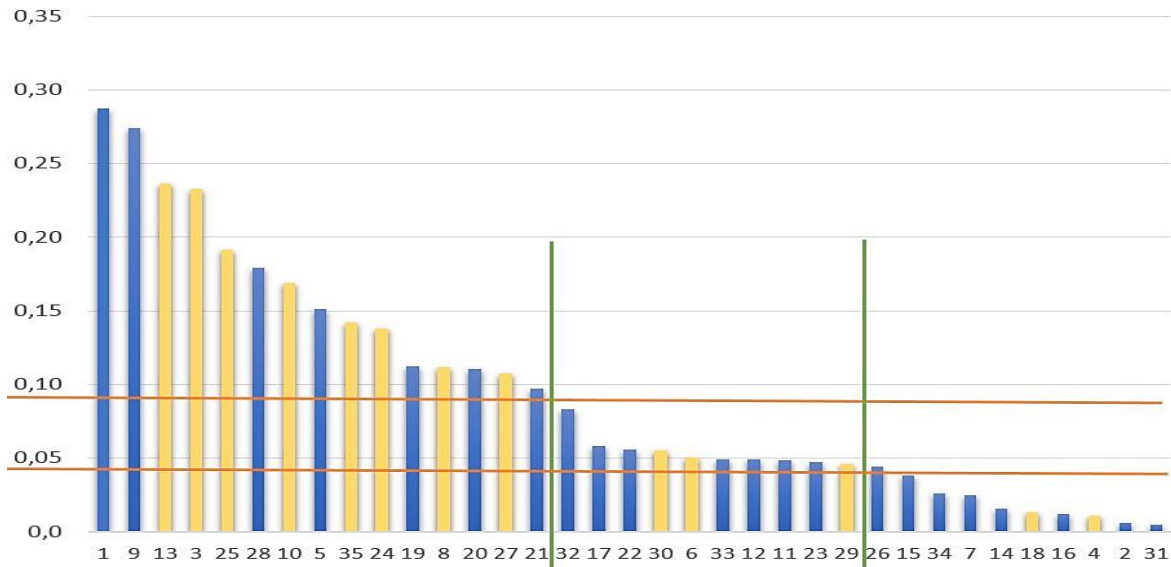


Figure 6. Difference in satisfaction index values.

Source: own elaboration.

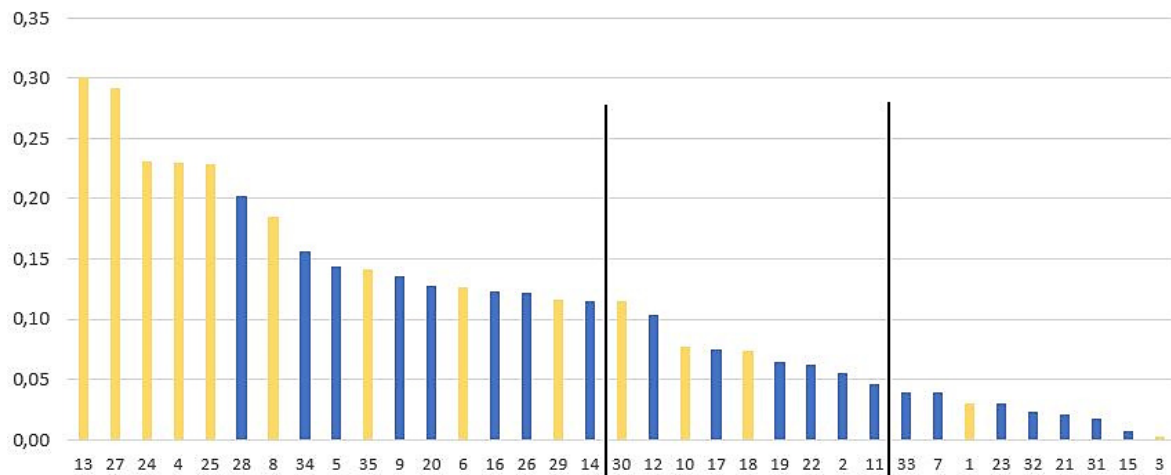


Figure 7. Difference in dissatisfaction index values.

Source: own elaboration.

The first group includes the requirements that shipowners should primarily take into account when adjusting the job offer and differentiating the terms and conditions of employment for a group of potential employees, since for these requirements the greatest differences were observed, in terms of satisfaction and dissatisfaction rates calculated for students and seafarers. By analysing the data presented in the figures, it can be seen that a significant part of the requirements in group one changed category, depending on their experience of working on a ship. In order to customize the job offer to a selected group, it is necessary to differentiate it, taking into account those requirements that have the highest impact on the group's satisfaction, while avoiding those that have the highest impact on the decrease in their satisfaction.

Groups two and three, on the other hand, combine requirements that are less differentiated in terms of the values of satisfaction indices and the satisfaction calculated for students and seafarers. This does not mean that these requirements are less important - however, since their

fulfilment affects the satisfaction of both students and seafarers to a similar degree, these requirements will not be the criteria for differentiating the job offer directed to these two groups of employees. In the case when a shipowner seeks employees in both study groups, the shipowner should take into account the fulfilment of those requirements that are equally important to the employee groups.

4. Conclusion

In response to the observed shortage of skilled maritime personnel worldwide, it is essential to seek effective solutions to this issue. A key challenge for today's shipowners involves managing activities aimed to build maritime human capital, based on identifying the requirements of seafarers and young candidates - students at maritime universities, i.e. future employees.

The Kano method is an effective method to categorize the requirements of maritime students and seafarers as for work on a ship and identify which of these have the highest influence on their job satisfaction. A job offer should be customised as much as possible to the requirements of the target group of employees to be targeted by the shipowner. Therefore, the shipowner should be aware in which areas the students' and seafarers' requirements as for work on board coincide, and where there are significant differences. If the recipients of the offer are students, it should first and foremost take into account the fulfilment of those requirements that will have the highest impact on the level of their satisfaction with the employment conditions offered, as this may influence their decision to choose career path at sea and work for a given shipowner. In the case of seafarers, the situation presents itself similarly. A shipowner, wishing to encourage the existing employees to continue to work with their current employer, the shipowner should ensure fulfilling those requirements that are the most important to them and most affect their job satisfaction. By targeting students and seafarers at the same time, the shipowner should focus on those requirements that have a high impact on the satisfaction of both groups and avoid those aspects that have the highest impact on their dissatisfaction.

The survey conducted made it possible to categorize the requirements and identify to what extent the fulfilment of these requirements influences job satisfaction in each group depending on the category of requirement. It was found that students primarily expect the terms of employment to include health insurance both during the contract and while at home. However, this is currently a matter dependent on the terms of the contract, and most often health insurance is provided only while working on board a ship. Hence, for seafarers who are aware of this, this requirement falls into the attractive category. However, given that it is a mandatory requirement for students, it is worth considering meeting the requirements in this regard, since

on the one hand it may encourage them to choose a particular crewing company, and on the other, it will encourage seafarers to extend their cooperation with the shipowner.

Students also expect the highest possible salary - the higher the salary compared to that offered by the competition, the higher their satisfaction. For seafarers, the amount of earnings falls into the attractive requirements, which has the highest impact (among other requirements in this category) on their job satisfaction. One-dimensional qualities that directly determine students' choice of a particular shipowner as a potential employer also include the efficiency of ship's equipment, effective cooperation with the shipowner's office, timeliness of crew substitutions and effective protection against piracy in dangerous areas of the world. For seafarers, on the other hand, most of these are among the mandatory requirements. The fulfilment of these requirements no longer affects their satisfaction, while the lack of fulfilment significantly affects their dissatisfaction. Consequently, failure to meet these requirements is undesirable. Positive feedback about the shipowner company is a requirement expected by both groups, students and seafarers. For seafarers, this is the only one-dimensional requirement identified. Most of the students' and seafarers' identified requirements referred to the "attractive" category. Students' satisfaction is most influenced by the fulfilment of their expectations in terms of a preferred type of ship, preferred length of contract, possibility to negotiate the rate or conditions of the contract, and fast-track path of promotion. Seafarers' satisfaction, on the other hand (ignoring the requirements indicated above), will be most influenced by meeting their requirements such as: negotiable rate/contract terms, fast-track path of promotion, preferred salary currency or apprenticeship benefits and incentive bonuses.

Payroll taxes paid by the shipowner is a requirement categorized as the reverse, undesirable, in both groups. Regarding this requirement, the shipowner should take measures to prevent employee dissatisfaction, such as allowing taxes to be paid directly by employees. In contrast, as regards the requirements categorized as indifferent or questionable, there is no need to take action, as these requirements do not directly affect job satisfaction.

A significant number of the requirements as for work on board that have the highest impact on students' and seafarers' satisfaction relate to issues directly or indirectly related to earnings. Hence, financial issues are very important to seafaring personnel, but they are not the only important aspect, as confirmed by the results of previous surveys in this matter. Especially important to all respondents are opinions about the employer. They trust the opinions and comments for example, on the currently popular social media. Developing a company image in social media and on portals dedicated to maritime issues, publishing information, e.g. as regards favourable working conditions, successes of the company, and at the same time the possibility to comment by the community (followers) can be beneficial for shipowners in the context of encouraging potential employees to take up a job in a given company.

From the point of view of seafarers with work experience, the perception of the requirements as for work on a ship differs compared to that of students. Identifying the differences also confirms the usefulness of the Kano method, which allowed us to identify

which requirements change category under the influence of onboard work experience, that is, under the influence of time. The results of study can provide valuable guidance for counteracting the maritime human resource shortage crisis for both shipowner companies and institutions training future seafarers, and thus prevent potential disruptions in the global supply chains.

References

1. Caesar, L., Cahoon, S. (2015). Training Seafarers for Tomorrow: The Need for a Paradigm Shift in Admission Policies. *Universal Journal of Management*, Vol. 3(4), pp. 160-167, doi: 10.13189/ujm.2015.030404.
2. Directive (EU) 2022/993 of the European Parliament and of the Council of 8 June 2022 on the minimum level of training of seafarers, OJ L169/45 (2022).
3. Howsawi, A.A., Althageel, M.F., Mohaideen, N.K., Khan, M.S., Alzahrani, A.S., Alkhadir, M.A., Alageel, S.M., Alkathiri, M.A., Hawsawi, R.A. (2020). Application of the Kano model to determine quality attributes of patient's care at the primary healthcare centers of the Ministry of Health in Saudi Arabia, 2019. *Journal of Family and Community Medicine*, Vol. 27, Iss. 3, pp. 178-185, doi: 10.4103/jfcm.JFCM_92_20.
4. International Chamber of Shipping (ICS) (2021). *Seafarer Workforce Report - The global supply and demand for seafarers in 2021*. Livingston: Witherby Publishing Group.
5. International Convention on Standards of Training, Certification and Watchkeeping (STCW Convention) (2017). London: International Maritime Organization. Retrieved from: <https://www.imo.org/en/OurWork/HumanElement/Pages/STCW-Convention.aspx>.
6. International Organization for Standardization (2015). *Quality management systems. Fundamentals and vocabulary (ISO 9000:2015)*.
7. Kalvaitienė, G., Senčila, V. (2019). Ship as a Social Space for Adaptation: Perception of the Phenomenon by Young Seafarers. *TransNav*, Vol. 13, No. 3, pp. 635-640, doi: 10.12716/1001.13.03.21.
8. Kłopotek, N., Dmowski, P., Szkiel, A. (2021). Directions of using the Kano Model to improve the quality of products and services. In: H. Śmigielska (Ed.), *Current trends in Quality Sciences – consumer behavior, logistic, product management. Part 2* (pp. 418-432). Radom: Sieć Badawcza Łukasiewicz – Instytut Technologii Eksploatacji Wydawnictwo Naukowe. Retrieved from: <https://ue.poznan.pl/pobierz/c1pIVlxfUIVQXg/>.
9. Kłopotek, N., Dmowski, P., Szkiel, A. (2023). Expectations of Maritime University Students of Future Work on a Ship. *TransNav*, Vol. 17, No. 3, pp. 701-706, doi: 10.12716/1001.17.03.22.

10. Kołodziej, A. (2016). Atrakcyjność, satysfakcja, prestiż. O praktycznym znaczeniu społecznej oceny zawodu marynarza. *Roczniki Socjologii Morskiej. Annals of Maritime Sociology, Vol. XXV*, pp. 12-18. Retrieved from: https://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.oai-journals-pan-pl-101317/c/oai-journals-pan-pl-101317_full-text_XXV_2_Ko_C5_82odziej.pdf.
11. Kowalik, K. (2018). Diagram Pareto-Lorenza w teorii i praktyce zarządzania jakością. *Archiwum wiedzy inżynierskiej. Archives of Engineering Knowledge, Vol. 3, No. 1*, pp. 22-24. Retrieved from: <https://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-6201ef46-7a1d-480f-9843-f02e75ef9e80>.
12. Lau, Y.-Y., Ng, A.K.Y. (2015). The motivations and expectations of students pursuing maritime education. *WMU Journal of Maritime Affairs, Vol. 14*, pp. 313-331, doi: 10.1007/s13437-015-0075-3.
13. *Maritime Labour Convention (MLC)* (2006). Genewa: International Labour Organization. Retrieved from: https://www.ilo.org/wcmsp5/groups/public/---ed_norm/---normes/documents/normativeinstrument/wcms_090250.pdf.
14. Matzler, K., Hinterhuber, H.H. (1998). How to make product development projects more successful by integrating Kano's model of customer satisfaction into quality function deployment. *Technovation, Vol. 18, No. 1*, pp. 25-38, doi: 10.1016/S0166-4972(97)00072-2.
15. Mitroussi, K. (2008). Employment of seafarers in the EU context: Challenges and opportunities. *Marine Policy, Vol. 32, Iss. 6*, pp. 1043-1049, doi: 10.1016/j.marpol.2008.03.006.
16. Rashid, M.M., Tamaki, J., Ullah, A.M.M.S., Kubo, A. (2011). A Kano Model Based Linguistic Application for Customer Needs Analysis. *International Journal of Engineering Business Management, Vol. 3, No. 2*, pp. 29-36, doi: 10.5772/50934.
17. Rozporządzenie Ministra Gospodarki Morskiej i Żeglugi Śródlądowej z dnia 23 kwietnia 2018 r. w sprawie wykszolenia i kwalifikacji członków załóg statków morskich, Dz.U. 2018 poz. 702 (2018).
18. Sencila, V., Kalvaitiene, G. (2018). Finding a Balance: Companies and New Seafarers Generation Needs and Expectations. *TransNav, Vol. 12, No. 2*, pp. 285-290, doi: 10.12716/1001.12.02.08.
19. Tezcan, Ö., Erdem K., Oğuz A. (2020). A Study on Working and Living Conditions of Turkish Seafarers. *Journal of ETA Maritime Science, Vol. 8, No. 1*, pp. 22-37, doi: 10.5505/jems.2020.28290.
20. Thipwong, P., Wong, W.-K., Huang W.-T. (2020). Kano Model Analysis For Five-Star Hotels In Chiang Mai, Thailand. *Journal of Management Information and Decision Sciences, Vol. 23, No. 1*, pp. 1-6. Retrieved from: <https://www.scholarscentral.com/pdfs/1908/Kano-model-analysis-for-five-star-hotels-in-chiang-mait-thailand-1532-5806-23-1-175.pdf>.

21. Ulewicz, R. (2016). The use of Kano model for the classification of the elements of product quality. *Systemy Wspomagania w inżynierii Produkcji. Review of Problems and Solutions*, No. 3(15), pp. 117-126. Retrieved from: https://www.researchgate.net/publication/309557957_THE_USE_OF_KANO_MODEL_FOR_THE_CLASSIFICATION_OF_THE_ELEMENTS_OF_PRODUCT_QUALITY.
22. Walliman, N. (2022). *Research Methods the basics (Third Edition)*. London: Routledge.
23. Wiśniewska, M. (2009). Rozpoznanie i zaspokojenie wymagań klienta z wykorzystaniem modelu Kano. *Problemy Jakości*, No. 4, pp. 6-10.
24. Yadav, H.C., Jain, R., Singh, A.R., Mishra, P.K. (2017). Kano integrated robust design approach for aesthetical product design: a case study of a car profile. *Journal of Intelligent Manufacturing*, Vol. 28, pp. 1709-1727, doi: 10.1007/s10845-016-1202-5.
25. Yao, M.-L., Chuang, M.-C., Hsu, C.-C. (2018). The Kano Model Analysis of Features for Mobile Security Applications. *Computers & Security*, Vol. 78, pp. 336-346, doi: 10.1016/j.cose.2018.07.008.
26. Yildirim, U., Toygar, A., Çolakoğlu, C. (2022). Compensation effect of wages on decent work: A study on seafarers attitudes. *Marine Policy* 143(105155), doi: 10.1016/j.marpol.2022.105155.

GIG ECONOMY AND SUSTAINABLE DEVELOPMENT: BIBLIOMETRIC ANALYSIS AND IDENTIFICATION OF FUTURE RESEARCH DIRECTIONS

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Purpose: The aim of this article is to identify the most common fields of study undertaken by researchers in scientific papers covering simultaneously the gig economy and sustainable development.

Design/methodology/approach: The research study used a structured literature review method. The structured bibliometric query Q1 allowed for the exploration of the Scopus database. As a result, 48 scientific studies from the period 2017-2023 were selected for analysis, which simultaneously addressed the issues of the gig economy and sustainable development.

Findings: The analyses carried out showed that the issue of sustainable development is addressed in the context of the gig economy. This is a relatively new research area, as shown, for example, by the generated database of studies used for the bibliometric analyses conducted. The issues of sharing economy and decent work are important areas addressed in the context of the gig economy. It was noticed that there was a lack of author keywords covering 'green' issues.

Research limitations/implications: Research results based on other databases (e.g. Web of Science) may lead to different results. It should be noted that the different bibliometric databases do not overlap, which is related to the indexing of scientific journals or publications in the databases. Nonetheless, a universal query was used in the study, which can be used in the various bibliometric databases once it has been adapted to their respective query form. In addition, the various databases are constantly being supplemented with new scientific papers, which also depends on the publishing process. Hence, the content of the Q1 query can in future be used for comparison purposes with the results obtained, or to compare different bibliometric databases with each other.

Originality/value: In the discussion that followed, attention was drawn to the issues of green jobs and green self-employment. In the authors' opinion, such research directions, although not yet visible in the authors' keywords, will be developed soon in the context of studies covering the issues of the gig economy and sustainable development considering the green transformation of the economy taking place. This article is addressed to all those who are interested in the issues of the gig economy and sustainable development.

Keywords: gig economy, green jobs, green labor market, green self-employment, sustainable development.

Category of the paper: Literature review.

1. Introduction

The dynamics of changes in the field of socio-economic reality that have been taking place in recent years is recognized by numerous researchers in their scientific reflections (e.g. Kozar, 2019; Kulkova, 2021; Wood et al., 2023; Wright et al., 2017). These changes are the result of, among other things, the development of technology and increasing digitization in almost every sphere of socio-economic life (e.g. Carby-Hall, Méndez, 2020; Van Rensburg et al., 2019). One can observe, for example, the rise of artificial intelligence in many areas of the economy (e.g. Bickley et al., 2022; Makridis, Mishra, 2022), or the implementation of blockchain technology to improve different logistics processes (Raja Santhi, Muthuswamy, 2022; Wodnicka, 2019). The gradual transition of numerous countries to the path of sustainable development also has a not insignificant impact on the dynamics of the introduced solutions, in the opinion of the authors of this article. As a result, scholarly considerations are increasingly paying attention not only to the issue of the changing labor market (Westerveld, 2019), but also to the issue of shifting working conditions (Pichault, McKeown, 2019). It can be seen, for example, that with the development of technology and increased accessibility to the Internet, new models of employment are emerging (Cornelissen, Cholakova, 2021; Murdoch et al., 2021). Hence, given the issues outlined above, it is important to note that the discussion of the future of work is increasingly being addressed by researchers in the literature (e.g. Aroles et al., 2019; Borzaga et al., 2019; Wood, Lehdonvirta, 2023). Within the scope of this discussion, the issue of the gig economy has an important place (e.g. Graham et al., 2017; Mieruch, McFarlane, 2023; Shrivastava, Roy, 2020; Stewart, Stanford, 2017).

The gig economy is characterized by flexible and independent workers (Duggan et al., 2022; Kost et al., 2020; Mbali, Anyikwa, 2022), who often perform short-term projects or offer services on online platforms. The work provided in the gig economy can generally be divided into three key categories, namely on-demand work within apps (e.g. Dukes, 2022; Kaine, Josserand, 2019; Mehta, 2023), crowdwork (e.g. Connelly et al., 2021; Di Gangi et al., 2023; Shafiei Gol et al., 2019), and work related to operating resources for short-term rental (e.g. Huang et al., 2021; Monahan, 2021). It should also be noted that some researchers indicate that the development of the gig economy can support the transition to a low-carbon society (Liu et al., 2023). Thus, the gig economy, in the opinion of the authors of this article, can support the implementation of sustainable development into economic practice. Consequently, it can also contribute to the green transformation of the economy.

In terms of the gig economy, whether it is coupled with sustainable development, there is a shift away from classic models of work. We are then specifically talking about the provision of work and services or business through online platforms (e.g. Hagiú, Wright, 2019; Kässi, Lehdonvirta, 2018; Koutsimpogiorgos et al., 2020), remote work (e.g. Rochadiat et al., 2020; Tyutyuryukov, Guseva, 2021) and cloud working (e.g. Ruggieri et al., 2016; Tucker, 2020),

collaborative employment (Arriagada et al., 2023), algorithmic work (e.g. Altenried, 2021; Bucher et al., 2021; Wood et al., 2019) and work automation (e.g. Jarrahi et al., 2021; Nguyen, 2018). Given the multiplicity of issues related to work in the gig economy identified above, it can be pointed out that the further development of the gig economy challenges traditional labor market structures and requires the adaptation of laws and policies to both protect and better meet the needs of those working in this area. Hence the perceived calls for the creation of a new definition of a self-employed but economically dependent person (e.g. Gospodarek, 2019; Musiała, 2014; Santagata de Castro, 2019), or a worker subordinated to platforms (e.g. Kobroń-Gąsiorowska, 2023; Świątkowski, 2020).

The aim of the article is to identify the most common research areas undertaken by researchers in scientific papers simultaneously covering the gig economy and sustainable development. To achieve such a goal, the Scopus database was explored. To enable comparison of the obtained research results with other bibliometric studies, a structured literature review (SLR) method was adopted. This method, thanks to the use of a query (Q1), makes it possible to conduct an identical study in the future for comparative purposes (to identify the changes taking place in the research area undertaken). Bibliometric analyses were performed using the VOSviewer software (version 1.6.20). In addition to the SLR method, the study also used the classical literature review (CLR) method, which also allowed us to deepen the description of the results obtained and to conduct a discussion around the future directions of research relating to the issue of the gig economy around the issue of sustainable development.

In this article, four interrelated sections are distinguished. The introduction points out the timeliness and complexity of the research issue undertaken. This section of the article also outlines the purpose of the research, presents the basic research assumptions along with an indication of the base explored and the research methods adopted. The second section was directed at exploring the methodology. Here, among other things, the constructed Q1 question is presented, and attention is paid to the various research activities. In turn, the penultimate section presents the results of the bibliometric analyses undertaken. The section also includes a discussion and identifies future directions for gig economy research around the issue of sustainable development. The final section summarizes the analyses undertaken.

2. Research methodology

The study conducted was divided into three key research stages (stage I - conceptualization of the research, stage II - extraction of data from the analyzed database, stage III - analysis of the obtained results). At each stage, strictly defined research activities were carried out (Figure 1), which, implemented step by step, led to the realization of the set research aim.

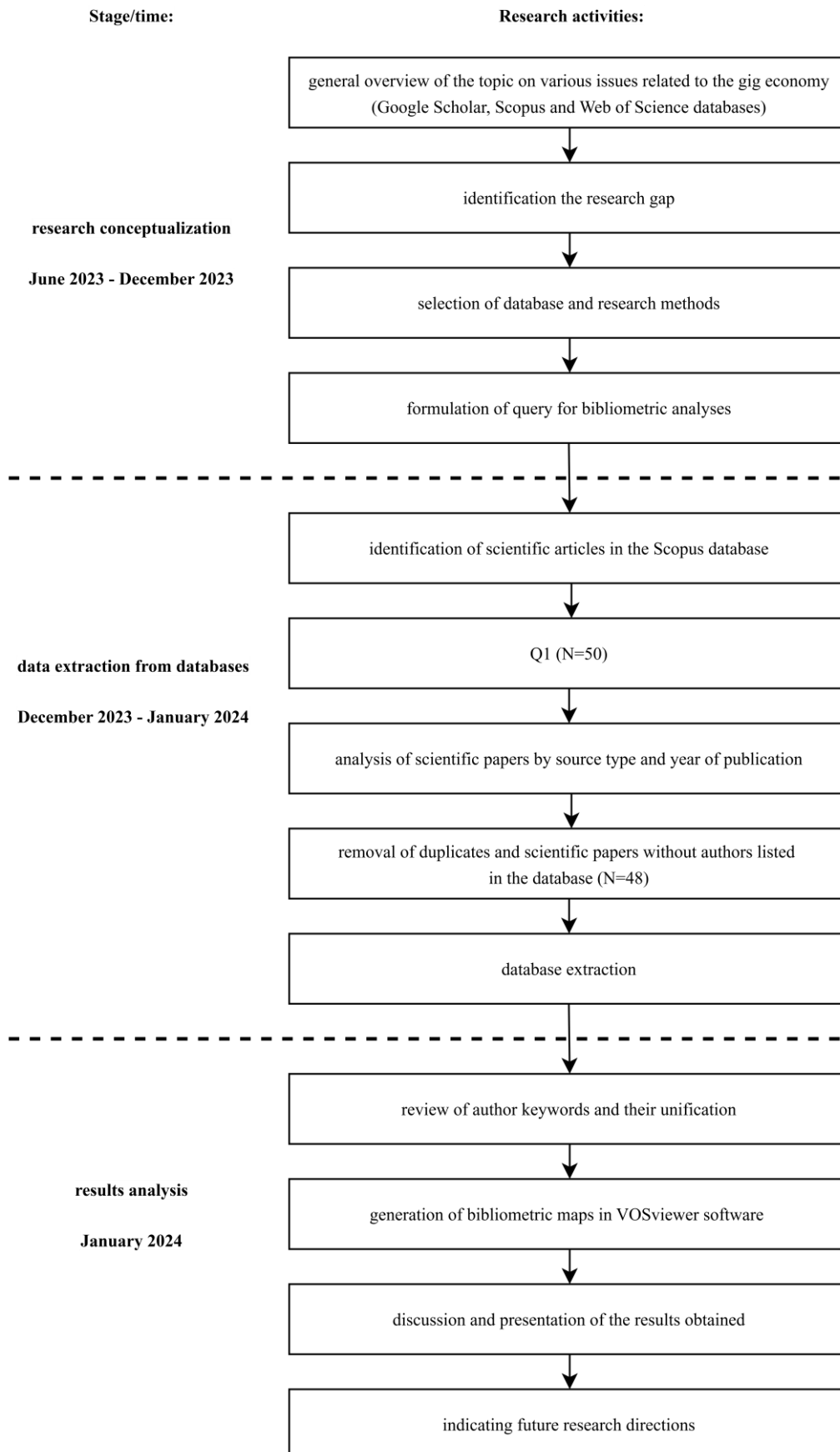


Figure 1. Research procedure stages and timeline.

Source: Authors' elaboration.

The research conceptualization stage began with a general review of scientific publications for gig economy issues. The review was conducted using Google Scholar and two bibliometric databases (Scopus and Web of Science databases). Based on the review, a research gap was recognized in the form of analyses in the gig economy and sustainable development. The research objective was then formulated. At this stage of the research, an appropriate quality database and research methods were also selected, which would identify the most common research areas undertaken by researchers in scientific papers covering both the gig economy and sustainable development. As a result, the Scopus database was selected.

The main rationale underlying the choice of the Scopus database was the fact that this database is considered by the scientific community to be a high-quality source of information (Baas et al., 2020). The indicated opinion is due, among other things, to the procedure for indexing scientific journals in this database after first meeting strict scientific standards. The Scopus database is characterized by international coverage and allows searching for information based on defined bibliometric queries. Moreover, it should be noted that the Scopus database has already been used for various types of bibliometric research in the area of the gig economy (e.g. Batmunkh et al., 2022; Guduru et al., 2023; Silva, Moreira, 2022). Due to the choice of SLR as a research method, a Q1 research query was constructed to explore the Scopus database (Table 1).

Table 1.
Search queries syntax details

Database	Symbol	Query syntax	No. results
Scopus	Q1	TITLE-ABS-KEY ("gig econom*" AND ("sustainable development" OR sustainability)) AND PUBYEAR > 2016 AND PUBYEAR < 2024 AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (PUBSTAGE, "final"))	50

Source: Authors' elaboration.

Based on the Q1 query, the second stage of the research involved the extraction of extracted data from the Scopus database. For this purpose, the titles, abstracts, and keywords of scientific papers available in the Scopus database were searched. Since the third stage of the research will involve bibliometric analysis considering the author's keywords using the VOSviewer software, it was assumed that only scientific papers written in English would be selected. Considering good practice in this type of analysis, the year in which the analysis is carried out was not included, so 2024 was omitted from the query. The query to the Scopus database initially selected 50 different scientific papers for further analysis (Table 2). At the next step of the analysis, those publications that did not have an assigned author were removed from the selected publications. This process contributed to the extraction of the final database of 48 scientific publications for further analysis related to the set research goal (date of extraction of the database 18.01.2024).

Table 2.

Scientific papers identified for research in Q1 query by source type and year of publication

Type of scientific paper source	Head in uppercase letters							Total
	2017	2018	2019	2020	2021	2022	2023	
Article	2	0	3	4	7	7	5	28
Conference paper	0	2	0	1	1	2	2	8
Book chapter	0	0	0	0	2	4	1	7
Book	0	0	1	0	2	2	0	5
Conference review	0	0	0	1	0	1	0	2
Total	2	2	4	6	12	16	8	50

Source: Authors' elaboration based on the Scopus database.

The final stage of the research presented in Figure 1 was based on the CLR method and bibliometric analysis using the VOSviewer software. Based on the review of the selected scientific studies, the obtained results of the undertaken considerations in the field of gig economy issues raised in the field of sustainability issues were presented, the discussion was carried out and conclusions were made.

3. Results and discussion

In terms of the 48 scientific publications analyzed, 221 author keywords were found to be assigned. The indicated set of authorial keywords was subjected to a standardization procedure, which aimed to standardize them in terms of the form of writing (e.g., due to differences in the linguistic notation of the same words - American English, British English, the use of singular or plural for a given word, or the use of various types of authorship abbreviations). The result was the substitution of three keywords (gig-economy for gig economy, smart cities for smart city, and 'gig' economy for gig economy), which also contributed to the final selection of 218 unique original author keywords for analysis. The minimum number of co-occurrences of a keyword accepted for research was two. Of the selected unique author keywords participating in the analyses, 17 met the indicated research threshold. In terms of such a score, two author keywords relating to the name of the country (Malaysia) and the research method used (bibliometric analysis) were excluded from further analysis. Hence, in the next stage of the research, based on the remaining 15 author keywords in a VOSviewer software, a visualization of their network of links was generated (Figure 2). The result was a bibliometric map of links consisting of four clusters representing the most frequently cited issues related to the gig economy based on original author keywords. The resulting visualization shows author keywords in the form of nodes. Between the nodes are lines representing the connections between each author keywords. The most frequent author keywords in the analyzed articles are distinguished on the bibliometric map by the size of the node.

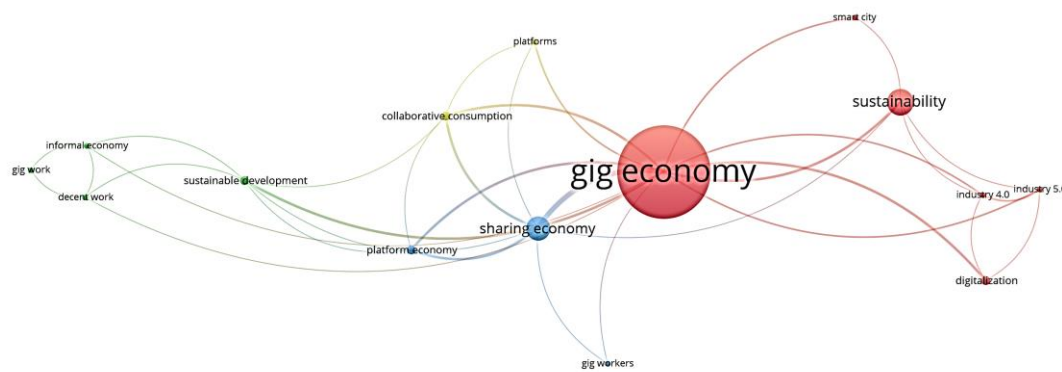


Figure 2. Bibliometric map of co-occurrence results of author's keywords based on the generated database for bibliometric analysis.

Source: Author's elaboration in VOSviewer software (version 1.6.20).

The construction of each of the four clusters is further presented in Table 3, where the color of a given cluster and the author keywords included in its scope are shown. The VOSviewer software assigned a given author keyword to only one cluster. The order of the listed author keywords in Table 3 is due to their alphabetical order. The number of co-occurrences (O) indicated in parentheses in Table 3 denotes the number of scientific papers (out of the 48 analyzed) in which a given word appeared as an author keyword. On the other hand, the number of links (L) indicates how many authorial keywords the analyzed keyword links to in the generated bibliometric map.

Table 3.
Keyword co-occurrence clusters presented in Figure 2

Cluster	Color	Keywords
1	red	digitalization (O = 3, L = 3); gig economy (O = 31, L = 13); industry 4.0 (O = 2, L = 4); industry 5.0 (O = 2, L = 4); smart city (O = 2, L = 2); sustainability (O = 9, L = 5)
2	green	decent work (O = 2, L = 4); gig work (O = 2, L = 2); informal economy (O = 2, L = 4); sustainable development (O = 3, L = 6)
3	blue	gig workers (O = 2, L = 2); platform economy (O = 3, L = 4); sharing economy (O = 8, L = 7)
4	yellow	collaborative consumption (O = 3, L = 5); platforms (O = 2, L = 3)

O - number of co-occurrences, L - number of links.

Source: Authors' elaboration in VOSviewer software (version 1.6.20).

The information presented in Table 3 indicates a variety of issues that have been raised by researchers in at least two different scientific papers, both of which referred to the gig economy and sustainable development. It is important to note that the issue of the role and importance of digitization for the gig economy is raised here in different contexts. For example, it should be emphasized here that the relationship between digitization, the gig economy and low-carbon development is discussed (Liu et al., 2023). Also noticeable are references to the issues of

industry 4.0 and industry 5.0 (Rahman et al., 2020). Although Rahman et al. (2019) highlights the changes taking place in business organizations in terms of moving away from the traditional reliance entirely on full-time employees. These changes can be observed in business organizations moving toward the gig economy and industry 5.0 (Rahman et al., 2019). The issue of the gig economy in the context of sustainability is also discussed when researchers explore the smart city issue (Bates et al., 2018; Khamis, 2021).

According to the authors of this article, a very important observed research area is the issue of decent work. In this area, scientific inquiries aimed at analyzing the potential of the gig economy for the creation of decent work are discernible (Cieslik et al., 2022), or the issue of decent working conditions for non-standard workers is raised (Loganathan, 2022). It should be emphasized at this point that one of the extremely important elements determining decent work and raised by researchers is the issue of decent working time (Rodrigues et al., 2021).

In addition to the issue of decent work, the literature also recognizes other issues related to gig workers. One of the issues raised is the lack of adequate legal protection for those who take up employment in this way. Hence, a kind of challenge in view of the development of the gig economy is the need to ensure the protection of gig workers' rights in the long term (Ahsan, 2020). This is very important, as many unethical practices are observed in the gig labor field (Kapoor, Agarwal, 2022). As the authors of this article recognize, unethical practices in the gig economy area are due, among other things, to the fact that this area of the economy is growing rapidly, while quite often there is a lack of adequate legal regulations to protect gig workers.

Also observed are references to the gig economy when discussing issues of collaborative consumption (Klarin, Suseno, 2021; Kozlenkova et al., 2021; Qureshi et al., 2021) and the sharing economy (Ahsan, 2020; Davies et al., 2017; Hart, Pomponi, 2021). The indicated issues are sometimes discussed simultaneously in the same scientific studies (Aditi, Bharti, 2021). According to the authors of the article, in the coming years, due to the growth of interest from researchers in the issues of the gig economy and the sharing economy, more studies combining the indicated research areas should be expected. In addition, considering the issue of sustainable development, discussions of issues related to various green research threads may also appear in such analyses in the future. Within the scope of the analyses carried out, a bibliometric map was also generated to indicate the changes occurring in the scope of the discussed issues over time (Figure 3).

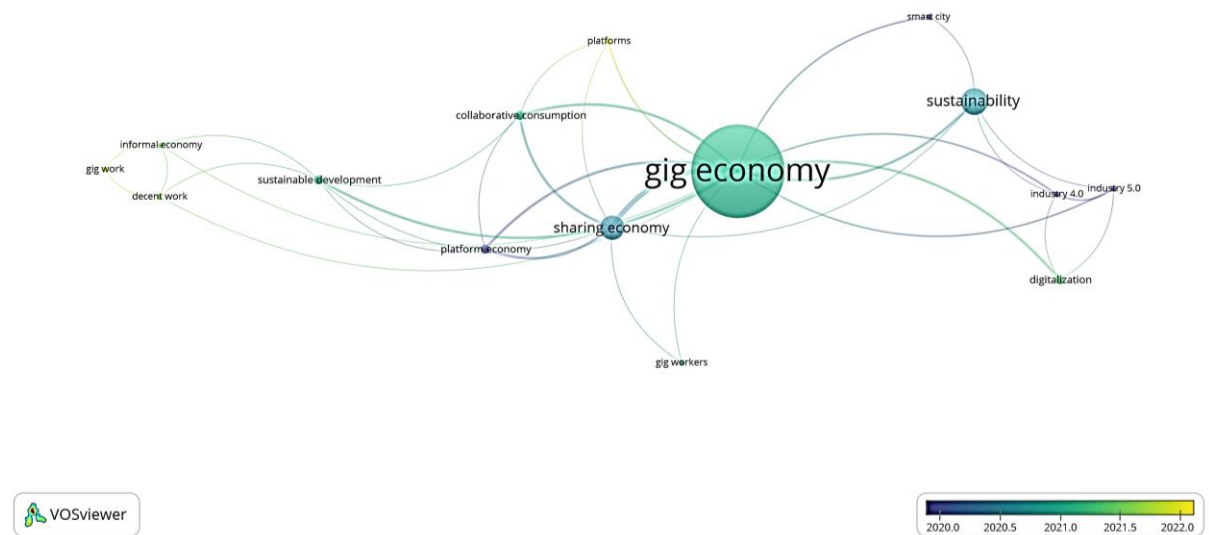


Figure 3. Overlay Visualization of co-occurrence results of author's keywords based on the generated database for bibliometric analysis.

Source: Author's elaboration in VOSviewer software (version 1.6.20).

The analyses carried out, illustrated in Figure 3, indicate the change over time of areas of interest on the part of researchers associated with the issue of the gig economy (the brighter the color, the more current the issue is in scientific inquiry). Nevertheless, at the same time it should be emphasized that the analyzed area is a new research thread that is still developing. The range of issues currently being addressed includes, among others, the already mentioned and discussed issues such as gig workers, gig work, or decent work. Nevertheless, these areas, in the opinion of the authors of this article in the context of sustainable development, and especially in the context of the issue of the economy undergoing a green transformation, still represent an unexplored research gap. There is a lack of research on the impact of gig economy development on the creation of green jobs, or on the development of green self-employment. It should be noted here that issues related to green jobs (Kavuş et al., 2023; Kozar, Sulich, 2023a; Tănasie et al., 2022) and green self-employment (Kozar, 2023; Kozar, Sulich, 2023b) are already a field of scientific consideration in various areas of the economy. So, a fundamental field of future scientific consideration addressed in scientific studies should be whether the development of the gig economy is conducive to the development of a green labor market. In addition, one of the future areas should be an attempt to define when and if gig workers can be called green gig workers at all. Perhaps in time, a model of the green gig economy, along with its key features, will be equally identified by researchers of the subject.

4. Summary

The analyses presented here showed the diversity of issues raised around the gig economy in scientific studies, where at the same time the issue of sustainable development is raised, which poses a significant challenge for researchers of the subject. It should be noted that the gig economy, along with the development of technology and increasing digitalization, is constantly evolving. Hence, it is necessary to see the need to develop appropriate mechanisms in individual countries, aimed at monitoring the development of the gig economy and emerging new solutions in this area, to be able to make appropriate legal changes, so that those who provide services in this way remain under adequate legal protection. Thus, the emergence of work based on online platforms, as part of the broader phenomenon known as the gig economy, poses a serious challenge to labor law regulations in individual countries, calling into question their validity. This aspect will increasingly be highlighted when discussing various issues related to gig economy labor issues (e.g., the issue of decent work), and especially when comparing good practices across countries.

In the analyses undertaken, it was not observed that the authors of the various scientific papers emphasized green research areas through keywords. Nevertheless, the development in this direction of the issue of the gig economy in the context of sustainable development in the opinion of the authors of this article is inevitable. Hence, given the specifics of the gig economy, it would be appropriate to start a discussion in the literature of who is a green self-employed but economically dependent person, or what characteristics a green worker subordinated to platforms should have. Research directed in such a direction would certainly allow for a much better indication of the role and importance of the gig economy in a sustainable development-oriented economy and would at the same time contribute to the development of research around the concept of a green labor market.

References

1. Aditi, Bharti, N. (2021). Sharing Economy in India: Looking Base of the Pyramid Through Critical Infrastructure. In: *Sharing Economy at the Base of the Pyramid* (pp. 173-196). Springer Nature Singapore. https://doi.org/10.1007/978-981-16-2414-8_8
2. Ahsan, M. (2020). Entrepreneurship and Ethics in the Sharing Economy: A Critical Perspective. *Journal of Business Ethics*, 161(1), 19-33. <https://doi.org/10.1007/s10551-018-3975-2>
3. Altenried, M. (2021). Mobile workers, contingent labour: Migration, the gig economy and the multiplication of labour. *Environment and Planning A: Economy and Space*,

- 0308518X2110548. <https://doi.org/10.1177/0308518X211054846>
4. Aroles, J., Mitev, N., de Vaujany, F. (2019). Mapping themes in the study of new work practices. *New Technology, Work and Employment*, 34(3), 285-299. <https://doi.org/10.1111/ntwe.12146>
 5. Arriagada, A., Bonhomme, M., Ibáñez, F., Leyton, J. (2023). The gig economy in Chile: Examining labor conditions and the nature of gig work in a Global South country. *Digital Geography and Society*, 5. <https://doi.org/10.1016/j.diggeo.2023.100063>
 6. Baas, J., Schotten, M., Plume, A., Côté, G., Karimi, R. (2020). Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quantitative Science Studies*, 1(1), 377-386. https://doi.org/10.1162/qss_a_00019
 7. Bates, O., Friday, A., Allen, J., Cherrett, T., McLeod, F., Bektas, T., Nguyen, T., Piecyk, M., Piotrowska, M., Wise, S., Davies, N. (2018). Transforming Last-mile Logistics. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, 2018-April*, 1-14. <https://doi.org/10.1145/3173574.3174100>
 8. Batmunkh, A., Fekete-Farkas, M., Lakner, Z. (2022). Bibliometric Analysis of Gig Economy. *Administrative Sciences*, 12(2). <https://doi.org/10.3390/admsci12020051>
 9. Bickley, S.J., Chan, H.F., Torgler, B. (2022). Artificial intelligence in the field of economics. *Scientometrics*, 127(4), 2055-2084. <https://doi.org/10.1007/s11192-022-04294-w>
 10. Borzaga, C., Salvatori, G., Bodini, R. (2019). Social and Solidarity Economy and the Future of Work. *Journal of Entrepreneurship and Innovation in Emerging Economies*, 5(1), 37-57. <https://doi.org/10.1177/2393957518815300>
 11. Bucher, E.L., Schou, P.K., Waldkirch, M. (2021). Pacifying the algorithm – Anticipatory compliance in the face of algorithmic management in the gig economy. *Organization*, 28(1), 44-67. <https://doi.org/10.1177/1350508420961531>
 12. Carby-Hall, J., Méndez, L.M. (2020). Labour law and the gig economy: challenges posed by the digitalisation of labour processes. In: *Labour Law and the Gig Economy: Challenges posed by the digitalisation of labour processes*. Taylor and Francis Inc. <https://doi.org/10.4324/9781003033721>
 13. Cieslik, K., Banya, R., Vira, B. (2022). Offline contexts of online jobs: Platform drivers, decent work, and informality in Lagos, Nigeria. *Development Policy Review*, 40(4). <https://doi.org/10.1111/dpr.12595>
 14. Connelly, C.E., Fieseler, C., Černe, M., Giessner, S.R., Wong, S.I. (2021). Working in the digitized economy: HRM theory & practice. *Human Resource Management Review*, 31(1), 100762. <https://doi.org/10.1016/j.hrmr.2020.100762>
 15. Cornelissen, J., Cholakova, M. (2021). Profits Uber everything? The gig economy and the morality of category work. *Strategic Organization*, 19(4), 722-731. <https://doi.org/10.1177/1476127019894506>
 16. Davies, A.R., Donald, B., Gray, M., Knox-Hayes, J. (2017). Sharing economies: moving

- beyond binaries in a digital age. *Cambridge Journal of Regions, Economy and Society*, 10(2), 209-230. <https://doi.org/10.1093/cjres/rsx005>
17. Di Gangi, P.M., Howard, J.L., Goh, S.H., Thatcher, J.B. (2023). Do you see what I see? A social capital perspective on microtask gig worker opportunity recognition within electronic networks of practice. *International Journal of Information Management*, 69, 102615. <https://doi.org/10.1016/j.ijinfomgt.2022.102615>
 18. Duggan, J., Sherman, U., Carbery, R., McDonnell, A. (2022). Boundaryless careers and algorithmic constraints in the gig economy. *The International Journal of Human Resource Management*, 33(22), 4468-4498. <https://doi.org/10.1080/09585192.2021.1953565>
 19. Dukes, R. (2022). On demand work as a legal framework to understand the gig economy. In: *A Research Agenda for the Gig Economy and Society* (pp. 133-148). Edward Elgar Publishing Ltd. <https://doi.org/10.4337/9781800883512.00015>
 20. Gospodarek, G. (2019). Status „niezależnego” usługodawcy a trójpodmiotowy model świadczenia usług w gig economy — cz. 1. *Praca i Zabezpieczenie Społeczne*, 2019(2), 9-17. <https://doi.org/10.33226/0032-6186.2019.2.3>
 21. Graham, M., Hjorth, I., Lehdonvirta, V. (2017). Digital labour and development: impacts of global digital labour platforms and the gig economy on worker livelihoods. *Transfer: European Review of Labour and Research*, 23(2), 135-162. <https://doi.org/10.1177/1024258916687250>
 22. Guduru, S., Santhanam, N., Pushparaj, N. (2023). Comprehending the research on the gig economy: a bibliometric approach. *Global Knowledge, Memory and Communication*. <https://doi.org/10.1108/GKMC-02-2023-0056>
 23. Hagi, A., Wright, J. (2019). The status of workers and platforms in the sharing economy. *Journal of Economics & Management Strategy*, 28(1), 97-108. <https://doi.org/10.1111/jems.12299>
 24. Hart, J., Pomponi, F. (2021). A Circular Economy: Where Will It Take Us? *Circular Economy and Sustainability*, 1(1), 127-141. <https://doi.org/10.1007/s43615-021-00013-4>
 25. Huang, Y., Chen, Y., Tan, C.H. (2021). Regulating new digital market and its effects on the incumbent market: Investigation of online peer-to-peer short-term rental. *Information & Management*, 58(8), 103544. <https://doi.org/10.1016/j.im.2021.103544>
 26. Jarrahi, M.H., Newlands, G., Lee, M.K., Wolf, C.T., Kinder, E., Sutherland, W. (2021). Algorithmic management in a work context. *Big Data & Society*, 8(2), 205395172110203. <https://doi.org/10.1177/20539517211020332>
 27. Kaine, S., Josserand, E. (2019). The organisation and experience of work in the gig economy. *Journal of Industrial Relations*, 61(4), 479-501. <https://doi.org/10.1177/0022185619865480>
 28. Kapoor, K., Agarwal, A. (2022). Impact of Gig Economy on Unethical Work Practices and Work Culture Adopted by Gig Organizations—Sustainability Concerns for the Future. In: *Sustainability in the Gig Economy* (pp. 137-149). Springer Nature Singapore.

- https://doi.org/10.1007/978-981-16-8406-7_10
29. Kässä, O., Lehtonvirta, V. (2018). Online labour index: Measuring the online gig economy for policy and research. *Technological Forecasting and Social Change*, 137, 241-248. <https://doi.org/10.1016/j.techfore.2018.07.056>
 30. Kavuş, H.K., Erköse, Y., Eryar, D. (2023). Driving Green Job Opportunities in Sustainable Waste Management through Co-Production Strategies: Informal Recycling Workers, Municipalities, and the National Agenda—A Case Study of İzmir. *Social Sciences*, 12(7), 387. <https://doi.org/10.3390/socsci12070387>
 31. Khamis, A. (2021). Smart Mobility. In: *Smart Mobility: Exploring Foundational Technologies and Wider Impacts*. Apress. <https://doi.org/10.1007/978-1-4842-7101-8>
 32. Klarin, A., Suseno, Y. (2021). A state-of-the-art review of the sharing economy: Scientometric mapping of the scholarship. *Journal of Business Research*, 126, 250-262. <https://doi.org/10.1016/j.jbusres.2020.12.063>
 33. Kobroń-Gąsiorowska, Ł. (2023). „Pracownicy zależni” w gospodarce Gig w ujęciu standardów prawa międzynarodowego – aktualne wyzwania. *Kwartalnik Prawa Międzynarodowego*, II(II), 161-173. <https://doi.org/10.5604/01.3001.0053.6686>
 34. Kost, D., Fieseler, C., Wong, S.I. (2020). Boundaryless careers in the gig economy: An oxymoron? *Human Resource Management Journal*, 30(1), 100-113. <https://doi.org/10.1111/1748-8583.12265>
 35. Koutsimpogiorgos, N., van Slageren, J., Herrmann, A.M., Frenken, K. (2020). Conceptualizing the Gig Economy and Its Regulatory Problems. *Policy and Internet*, 12(4), 525-545. <https://doi.org/10.1002/poi3.237>
 36. Kozar, Ł.J. (2019). Zielone miejsca pracy. Uwarunkowania – identyfikacja – oddziaływanie na lokalny rynek pracy. In: *Zielone miejsca pracy. Uwarunkowania – identyfikacja – oddziaływanie na lokalny rynek pracy*. Wydawnictwo Uniwersytetu Łódzkiego. <https://doi.org/10.18778/8142-836-1>
 37. Kozar, Ł.J. (2023). Self-employment and Sustainable Development-Using the ICT Solutions for Greening Economic Activity. *Procedia Computer Science*, 225, 468-475. <https://doi.org/10.1016/j.procs.2023.10.031>
 38. Kozar, Ł.J., Sulich, A. (2023a). Green Jobs in the Energy Sector. *Energies*, 16(7), 3171. <https://doi.org/10.3390/en16073171>
 39. Kozar, Ł.J., Sulich, A. (2023b). The Development of Employees’ Green Competencies Through Sustainable Business Practices. *Forum Scientiae Oeconomia*, 11(3), 127-143. https://doi.org/10.23762/FSO_VOL11_NO3_7
 40. Kozlenkova, I.V., Lee, J.-Y., Xiang, D., Palmatier, R.W. (2021). Sharing economy: International marketing strategies. *Journal of International Business Studies*, 52(8), 1445-1473. <https://doi.org/10.1057/s41267-020-00393-z>
 41. Kulkova, I. (2021). Socio-cultural Consequences of Population Adaptation Towards Dynamic Development Caused by Digitalization. *Lecture Notes in Information Systems and*

- Organisation*, 45, 157-166. https://doi.org/10.1007/978-3-030-71397-3_12
42. Liu, K., Feng, Z., Zhang, Q. (2023). Examining the role of digitalization and gig economy in achieving a low carbon society: an empirical study across nations. *Frontiers in Environmental Science*, 11. <https://doi.org/10.3389/fenvs.2023.1197708>
 43. Loganathan, M. (2022). Assessing Social Sustainability in the Gig Economy. *The Indian Journal of Labour Economics*, 65(3), 831–843. <https://doi.org/10.1007/s41027-022-00399-1>
 44. Makridis, C.A., Mishra, S. (2022). Artificial Intelligence as a Service, Economic Growth, and Well-Being. *Journal of Service Research*, 25(4), 505-520. <https://doi.org/10.1177/10946705221120218>
 45. Mbali, A., Anyikwa, I. (2022). *The Gig Economy, Digital Labour Platforms, and Independent Employment in the Eastern Cape*. March, 1-29. <https://doi.org/10.25828/7tn9-1998>
 46. Mehta, B.S. (2023). Changing Nature of Work and the Gig Economy: Theory and Debate. *FIIB Business Review*, 12(3), 227-237. <https://doi.org/10.1177/2319714520968294>
 47. Mieruch, Y., McFarlane, D. (2023). Gig Economy Riders on Social Media in Thailand: Contested Identities and Emergent Civil Society Organisations. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, 34(6), 1232-1242. <https://doi.org/10.1007/s11266-022-00547-7>
 48. Monahan, T. (2021). Recoding the city: cultural mediation of short-term rental platforms in the US. *Cultural Studies*, 35(4-5), 946-967. <https://doi.org/10.1080/09502386.2021.1895258>
 49. Murdoch, G., Maurer, L., Smale, A.C., Mirabella, A., Poras, G., D’Anthonay, E., Rogel, D. (2021). Taxation of Workers in the Gig Economy: A European Perspective. *Intertax*, 49(1), 71-81.
 50. Musiała, A. (2014). Anna Musiała: Prawna problematyka świadczenia pracy przez samozatrudnionego ekonomicznie zależnego. *Monitor Prawa Pracy*, 2, 69-73.
 51. Nguyen, D. (2018). The University in a World of Digital Technologies: Tensions and Challenges. *Australasian Marketing Journal*, 26(2), 79-82. <https://doi.org/10.1016/j.ausmj.2018.05.012>
 52. Pichault, F., McKeown, T. (2019). Autonomy at work in the gig economy: analysing work status, work content and working conditions of independent professionals. *New Technology, Work and Employment*, 34(1), 59-72. <https://doi.org/10.1111/ntwe.12132>
 53. Qureshi, I., Bhatt, B., Shukla, D.M. (2021). Sharing Economy at the Base of the Pyramid. In: I. Qureshi, B. Bhatt, D.M. Shukla (Eds.), *Sharing Economy at the Base of the Pyramid: Opportunities and Challenges*. Springer Nature Singapore. <https://doi.org/10.1007/978-981-16-2414-8>
 54. Rahman, N.A.A., Mohammad, M.F., Ghafar, N.H., Moin, M.I.A., Ali, A. (2020). The salient motives for Malaysia aviation industry sustainability: An explorative study on

- business, management and technology components in aviation management program in Malaysia. *International Journal of Supply Chain Management*, 9(3), 81-93.
55. Rahman, N.A.A., Muda, J., Mohammad, M.F., Ahmad, M.F., Rahim, S.A., Fernando, M.V. (2019). Digitalization and leap frogging strategy among the supply chain member: Facing GIG economy and why should logistics players care? *International Journal of Supply Chain Management*, 8(2), 1042-1048.
56. Raja Santhi, A., Muthuswamy, P. (2022). Influence of Blockchain Technology in Manufacturing Supply Chain and Logistics. *Logistics*, 6(1), 15. <https://doi.org/10.3390/logistics6010015>
57. Rochadiat, A.M.P., Tong, S.T., Hancock, J.T., Stuart-Ulin, C.R. (2020). The Outsourcing of Online Dating: Investigating the Lived Experiences of Online Dating Assistants Working in the Contemporary Gig Economy. *Social Media + Society*, 6(3), 205630512095729. <https://doi.org/10.1177/2056305120957290>
58. Rodrigues, I.P., Schreier, C., Steiner, E., Zemp, M. (2021). SHIFTING TO GIG LABOUR: PERCEPTIONS OF SUSTAINABILITY. *ABAC Journal*, 41(4), 247-271. <https://doi.org/10.14456/abacj.2021.12>
59. Ruggieri, A., Mosconi, E.M., Poponi, S., Silvestri, C. (2016). Digital Innovation in the Job Market: An Explorative Study on Cloud Working Platforms. *Lecture Notes in Information Systems and Organisation, Vol. 11*. Springer Heidelberg, pp. 273-283. https://doi.org/10.1007/978-3-319-23784-8_21
60. Santagata de Castro, R. (2019). Rethinking the concept of employee: the digital transformation of work in Germany and in Italy. *Monitor Prawa Pracy*, 4, 20-24.
61. Shafiei Gol, E., Stein, M.-K., Avital, M. (2019). Crowdwork platform governance toward organizational value creation. *The Journal of Strategic Information Systems*, 28(2), 175-195. <https://doi.org/10.1016/j.jsis.2019.01.001>
62. Shrivastava, A., Roy, G. (2020). Future of Gig Economy: Opportunities and Challenges. *IMI Konnect*, 9(1), 14-25.
63. Silva, B.C., Moreira, A.C. (2022). Entrepreneurship and the gig economy: A bibliometric analysis. *Cuadernos de Gestión*, 22(2), 23-44. <https://doi.org/10.5295/cdg.211580am>
64. Stewart, A., Stanford, J. (2017). Regulating work in the gig economy: What are the options? *The Economic and Labour Relations Review*, 28(3), 420-437. <https://doi.org/10.1177/1035304617722461>
65. Świątkowski, A. (2020). Status stron cyfrowych stosunków prawnych: casus firmy przewozowej Uber. *Roczniki Administracji i Prawa*, 4(XX), 245-259. <https://doi.org/10.5604/01.3001.0014.8438>
66. Tănăsie, A.V., Năstase, L.L., Vochița, L.L., Manda, A.M., Boțoteanu, G.I., Sitnikov, C.S. (2022). Green Economy—Green Jobs in the Context of Sustainable Development. *Sustainability*, 14(8), 4796. <https://doi.org/10.3390/su14084796>
67. Tucker, E. (2020). Towards a political economy of platform-mediated work. *Studies in*

- Political Economy*, 101(3), 185-207. <https://doi.org/10.1080/07078552.2020.1848499>
68. Tyutyuryukov, V., Guseva, N. (2021). From remote work to digital nomads: tax issues and tax opportunities of digital lifestyle. *IFAC-PapersOnLine*, 54(13), 188-193. <https://doi.org/10.1016/j.ifacol.2021.10.443>
69. Van Rensburg, N.J., Telukdarie, A., Dhamija, P. (2019). Society 4.0 applied in Africa: Advancing the social impact of technology. *Technology in Society*, 59, 101125. <https://doi.org/10.1016/j.techsoc.2019.04.001>
70. Westerveld, M. (2019). The Netherlands: solo self-employment and labour on demand. In: *Social Security Outside the Realm of the Employment Contract: Informal Work and Employee-like Workers* (pp. 220-237). Edward Elgar Publishing Ltd. <https://doi.org/10.4337/9781788113403.00020>
71. Wodnicka, M. (2019). Technologie blockchain przyszłością logistyki. *Zeszyty Naukowe Małopolskiej Wyższej Szkoły Ekonomicznej w Tarnowie*, 41(1), 43-54. <https://doi.org/10.25944/ZNMWSE.2019.01.4354>
72. Wood, A.J., Graham, M., Lehdonvirta, V., Hjorth, I. (2019). Good Gig, Bad Gig: Autonomy and Algorithmic Control in the Global Gig Economy. *Work, Employment and Society*, 33(1), 56-75. <https://doi.org/10.1177/0950017018785616>
73. Wood, A.J., Lehdonvirta, V. (2023). Platforms Disrupting Reputation: Precarity and Recognition Struggles in the Remote Gig Economy. *Sociology*, 57(5), 999-1016. <https://doi.org/10.1177/00380385221126804>
74. Wood, A.J., Martindale, N., Lehdonvirta, V. (2023). Dynamics of contention in the gig economy: Rage against the platform, customer or state? *New Technology, Work and Employment*, 38(2), 330-350. <https://doi.org/10.1111/ntwe.12216>
75. Wright, C.F., Wailes, N., Bamber, G.J., Lansbury, R.D. (2017). Beyond National Systems, Towards a 'Gig Economy'? A Research Agenda for International and Comparative Employment Relations. *Employee Responsibilities and Rights Journal*, 29(4), 247-257. <https://doi.org/10.1007/s10672-017-9308-2>

USING QUASI-EXPERIMENTAL DESIGNS FOR CAUSAL EFFECTS

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Purpose: This paper discusses the concept of identifying the causal effects using quasi-experimental methods and applies this method to investigate the impact of high license fees on the quality of mobile Internet in Poland.

Design/methodology/approach: Quasi-experiment design, especially the difference-in-differences method and the interrupted time series design were used to examine the causal effects of spectrum fees in Poland. Data on the quality of mobile Internet in Poland and around the world published by Akamai and data provided by Ookla® under the agreement¹ were used for analysis.

Findings: The study did not confirm the impact of high spectrum fees on the quality of the Internet in Poland.

Practical implications: The results obtained can help policymakers in Poland and other countries in making decisions on spectrum management.

Originality/value: This is the first paper using the quasi-experimental method to examine the effects of the 4G auction in Poland.

Keywords: quasi-experiment, difference in difference (DiD), interrupted time series design (ITS), spectrum auction, mobile Internet market.

Category of the paper: Research paper.

1. Introduction

One of the key issues in scientific research is uncovering causal effects between the analyzed phenomena (Angrist, Piszke, 2009). This issue is particularly important in public policy research. Causal inference supports the evaluation of implemented policies or interventions, like the effects of an aid program or changes in tax law, as well as helps predict the consequences of changing regulations and facilitates policymakers in future decisions.

¹ Data provided by Ookla® based on John Paul II University in Biała Podlaska analysis of Speedtest Intelligence® data from 2017 to 2020. Ookla® trademarks used under license and reprinted with permission.

Identifying the real links between an effect and a cause is quite difficult and connected with many methodological problems. In fact, it is difficult to prove that a given effect (e.g., a decrease in traffic accidents) is the result of specific interventions, such as changes in traffic regulations, rather than the result of other, not included factors. Despite methodological difficulties, a disturbing trend can be observed in empirical research, involving the misuse of the interpretation of the results obtained in terms of causal relationships, including the excessive use of the term "impact" in the titles of research papers (Imai, 2008; Sagan, 2011). It is also quite common, especially in survey research, to use the so-called subjective confirmation of causality, where the existence of causality (e.g., the effects of implementing an aid program) is inferred based on respondents' subjective opinions on the subject, rather than on reliable measurements of specific evaluation metrics (Sagan, 2015).

It is also common practice to draw conclusions on causation based only on the correlation observed between variables. Correlation refers to the situation when changes in one variable co-occur with changes in another variable, which, however, does not necessarily mean that the relationship identified from empirical data is causal. In reality, it may, for example, be the result of a third variable not included in the study (called a confounding factor), which affects both variables causing the correlation between variables to be a spurious relationship. An additional problem in correlation studies is that it is often not possible to determine the direction of the relationship (indicate which variable came first e.g. is the cause). In addition, the same variable can be both cause and effect, i.e. there can be a feedback loop between two variables that interact with each other. For studies involving multiple variables, endogeneity between explanatory variables can also add additional complications for researchers (Shadish, Cook, Campbell, 2002; Sagan, 2011).

The most reliable method of identifying causality is a randomized controlled trial (RCT), which, by manipulating the factor analyzed and random assignment, eliminates the problem of confounding factors and directionality allowing the discovery of causal effects (Coleman, 2019). In medicine they are a natural way of conducting experiments, and are considered the "gold standard", but in the social sciences implementation of RCT is difficult and often even impossible. In such cases, quasi-experimental designs are increasingly used, which under certain conditions, despite undermining the assumptions of a typical experiment, can be as reliable as RCTs (Shadish et al., 2002; Kim, Steiner, 2016).

The paper aims to present the concept of identifying causal effects by the quasi-experimental design and to exemplify this method on the basis of the mobile Internet market in Poland. Quasi-experiment is a relatively new approach in economic studies, so we believe, that our paper can contribute to the spread of this method among Polish researchers. This study is a continuation of the author's research on spectrum auctions (Kuś, 2020, 2022) and the potential impact of high license fees on the mobile Internet market (Kuś, 2023).

In the following part of the paper, the background for quasi-experimental design is presented, and two major statistical techniques used in conducting this type of research are presented: the difference-in-differences method and the interrupted time series design (in single and multiple group versions). Section 4 presents an example of using a quasi-experimental project on the basis of the mobile internet market in Poland

2. Quasi-experimental designs as a tool for causal inference

The most appropriate and reliable method for discovering causal relationships is experiment. Unlike correlation and regression analysis, which can only determine the direction and strength of a relationship, experiments can additionally provide insight into how a change in one factor leads to changes in another. By manipulating the factor of interest with other conditions left unchanged, it is possible to see a potential causal factor and have more confidence that what has changed is responsible for the outcome or effect we observed (Coleman, 2019; Shadish et al., 2002).

The basis of causal inference is counterfactual analysis. The counterfactual is something that contradicts facts. In an experiment, we observe what happened to individuals after the analyzed factor (intervention, policy or program) was worked. The counterfactual state is a hypothetical result, that tells what would have happened to the same individuals if they simultaneously had not been exposed to it (if the intervention had not occurred). In reality, however, this alternative (hypothetical) state is never observed, since the same individuals can't be and not be exposed to the intervention at the same time. Consequently, the main task in experimental design is to create reasonable approximations of this physically impossible counterfactual scenario and to understand how it differs from the actual state (Shadish et al., 2002). To do this, it is necessary to identify two groups of participants: an experimental (treatment) group consisting of individuals exposed to the factor or intervention, and a control group which are not exposed to it. The inclusion of a control group captures what the results would have been if the program (policy) had not been implemented (i.e., it identifies the alternative scenario). The effect is the difference between what happened when exposure to the factor/intervention took place and what would have happened if it had not. This simultaneously isolates and tests the effects of one factor and increases confidence that the effect is caused by the analysed factor and not something else (Coleman, 2019).

The most perfect form of experiment is the randomized controlled trial (RCT), the development of which is widely credited to Ronald Fisher (Shadish et al., 2002). Its characteristic feature is the random assignment to groups (e.g., by flipping a coin), which ensures that they are probabilistically similar and increases certainty that observed differences in outcomes between the groups at the end of the experiment are the result of the intervention

not to differences between groups that already existed at the beginning of the trial (Shadish et al., 2002).

Despite many advantages of randomized experiments, there are situations in which random assignment or inclusion of control groups is difficult or even impossible. This is the case, for example, with nationwide interventions (involving all individuals), those that have occurred in the past or interventions where ethical, political or logistical constraints exclude random assignment. In such situations, quasi-experimental designs can be an effective way to learn about causal effects (Turner et al., 2021). In these projects, a program or policy is viewed as an "intervention" whose effects are studied in terms of achieving its goals measured by a predetermined set of metrics. Recent innovations allow researchers to treat quasi-experimental design similarly to randomized studies and obtain equally reliable results (Wing, Simon, Bello-Gomez, 2018; White, Sabarwal, 2014).

Quasi-experiments, like RCT projects, are designed to test causal hypotheses and share with them many technical details, such as the common use of control groups and pre-test measurements. A quasi-experimental design, however, by definition lacks random assignment. Assignment to conditions (experimental group and control group) is most often determined by the researcher or is done by the participant's own choice (White, Sabarwal, 2014; Shadish et al., 2002). Unlike traditional experiments, in which an intervention is introduced purposely to observe its effects, quasi-experimental designs are often conducted retrospectively, i.e. after the intervention has been implemented. However, it is always strongly recommended that, if possible, evaluation planning should begin before the intervention, since this method requires pre-intervention data that is not always available post facto

A special case of quasi-experiments are so-called natural experiments, in which a naturally occurring incident, unplanned and uncontrolled for research purposes, such as an earthquake or an unexpected migrant influx, plays the role of the intervention. This incident is independent of the ongoing processes and affects only a portion of the individuals, which is an exogenous source of variation in the dependent variable and provides a naturally occurring contrast between treatment and control groups (Meyer, 1995).

The fact that in a quasi-experiment, participants are not randomly assigned may raise concerns that individuals in the control group may differ from those in the experimental group in several systematic (non-random) ways, other than exposure to the intervention (selection bias). In such situations, the observed differences between the two groups in the indicators of interest (values of the dependent variable) may be due, in whole or in part, to poor matching rather than to the intervention. Thus, when designing a quasi-experimental study, it is necessary to identify a comparison group that is as similar as possible to the experimental group in terms of baseline (pre-intervention) characteristics and also to use an appropriate methodology that corrects for any differences (White, Sabarwal, 2014). This issue will be discussed in the next section.

3. Statistical techniques used in quasi-experimental designs

In this section, we will discuss two basic methods of data analysis for measuring causal effects in quasi-experimental projects.

3.1. The Difference-in-Differences method

One of the most well-known and oldest techniques used to estimate causal relationships based on quasi-experiments is the difference-in-difference (DiD) method. This method is currently employed in econometrics, but the underlying logic called the controlled before-and-after study, was applied as early as the 1850s by John Snow to study the causal effects of the spread of the cholera epidemic in London (Goldman-Bacon, 2021).

DiD design is typically used to estimate the effects of interventions or changes in policies (e.g., tax policy). The essence of this method is to compare the differences in outcomes (measured by a predefined indicator - Y) before and after the intervention between the individuals exposed (the experimental group) and those who are not exposed to it (the control group).

The great attractiveness of the DiD method comes from its simplicity, as well as its potential to avoid many problems related to endogeneity that often arise when studying causal effects (Meyer, 1995). DiD designs can be used in settings where interchangeability between experimental and control groups cannot be assumed, making this method a good approach for quasi-experimental studies, where randomization at the individual level is not possible for various reasons. Due to intuitive methodology, this approach is widely used in research on public policy, health care, economics and many others, including for evaluating the effectiveness of European Union support programs (Bondonio, 2021).

One of the most widely cited publications using the difference-in-differences method is Card and Krueger's study on the effect of increased minimum wage on employment in fast-food restaurants in New Jersey (Card, Krueger, 1994). Using neighbouring Pennsylvania as a natural control group (the minimum wage was not changed in that state), they revealed that, contrary to classical economic theories, raising the minimum wage did not increase employment. These results contributed to the spread of quasi-experimental research using the DiD method in economics, leading David Card to receive the A. Nobel Prize in 2021.

The DiD project provides a stronger estimate of impact than a simple comparison of differences in outcomes between the treatment and control groups after the intervention. Simple before-and-after outcome comparisons can be affected by temporary trends in the outcome variable or other events that occurred between the two periods compared. The difference-in-differences method removes biases in post-intervention period comparisons between the experimental and control groups that may be due to permanent differences between these groups (including differences that may have already existed at the beginning of the study),

as well as biases from comparisons over time in the test group that may be due to trends caused by other causes (Difference-in-Difference Estimation, 2023; White, Sabarwal, 2014).

The main limitation of the DiD method is the parallel trend assumption, which states that if there had been no intervention, the difference between the experimental and the control group would have been constant, i.e. it would have remained the same in the post-intervention period as in the pre-intervention period. This allows DiD to include unobserved variables that are assumed to remain constant over time (White, Sabarwal, 2014).

Trend parallelism is by nature unobservable in DiD projects. This assumption is intended to determine the alternative (counterfactual) scenario, i.e., what would have happened if the intervention had not occurred. Although there is no statistical test to verify this assumption, in situations where we have observations at multiple time points, it can be helpful to visually control the data and examine trends before the intervention to see if exposed and unexposed groups followed similar trajectories. This step is not always possible, as the DiD method compares only two points data: before and after the intervention, and does not require data from multiple time points.

Most often, a linear econometric model is used to estimate the difference in differences. To isolate the analyzed effect it controls independent changes within groups over time (effects of confounding variables) and between groups (baseline differences). In the standard version with two variables, the DiD method corresponds to the following econometric multivariate regression model (Sagan, 2011):

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 Z_i + \beta_3 X_i Z_i + \xi_i \quad (1)$$

where:

Y – dependent variable (outcome variable),

X – dummy variable describing the state: (X = 0 – before intervention, X = 1 – after intervention),

Z – dummy variable representing the group (Z = 0 – control group, Z = 1 – experimental group).

The ordinary least squares (OLS) method is commonly used to estimate model parameters. The estimate of the effect of interest, i.e., those changes that are associated with both groups (experimental and control) and state (before and after intervention) is the coefficient β_3 standing by the interaction $X_i Z_i$. It determines the difference in slope (difference in differences) between the two groups before and after the intervention, i.e. it estimates how much more the dependent variable increased (or decreased - depending on the sign of the coefficient) in the experimental group compared to the control group. The remaining parameters of the model (1) have the following interpretation: the parameter β_0 estimates the average value of the dependent variable in the control group before the intervention, β_1 determines the difference in the outcome before

and after the intervention in the control group, and β_2 estimates the difference between the groups in the pre-intervention period.

The adoption of the regression method makes it possible to verify the model and assess its internal consistency. By including additional explanatory variables, confounding factors can also be controlled, making DiD estimation more robust to errors.

3.2. Interrupted time series design

The DiD design discussed in the previous section usually refers to a controlled "before-and-after" study in which the outcome is measured at one baseline (before the intervention) and one time point after the intervention, or the average outcomes are compared before and after the intervention, but where the variable representing time is not included in the model. The counterfactual in this method is estimated from the control group only, and it is assumed that both groups' trends are parallel. Although some approaches can be used to increase the similarity of the two groups, the assumption of parallel trends in the DiD design is not always verifiable, which may raise concerns about the validity of the results obtained.

An alternative approach to studying causal effects (effects of interventions) is the interrupted time series design (ITS), which uses multiple sequential observations before and after an intervention and takes time into account. To use this method, data on the outcomes of interest (the dependent variable) spread over equally spaced intervals (e.g., months, quarters) are required.

The simplest version of the ITS design (named single group ITS) does not include a control group and is based on the following multiple regression model (Linden, Arbor, 2015):

$$Y_t = \beta_0 + \beta_1 t + \beta_2 X_t + \beta_3 t X_t + \xi_t \quad (2)$$

where:

Y_t – dependent variable (outcome variable) measured at each equally distributed time point t ($t = 1, 2, \dots, N$),

t – variable determining the time since the start of the study ($t = 1, 2, \dots, N$),

X_t – dummy variable representing the intervention ($X_t = 0$ before the intervention, $X_t = 1$ after the intervention).

The coefficients of the model defined by formula (2) have the following interpretation: β_0 specifies the initial level of the outcome variable Y , β_1 estimates the slope until the introduction of the intervention, β_2 represents the change in the level of the dependent variable observed immediately after the introduction of the intervention (compared to the counterfactual) and β_3 represents the difference between the slope of the outcome before and after the intervention. Evidence of the causal effect of the intervention is provided by the significance of the parameters β_2 (immediate effect) and β_3 (over time effect).

The counterfactual scenario in the interrupted time series model without a comparison group is estimated by extrapolating the pre-intervention trend, and it is assumed that the trend will remain unchanged in the absence of intervention. Since observations are made in the same population, differences between groups do not create a problem, and the strict time structure makes it possible to control for underlying trends and temporally changing confounders. The main threat to interrupted time series designs without a control group is the possibility of co-occurring events with the intervention (historical or instrumental effects) (Shadish et al., 2002).

If it is possible to compare the results of the intervention group with a control group, the internal validity of model (2) is further strengthened due to the ability to control for confounding variables. Such an approach is referred to as comparative interrupted time series design (CITS) or multiple group ITS design, and is represented by the following econometric model (Linden, Arbor, 2015):

$$Y_t = \beta_0 + \beta_1 t + \beta_2 X_t + \beta_3 t X_t + \beta_4 Z + \beta_5 t Z + \beta_6 X_t Z + \beta_7 t Z X_t + \xi_t \quad (3)$$

Additional elements of this model compared to model (2) are the dummy variable Z representing group assignment ($Z = 0$ for the control group and $Z = 1$ for the treatment group) and the interaction of this variable with the other variables.

Figure 1 shows a graphical representation of the ITS method, which can help in understanding this project. The coefficients of the lower line (β_0 to β_3) represent the trajectory of the control group before and after the intervention, while the coefficients of the upper line (β_4 to β_7) represent the experimental group. Specifically: β_4 and β_6 represent the difference in the level of the dependent variable Y between the test group and the control group before and immediately after the intervention, respectively; β_5 represents the difference in the slope (trend) of the outcome variable between the experimental group and the control group before the intervention; and β_7 represents the difference between the groups in the slope (trend) of the outcome variable after the start of the intervention compared to before the intervention (i.e., it determines the effect of the intervention on the outcome's growth rate).

In the CITS design, the impact of the program is estimated by testing whether the treatment group differs from the baseline trend by a greater amount than the control group during the observation period. This design is a stronger one than the DiD because it controls differences between experimental and comparison groups concerning their baseline levels and growth. In addition, the CITS design has more rigorous data requirements than the DiD design. It needs data for at least four equally spaced time points before starting the intervention to estimate the baseline trend (Somers et al., 2013).

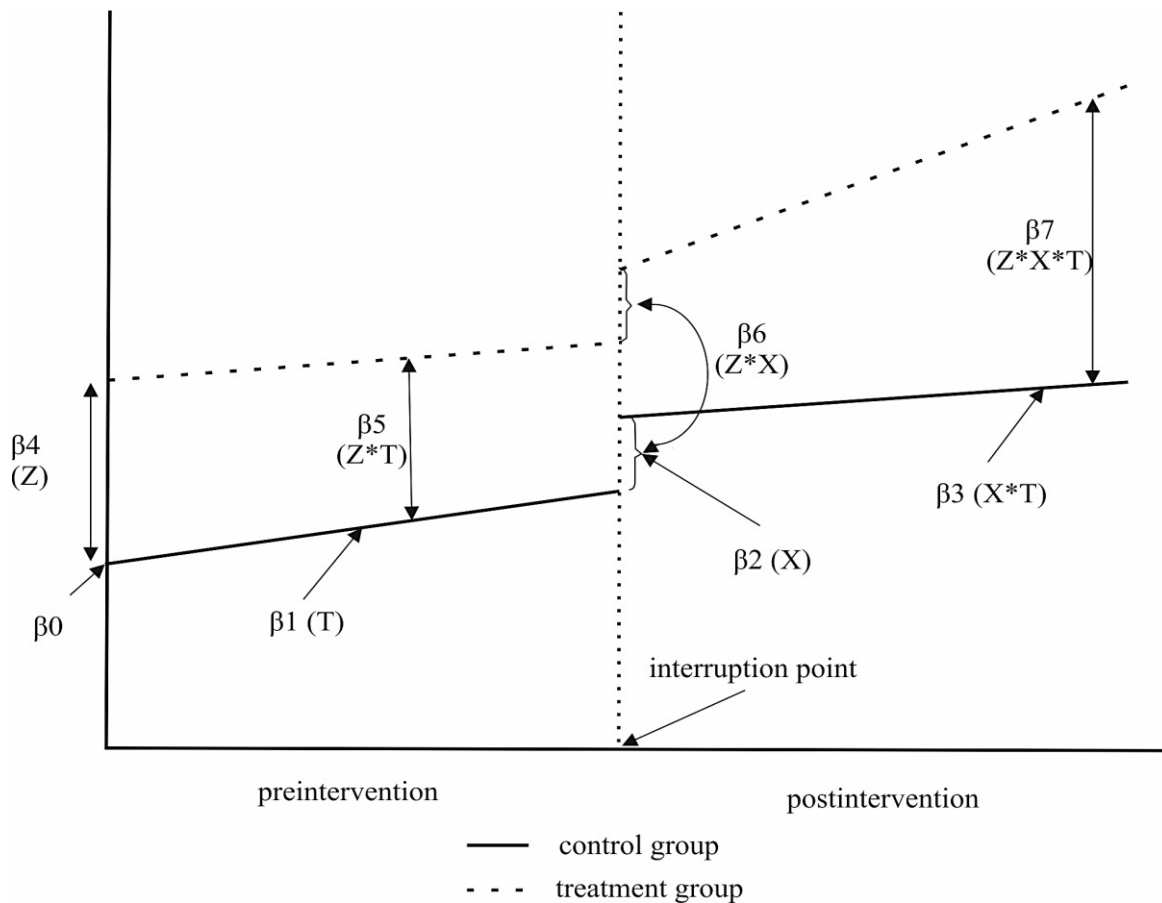


Figure 1. Graphical presentation of ITS.

Source: (Linden, Arbor, 2015).

A key assumption of the interrupted time series design with a control group is, as in the DiD method, the parallel trends assumption, which in practice means that variables not included in the study affect both treatment and control groups similarly. Failure to meet this assumption can lead to unwarranted conclusions about the causal effects of intervention. In the case of random assignment, similarity between individuals in the two groups is highly probable, but in the case of quasi-experimental designs, it cannot be excluded that the observed differences are due to prior disparities between groups.

The main advantage of the CITS design is the ability to test comparability between groups with respect to the variables included in the model. Of special importance in the context of the parallel trends assumption are the two parameters β_4 and β_5 , which allow us to determine whether the experimental and control groups are comparable in both the level and trajectory of the outcome in the pre-intervention period. To reduce the risk of bias, researchers can try to approximate the randomization process by finding control groups that display similarity with the test group in terms of observed variables before the intervention. One approach to finding comparable control groups among potential candidates is an iterative process in which each control group is compared separately to the experimental group using model (3). Those groups for which the β_4 and β_5 parameters do not display statistical significance can be considered credible (Linden, Arbor, 2015).

An additional benefit of the CITS method is its robustness to co-occurring events, like other potentially competing interventions (historical effects) or changes in outcome measurement methodology. If the co-occurring events affect the experimental and comparison groups to the same extent, then the CITS methodology allows a reliable estimate of the treatment effect (Kim, Steiner, 2016).

4. Application of quasi-experimental methods in the case of the Polish mobile Internet market

In this section, we will apply three quasi-experimental methods presented in Section 3 to evaluate the effects of high spectrum prices on the Polish mobile Internet market. The main role in our study will be played by the Polish auction of frequencies necessary for LTE services, which ended in October 2015. Spectrum auction was an unusual event in the Polish telecommunications market, as this form of spectrum allocation was implemented in Poland for the first time. The importance of the event was also reinforced by the fact that, in light of the poor quality of fixed-line Internet in Poland, the auction was an opportunity to meet the goals of the European Digital Agenda, which was to provide all Europeans with broadband Internet access by 2020 (EC, 2010).

Four major mobile operators (i.e., Orange, P4, T-Mobile and Polkomtel) and two others: NetNet and Hubb Investment participated in the auction. It had a turbulent course and lasted a very long time compared to other spectrum auctions in the world (the main bidding included 513 rounds), largely due to significant failures in the auction rules (Kuś, 2020). The lack of credibility of bidding and the inability to enforce the bids made by auction participants encouraged speculative bidding and translated into the level of prices achieved. The total revenue from the auction amounted to more than PLN 9 billion and was one of the highest in Europe, which raised concerns about the negative effects of high spectrum prices on the Polish mobile market and consumers (Kuś, 2020, 2023).

Concerns about the results of the Polish LTE auction fit into the discussion about the impact of high license fees on the wireless market development, which has been going on for years in the academic and industry literature (Kuś, 2023). Two opposing views are presented in this discussion. Proponents of standard economic theory believe that license fees are sunk costs, so they are irrelevant to the development of the mobile market, in particular, they do not affect pricing and investment decisions (Garrison, Noreen, Brewer, 2010; Kwerel, 2000; Buchheit, Feltovich, 2011). On the other hand, some researchers and industry representatives point out some weaknesses in the sunk cost argument concerning mobile markets, claiming that high amounts paid by operators can slow down network development and hurt consumers (Bauer 2003; GSMA, 2019, ITU, 2019).

Due to the discrepancy in positions on this issue, many empirical studies are being conducted on the real-world links between license fees and the outcome of mobile markets. Much of this research employs standard correlation and regression analysis, which, as noted in Section 1, can lead to invalid conclusions about causal relationships. Given that we will use the new quasi-experimental approach to investigate the causal effects of interest. The Polish LTE auction will be treated as a natural experiment to examine whether high license prices have had a negative impact on the quality of mobile services in Poland. As a measure of service quality, we have adopted the download speed rate, which will play the role of the dependent variable in our quasi-experiment. In addition, to capture the causal effects, the Polish outcomes were compared with the results in other countries (with a global trend), which will constitute a kind of control group. Significant changes in Poland's position compared to other countries after the spectrum auction will support the thesis that high spectrum prices harmed the mobile market in Poland.

Data on download speed comes from two international diagnostic companies: Akamai and Ookla. These were quarterly data covering the period of 2013-2020 i.e. the period before and after the auction. The research period is relatively short, which is a weakness of the study but is nevertheless determined by the nature of the topic undertaken, particularly by rapidly changing technologies. The lower limit of the timeframe is due to the availability of data, while the upper limit is due to the fact that since 2020 mobile services in many countries have already been provided in 5G technology based on other, dedicated to this technology frequency bands. In Poland, this band was not allocated until 2023, i.e. much later than in other countries, which could be one of the important reasons for the discrepancy in the quality of mobile services in Poland and around the world, and could wrongly suggest that the decreasing quality of mobile services in Poland compared to other countries is due to the high prices of 4G spectrum.

Table 1 presents the estimation results of the multivariate regression models corresponding to the three statistical techniques presented in Section 3, i.e. DiD (column 2), single ITS (column 3) and the ITS with a control group (column 4). In brackets are p-values for the Student's T-test verifying the significance of the relevant explanatory variable. Estimation was done by the OLS method using the Statistica software, adopting a significance level of 0.05.

Table 1.

The results of the estimation of multiple regression DiD and ITS models

Variable (effect)	Method		
	DiD	single ITS	ITS with a control group
t	---	0.36 (0.04)	0.36 (0.147)
X	18.29 (p<0.01)	0.841 (0.46)	0.27 (0.87)
Z	0.26 (0.94)	---	0.21 (0.91)
t*X	---	1.13 (p<0.01)	1.15 (p<0.01)

Cont. table 1.

X*Z	1.15 (0.79)	---	1.15 (0.61)
t*Z	---	---	0.02 (0.97)
t*X*Z	---	---	-0.03 (0.93)
Intercept	4.03 (0.11)	2.09 (0.04)	1.98 (0.15)
	R2=0.57 F=25.68 P<0.01	R2=0.98 F=760.21 P<0.01	R2=0.98 F=336.53 P<0.01

Note. Statistically significant results are in bold.

Source: own elaboration.

The results of the F-tests confirm the overall significance of the models (p-value in all cases meets the condition of $p < 0.01$) and the coefficients of determination (R-squared) confirm their good fit to the data. The independent variables in our models explain from 57% (DiD) to 98% of the variation in the dependent variable (ITS with the control group). Based on the DiD model we can conclude, that before the intervention the global average download speed was 4.03 Mb/sec while in Poland it was 0.26 Mb/sec higher. However, the results of the T-test indicate that these results were not statistically significant ($p > 0.05$ in both cases). The coefficient corresponding to the interaction term X*Z is also no significant ($p = 0.79$), indicating that there is no significant impact of high auction prices on the quality of the Internet in Poland. The significance of the parameter on the variable X denoting the intervention allows us to conclude that global Internet quality after the auction was significantly higher than before it (by 18.29 Mb/sec on average, $p < 0.01$), which is in line with the general trend showed, that the quality of the Internet is constantly improving due to the development of technology.

Applying the ITS design, in turn, it was estimated that at the beginning of the study period, the download speed in Poland was 2.09 Mb/sec (a statistically significant outcome, $p = 0.04$) and in the pre-intervention period it increased every quarter by an average of 0.36 Mb/sec. The model did not confirm a significant change in Internet quality in Poland immediately after the intervention (the estimated increase of 0.84 Mb/sec was not statistically significant, $p = 0.46$). However, the significance of the parameter at interaction t*X ($p < 0.01$) indicates that the speed of Internet in Poland increased faster after the auction than before, confirming the causal effect of the intervention over time. It should be noted, however, that this model does not take into account a control group, i.e. it does not take into account changes in Internet quality worldwide. Thus, based on such a model, we cannot determine whether the changes in Internet quality in Poland after the auction were the result of the intervention, or whether they were due to global trends, according to which Internet quality around the world is continuously improving. Before drawing definitive conclusions, therefore, it is necessary to analyze the CITS model, which compares the results in Poland with a comparable control group, and see whether the Polish results differ from the baseline trend more than the results in the control group.

The results of the estimation of the ITS model with the control group, presented in Table 1 (column 3), do not confirm the impact of 4G auction outcomes on Internet quality in Poland. The only statistically significant parameter turned out to be the parameter standing at the interaction $t \cdot X$. However, this parameter refers to the control group (see, Section 3.2) and indicates that the increase in download speeds in the control group after the intervention was higher than before it. There were no significant differences between the results in Poland and the world immediately after the auction ($\beta_6 = 1.15$, $p = 0.61$) and after the intervention ($\beta_7 = -0.03$, $p = 0.93$). The rate of increase in download speed in Poland was slightly lower compared to global changes ($\beta_7 = 0.03$), but the difference was not statistically significant ($p = 0.93$).

Noteworthy is also the fact that the implemented control group was comparable to the experimental group at baseline ($\beta_4 = 0.21$, $p = 0.91$) as well as in trend ($\beta_5 = 0.02$, $p = 0.97$). It indicates that the parallel trends assumption was met and the control group defined in the study was reliable (Linden, Arbor, 2015).

5. Summary

The concept of using quasi-experimental design to study causal effects was discussed in this article. Particular attention was paid to two statistical techniques that serve this purpose: the difference-in-differences and interrupted time series methods.

The paper also presents an application case study of a quasi-experimental design to investigate the potential impact of high license fees on the quality of mobile services in Poland, contributing to the broad discussion on the relationship between spectrum cost and wireless market development, that has been going on for years in the scientific and industry communities. Given the lack of a consistent position on this issue, analyzing specific markets, especially markets that have faced high license fees, can be a valuable contribution to the discussion of the sunk cost argument in relation to mobile markets.

The use of a quasi-experimental method made it possible to conclude about the causal effects of the Polish 4G auction. For this purpose, econometric multivariate regression models were estimated, in which the dependent variable was a variable representing the quality of mobile Internet in Poland. Our research did not confirm the thesis that high license costs affected the quality of the Internet in Poland. Although the estimation results of the ITS model without the control group indicated a significantly higher quality of the Polish Internet after the auction, taking into account global trends, it turned out that the observed changes were not significantly different from those registered in the control group, and finally cannot be considered an effect of the auction outcome. Our findings are consistent with the sunk cost argument in relation to mobile markets, which may provide an argument in the discussion

between policymakers and the industry community. They also make room for further in-depth research, including, for example, the potential impact of spectrum prices on the financial situation of service providers and the level of investment in the network.

References

1. Angrist, J.D., Pischke, J.S. (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton, NJ: Princeton University Press.
2. Bauer, J.M. (2003). Impact of license fees on the prices of mobile voice service. *Telecommunications Policy*, Vol. 27, Iss. 5-6, pp. 417-434, doi: 10.1016/S0308-5961(03)00009-0.
3. Bondonio, D. (2021). *Cross-Regional Sequential Difference in Difference (CR-SEQDD): An Empirical Approach for Evaluating EU Thematic-Objective Interventions with Regional Data Aggregated at the National Level*. Publications Office of the European Union. Retrieved from: https://ec.europa.eu/regional_policy/en/information/publications/evaluations-guidance-documents/2021/cross-regional-sequential-difference-in-difference-cr-seqdd, 15.11.2023.
4. Buchheit, S., Feltovich, N. (2011). Experimental Evidence of a Sunk-Cost Paradox: A study of Pricing Behavior in Bertrand—Edgeworth Duopoly. *International Economic Review*, Vol. 52, Iss. 2, pp. 317-347, doi: 10.1111/j.1468-2354.2011.00630.x.
5. Card, D., Krueger, A.B. (1994). Wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania. *American Economic Review*, Vol. 84, Iss.4, pp. 772-793, 1.12.2023.
6. Coleman, R. (2019). *Designing experiments for the social sciences: how to plan, create, and execute research using experiments*. Thousand Oaks, California: SAGE Publications, Inc.
7. *Difference-in-Difference Estimation*, Retrieved from: <https://www.publichealth.columbia.edu/research/population-health-methods/difference-difference-estimation>, 2.11.2023.
8. European Commission (2010). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions A Digital Agenda for Europe (COM/2010/0245). Retrieved from: <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=celex%3A52010DC0245>, 17.05.2023.
9. Garrison, R.H., Noreen, W.E., Brewer, C.P. (2010). *Managerial Accounting*. New York: McGraw-Hill. Retrieved from: <https://eduguidehome.files.wordpress.com/2019/02/managerial-accounting-garrissonnorenbrewer-13e.pdf>, 15.03.2023.

10. Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, Vol. 225, Iss. 2, pp. 254-277. doi: <https://doi.org/10.1016/j.jeconom.2021.03.014>.
11. GSMA (2019). *The impact of spectrum prices on consumer*. Retrieved from: <https://www.gsma.com/spectrum/wp-content/uploads/2019/09/Impact-of-spectrum-prices-on-consumers.pdf>, 5.04.2023.
12. Imai, K., King, G., Stuart, E.A. (2008). Misunderstandings between experimentalists and observationalists about causal inference. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, Vol. 171, Iss. 2, pp. 481-502. doi: 10.1111/j.1467-985X.2007.00527.x
13. ITU (2019). *ITU Contribution to the Implementation of the WSIS - Outcomes 2019*. Retrieved from: <https://www.itu.int/en/itu-wsis/Pages/Contribution.aspx>. 23.03.2023.
14. Kim, Y, Steiner, P. (2016). Quasi-Experimental Designs for Causal Inference. *Educational Psychologist*, Vol. 51, Iss. 3-4, pp. 395-405. doi: 10.1080/00461520.2016.1207177.
15. Kuś, A. (2020). Polish experience from first-ever spectrum auction. *Telecommunication Policy*, Vol. 44, Iss. 7, pp. 1-11. doi: 10.1016/j.telpol.2020.101971.
16. Kuś, A. (2023). Do the high spectrum prices harm consumers? Evidence from Poland. *European Research Studies Journal*, Vol. XXVI, Iss. 3, pp. 415-437. doi: 10.35808/ersj/3222.
17. Kwerel, E. (2000). Spectrum Auctions Do Not Raise the Price of Wireless Services: Theory and Evidence. *Office of Plans and Policy Federal Communications Commission*. Retrieved from: <https://wireless.fcc.gov/auctions/data/papersAndStudies/SpectrumAuctionsDoNotRaisePrices.pdf>, 24.04.2023.
18. Linden, A., Arbor, A. (2015). Conducting Interrupted Time-series Analysis for Single- and Multiple-group Comparisons. *The Stata Journal*, Vol. 15, Iss. 2, pp. 480-500. doi: 10.1177/1536867X1501500208
19. Meyer, B.D. (1995). Natural and Quasi- Experiments in Economics. *Journal of Business & Economic Statistics*. Vol. 13, Iss. 2, pp. 151-161. doi: 10.1080/07350015.1995.10524589.
20. Sagan, A. (2011). Przyczynowość w badaniach marketingowych. *Zeszyty Naukowe Uniwersytetu Szczecińskiego, Problemy zarządzania, finansów i marketingu*, Vol. 38, pp. 273-283. doi: 10.18276/pzfm.2015.38-25.
21. Sagan, A. (2015). Zależności przyczynowe w diagnozie efektów komunikacyjnych. *Zeszyty Naukowe UE w Poznaniu*, Vol. 208, pp. 73-84.
22. Shadish, W.R., Cook, T.D., Campbell, D.T. (2002). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston: Houghton Mifflin Company.
23. Somers, M., Zhu, P., Jacob, R., Bloom, H. (2013). *The validity and precision of the comparative interrupted time series design and the difference-in-difference design in educational evaluation*. MDRC Working paper on research methodology. New York, NY:

- MDRC. Retrieved from: https://www.mdrc.org/sites/default/files/validity_precision_comparative_interrupted_time_series_design.pdf, 27.11.2023.
24. Turner, S.L., Karahalios, A., Forbes, A.B., Taljaard, M., Grimshaw, J.M., McKenzie, J.E. (2021). Comparison of six statistical methods for interrupted time series studies: empirical evaluation of 190 published series. *BMC Medical Research Methodology*, Vol. 21, Iss. 1. doi: 10.1186/s12874-021-01306-w.
25. White, H., Sabarwal, S. (2014). *Quasi-Experimental Design and Methods, Methodological Briefs: Impact Evaluation*, 8. Florence UNICEF Office of Research. Retrieved from: https://www.unicef-irc.org/KM/IE/img/downloads/Quasi-Experimental_Design_and_Methods_ENG.pdf, 22.09.2023.
26. Wing, C., Simon, K., Bello-Gomez, R.A. (2018). Designing Difference in Difference Studies: Best Practices for Public Health Policy Research. *Annual Review of Public Health*, Vol. 39, Iss. 1, pp. 453-69. doi: 10.1146/annurev-publhealth-040617-013507.

STRENGTHENING CUSTOMER RELATIONSHIPS AND THE DEVELOPMENT POTENTIAL OF SERVICE ENTERPRISES

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Purpose: The aim is to indicate how strengthening customer relationships affects the development potential of enterprises.

Design/methodology/approach: The reasoning is based on the results of a study on a group of 184 service enterprises employing more than 10 employees. The research was carried out in 2022. The research tool was an original survey questionnaire, which was assessed for reliability. After formal evaluation, the collected data were subjected to statistical analysis, including the use of descriptive statistics and non-parametric statistics.

Findings: Research has shown that most of the activities of service enterprises in the area of strengthening relationships with customers have a positive impact on the development potential of enterprises, including enterprise revenues, market share, the level of employment and investments in the company, and the level of use of new technologies and information solutions.

Research limitations/implications: The research conducted has its limitations in the form of a small research group from the Silesian Voivodeship. In the future, it is planned to expand the research on a representative group, which will enable a broader exploration of the problem and the identification of the determinants of the competitiveness of service enterprises in the era of a difficult business environment.

Practical implications: The results of the study on a group of service enterprises allow management practitioners to indicate which activities in the area of strengthening customer relationships positively determine the enterprise's potential, which determines its market competitiveness.

Originality/value: The novelty of the study is the analysis of the impact of activities in the area of strengthening customer relationships on the company's results, called development potential, which determines the market competitiveness of service enterprises. The research results can be a guide in managing customer relations in service enterprises.

Keywords: customer orientation, customer relations, enterprise development potential, organizational flexibility, management.

Category of the paper: Research paper.

1. Introduction

The operating conditions of the organization currently require it to be flexible. A flexible organization is one in which both the organizational culture and the structure itself enable adaptation to environmental conditions. However, this adaptation must be rapid, responding to customer needs and competitive requirements (Brilman, 2002, p. 391). These are not easy conditions for the operation of enterprises; they can even be called extreme. A flexible approach to market behavior results from both external and internal conditions (Pakulska, 2020, pp. 9-10). In a competitive environment, both groups of conditions determine organizational behavior. Therefore, organizational behavior fits into organizational flexibility and its definition to various extents. The need for organizational activities aimed at adapting to ongoing market and organizational changes requires flexibility to varying degrees (Reeves, Deimler, 2011). In the case of service enterprises, organizational activities are indicated to strengthen enterprise-customer relations, which serve to constantly verify and adapt functionalities. These are necessary capabilities in the case of this group of enterprises, which are strategic in nature and generally include the organization's capabilities in the area of dynamic relationships to respond to ongoing changes. These capabilities constitute the essence of organizational flexibility. The basis for building relationships with the client is, among others: the ability to establish contact, which is the starting point of long-term cooperation, a partnership approach, respect, openness, active listening and, above all, the ability to discover the client's needs and respond to them.

The aim is to indicate how strengthening customer relationships affects the development potential of enterprises. The conclusions are based on the results of own research on a group of service enterprises operating in the Silesian Voivodeship. The analysis process used descriptive statistics and non-parametric statistics appropriate to the purpose of the study.

2. Strengthening customer relationships - creating relationship capital

The concept of organizational flexibility is very often used to describe an enterprise's response to changing environmental conditions. Due to the fact that the environment is highly or even extremely turbulent, the adaptive activities of enterprises focus on various aspects of activity (Suder, Okręglicka, 2023). In the case of service enterprises, activities that strengthen enterprise-customer relations turn out to be important. The origins of customer relationship management therefore come from changes taking place on the market as well as changes in the conditions of cooperation with customers. These include, among others: a significant increase in market competition, an increase in the role of information, including access to information,

an increase in the risk of running a business, an increase in production flexibility, an increase in the number of distribution channels, an increase in the turnover of sales department employees, a decrease in the effectiveness of promotion, a decrease in customer loyalty, an increase in the costs of acquiring new customers and an increase in customer requirements (Wolak-Tuzimek, 2023).

A review of international literature does not allow us to clearly define the concept of "relationships". Initially, the organization's relational capital was identified only with the area of customer relations (de Castro et al., 2004). Currently, this concept is perceived much more broadly and includes relationships with all enterprise stakeholders, i.e. the organization's relationships with external partners and within the organization (Cucculelli, Peruzzi, Zazzaro, 2019). Therefore, relational capital can be defined as all the connections between an enterprise and its stakeholders which are based on mutual influence, trust and interdependence. Activities that strengthen the relationship lead to an increase in commitment, a reduction (or reduction) of uncertainty and risk, and an increase in trust (Daspit, 2014; Danielak, 2012, pp. 356-369). The skills of building and strengthening relationships combined with professional knowledge, professional experience and flexible action create relational competences (Ecclestone, Hayes, 2009). Competencies, as defined by Niewiadomski (2009), include knowledge, skills, personality traits, experience, as well as behaviors and attitudes aimed at effective and efficient organizational activities in a constantly changing, turbulent environment and various professional situations of organizational participants. Creating relational capital is an inherent feature of every organization that is an open system and therefore exchanges resources with the environment. It turns out that nowadays, the advantage is gained by the company that configures relationships with partners so that they are stronger than those of competing organizations (Stańczyk-Hugiet, 2012). Appropriate relationship management leads to the development of appropriate relational capital. It involves, among others, balancing activities but also the integration of some activities, because it should be remembered that the goals of individual partners or stakeholders of the company are different (Freeman, Mc Vea, 2001; Roba, Maric, 2023, pp. 469-487).

Focusing on external relationships, i.e. relationships with customers, it can be concluded that they are most often perceived through the prism of, among others, how to formalize cooperation. Therefore, the effect in the form of the result of the activity or the method of management influencing the content of the relationship, the number of customers, the level of their satisfaction and trust in the organization, as well as the power relationship in the cooperation process (Wasiluk, 2020, p. 26). Creating or strengthening relationships with customers of an enterprise, not only a service one, requires skilful planning, organizing, motivating and controlling, as well as developing a strategy for customer activities (Chang, Huang, 2016). Competences and abilities necessary to shape relationships play a particular importance in this process. These competencies, called relational competencies, are based on the use of knowledge and skills related to sharing knowledge, but also on the competencies,

abilities and attitudes of organization members that determine the building of relationships. Professional knowledge, professional experience and readiness to act flexibly are necessary. Creating and strengthening the resources of relational capital comes down, first of all, to creating conditions that enable the initiation, shaping, development and consolidation of relationships between members of a given organization and between the organization and external stakeholders, in this case customers (Gach, 2009, p. 179).

The process of creating customer relationships is systematized, i.e., it takes place in specific stages. The stages include the stage of attracting the customer with an attractive offer or service, the initial stage, the stage of development, and the stage of decay and termination of the relationship. Individual stages in strengthening relationships moderate the creation, formalization activities, development strategy, building trust, evaluation, and continuous improvement of relationships (Chomiak-Orsa, 2013, p. 162; Ioannou, Zolkiewski, 2019). There is no doubt that the way an enterprise initiates, maintains, develops and finalizes relationships affects its management. It is also worth noting that employees also influence the efficiency of activities related to building and strengthening relationships with customers. The personality traits of employees directly related to customer service have a strong impact on relationships, including their competences in the field of service, but also professional motivation and commitment to the organization's activities (Robak, 2013). The emotional relationship between the client and the company becomes a purposeful pursuit of common values and norms, willingness to cooperate, joint commitment and support of the parties in the implementation of tasks. Trust is identified with intangible capital, which has a significant impact on creating organizational value and developing a competitive advantage. Customer loyalty results from experience, belief in honesty and the certainty that relationships are ethical and built on appropriate values (Nowotarska-Romaniak, 2020). Orientation on long-term relationships or strengthening relationships based on trust favors the company's achievement of good business results and is often a determinant of the organization's survival (Łęgowski, 2017). In turn, the literature indicates that the main goal of customer relationship management (CRM), treated as a set of organizational activities, is to increase its value by increasing sales and its profitability over time (Deszczyński, Deszczyński, 2004; Nilashi et al., 2023). Therefore, involvement in relationships with partners, including customers, is often considered the most sustainable advantage due to the resulting barriers to competition (Roba, Maric, 2023, pp. 469-487).

3. Methods

The aim is to indicate how strengthening customer relationships affects the development potential of enterprises. The study was conducted on a group of service enterprises operating in the Silesian Voivodeship. The study was carried out in several stages. First of all, a review of the literature was carried out, which allowed for the formulation of research questions. Then, pilot research was carried out using the author's survey questionnaire. Ultimately, the actual research was conducted in 2022. After rejecting incomplete questionnaires, 184 economic entities ultimately participated in the study. The research tool was composed of data characterizing the entities being studied and appropriate questions that allowed for collecting the necessary data to answer the research questions. The original research tool, which allowed for the collection of quantitative data, used a 5-point Likert scale, which is the most frequently used in social research (Babbie, 2004, pp. 191-192). The results obtained from the Likert scale are aggregated and analyzed for individual respondents in a managerial approach (Sheng, Zhou, Li, 2011).

The survey questionnaire was subjected to reliability testing (Hair et al., 2020). Its reliability was tested using Cronbach's alpha index (Taber 2018), the value of which was above 0.75 for the distinguished variables. Therefore, it can be assumed that this level is at least satisfactory, the research scales constructed in the questionnaire meet the criteria, and their use in quantitative research is justified (George, Mallery, 2016, p. 240). During the statistical analysis of the obtained empirical data, statistical methods adequate to the adopted research aim were used.

Among the respondents, the largest group were companies running their service activities for over 20 years (29.35% of responses), followed by companies declaring experience between 11 and 20 years (26.63% of responses). Enterprises that had been running their service activities for up to 5 years accounted for 1/4 of all respondents. Among the surveyed Silesian service enterprises, there were 133 small entities (72.3% of responses) employing up to 49 employees, 22 medium-sized entities employing from 50 to 249 employees (11.9% of responses) and 29 large entities employing more than 249 employees (15.8% of responses).

4. Results and discussion

The research conducted among service enterprises showed that strengthening relationships with customers takes place through various levels of activities analyzed in the area of the studied variables. It turns out that the activities of service companies are most focused on anticipating the needs of regular customers and proposing new services, as well as identifying

and emphasizing benefits for customers. These activities that strengthen relationships with customers were rated by respondents at a level of 4.22 on a 5-point scale. The surveyed companies placed equally strong emphasis on close contact with leading customers and recognizing customer needs earlier than the competition, which, in their opinion, strengthens customer relationships. These activities, in turn, were rated at 4.20 on a 5-point scale (Figure 1).

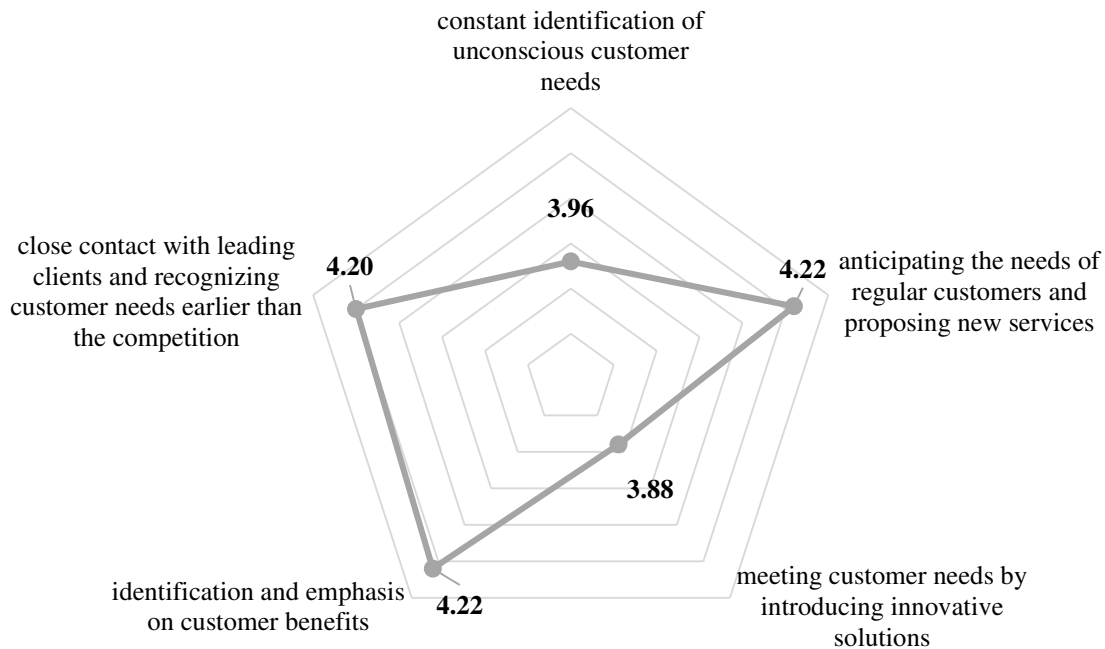


Figure 1. Activities in the area of strengthening relationships with customers of service enterprises.

As a result, further analysis allowed us to indicate the relationship between the activities of Polish service enterprises to strengthen relationships with customers and the basic indicators determining the development potential of enterprises. The activities that strengthen customer relationships (ASCR) include:

- ASCR_1 (constant identification of unconscious customer needs),
- ASCR_2 (anticipating the needs of regular customers and proposing new services),
- ASCR_3 (meeting customer needs by introducing innovative solutions),
- ASCR_4 (identification and emphasis on customer benefits),
- ASCR_5 (close contact with leading clients and recognizing customer needs earlier than the competition).

The development potential of the enterprises was identified by enterprise revenues, enterprise's market share, employment level, level of investment in the enterprise and use of new technologies and information solutions.

It turns out that only in the case of activities related to the constant identification of unconscious customer needs and the company's revenues, there is a moderate, statistically significant (p -value < 0.05) positive relationship. Other activities indicated by entrepreneurs did not indicate a statistically significant relationship (Table 1).

Table 1.

Relationships between activities that strengthen customer relationships and the revenues of a service enterprise (n = 184)

Variables	Enterprise revenues
	*Spearman rank correlation (p-value < 0.05)
ASCR_1	0.526*
ASCR_2	0.312
ASCR_3	0.201
ASCR_4	0.337
ASCR_5	-0.040

Source: Own research.

When analyzing the relationship between activities that strengthen customer relationships and the service company's market share, three out of five distinguished activities indicate a statistically significant relationship (p-value < 0.05). The constant identification of the unconscious needs of customers of service enterprises, the anticipation of the needs of regular customers, and the proposal of new services, as well as the identification and emphasis on benefits for customers, show a moderately positive relationship with the company's market share (Table 2).

Table 2.

Relationships between activities that strengthen customer relationships and the market share of a service enterprise (n = 184)

Variables	Enterprise's market share
	*Spearman rank correlation (p-value < 0.05)
ASCR_1	0.592*
ASCR_2	0.411*
ASCR_3	0.319
ASCR_4	0.439*
ASCR_5	-0.024

Source: Own research.

The analysis of the relationship between activities that strengthen customer relations and the level of employment in the company shows that three out of five distinguished activities indicate a statistically significant relationship (p-value < 0.05). The constant identification of the unconscious needs of customers of service enterprises, the anticipation of the needs of regular customers and the proposal of new services, as well as the identification and emphasis on benefits for customers show a moderate and or weak positive relationship with the level of employment in the enterprise (Table 3).

Table 3.

Relationships between activities that strengthen customer relationships and the level of employment in a service enterprise (n = 184)

Variables	Employment level in the enterprise
	*Spearman rank correlation (p-value<0.05)
ASCR_1	0.451*
ASCR_2	0.379*
ASCR_3	0.329
ASCR_4	0.396*
ASCR_5	-0.007

Source: Own research.

The analysis of the relationship between activities that strengthen customer relationships and the level of investment in a service enterprise shows that as many as four out of five distinguished activities indicate a statistically significant relationship (p -value < 0.05). Constant identification of the unconscious needs of customers of service enterprises, anticipating the needs of regular customers and proposing new services, satisfying customer needs by introducing innovative solutions, and identifying and focusing on benefits for customers show a moderately positive relationship with the level of investment in the enterprise (Table 4).

Table 4.

Relationships between activities that strengthen customer relationships and the level of investment in a service enterprise (n = 184)

Variables	The level of investment in the enterprise
	*Spearman rank correlation (p -value <0.05)
ASCR_1	0.497*
ASCR_2	0.502*
ASCR_3	0.417*
ASCR_4	0.500*
ASCR_5	0.051

Source: Own research.

Also, the analysis of the relationship between activities that strengthen customer relationships and the use of new technologies and information solutions in a service enterprise shows that as many as four out of five distinguished activities indicate a statistically significant relationship (p -value <0.05). Constant identification of unconscious needs of customers of service enterprises, anticipating the needs of regular customers and proposing new services, satisfying customer needs by introducing innovative solutions and identifying and focusing on benefits for customers show a moderate or strong positive relationship with the use of new technologies and information solutions in the enterprise (Table 5).

Table 5.

Relationships between activities that strengthen customer relationships and the level of use of new technologies and information solutions in a service enterprise (n = 184)

Variables	Using new technologies and information solutions in the enterprise
	*Spearman rank correlation (p -value <0.05)
ASCR_1	0.561*
ASCR_2	0.688*
ASCR_3	0.432*
ASCR_4	0.615*
ASCR_5	0.148

Source: Own research.

To sum up, the research has shown that the more activities a service company performs in the area of constant identification of unconscious customer needs, the higher the company's revenues, the company's market share increases, the level of employment and investments in the company increases, and the level of use of new technologies and information solutions in the surveyed company increases. These results are confirmed by the research of Nilashi et al.

(2023), who conclude that actions to improve customer satisfaction lead to better customer relations, increased profitability, and an increase in enterprise value. The more intensively an enterprise anticipates customer needs and more often proposes new services, the more the enterprise's market share increases, the level of employment and investments in the enterprise increases, and the level of use of new technologies and information solutions in the service enterprise increases. As Chang and Huang (2016) point out, knowing the impressions after using the service is of fundamental importance for preparing future strategies and further strengthening the relationship with the customer. It turns out that research by Chuang and Lin (2013) confirms the conclusion that activities that strengthen customer relationships allow companies to gain a deeper understanding of the moods, inclinations, and perspectives of their customers. Moreover, meeting customer needs by introducing innovative solutions has a positive impact on the level of investment in the surveyed enterprises and the level of use of new technologies and information solutions. Moreover, the greater the identification efforts and the emphasis on customer benefits, the greater the service company's market share, employment, and investment levels, as well as the greater the use of new technologies and information solutions. Extensive research presented in the literature confirms that the impact of customer relationship management consisting of strengthening these relationships provides a competitive advantage (Mithas et al., 2005; Zhang, et al., 2006) and material and intangible benefits (Wang et al., 2004). Relationship-building activities create emotionally stable environments based on the customer-enterprise relationship (Ladhari, 2007), consequently leading to customer satisfaction (García-Pascual et al., 2023).

Interestingly, research has shown that activities involving close contact with leading customers of service enterprises and identifying customer needs earlier than the competition do not show any correlation with the level of revenue, market share, employment level, or investment and the level of use of new technologies and information solutions.

5. Conclusions

Research conducted on a group of service enterprises operating in the Silesian Voivodeship in 2022, the aim of which was to indicate how strengthening customer relations affects the development potential of enterprises, allowed for the formulation of conclusions. It turns out that not all activities in the area of strengthening customer relations in service enterprises are determined by indicators assessing the development potential, including the enterprise's revenues, the company's market share, the level of employment and investments in the enterprise, or the level of use of new technologies and information solutions. Most often, the company's results are positively influenced by the constant identification of unconscious customer needs, the anticipation of the needs of regular customers, the proposal of new services,

and the identification and emphasis on benefits for customers. However, no relationship was found between close contact with leading customers and recognizing customer needs earlier than the competition in relation to the factors influencing the development potential of service enterprises.

The conducted research expands the scope of research in the field of building and strengthening relationships with customers, which undoubtedly contributes to increasing knowledge in the area of the organization's market competitiveness. This is particularly important now, when the operating conditions of enterprises are difficult and demanding. Therefore, operational flexibility by responding to customer needs and strengthening customer-enterprise relationships may be an important determinant of achieving competitiveness.

The study conducted on a group of Silesian service enterprises has its limitations, which result from the small research group coming only from a selected region of Poland. In the future, however, it is planned to expand the research on a representative group, which will enable a broader exploration of the problem and the identification of the conditions for the competitiveness of service enterprises in the era of a difficult business environment. Nevertheless, the conclusions from the study on a group of service enterprises allow management practitioners to indicate which activities in the area of strengthening customer relations positively determine the enterprise's potential and its market competitiveness.

References

1. Babbie, E. (2004). *Badania społeczne w praktyce*. Warszawa: PWN.
2. Brillman, J. (2002). *Nowoczesne koncepcja i metody zarządzania*. Warszawa: PWE.
3. Chang, W.-L., Huang, L.-Y. (2016). Measuring service experience: a utility-based heuristic model. *Service Business*, Vol. 10, pp. 1-30, doi: 10.1007/s11628-014-0263-9.
4. Chomiak-Orsa, I. (2013). *Zarządzanie kapitałem relacyjnym w procesie wirtualizacji organizacji. Podejście modelowe*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.
5. Chuang, S.-H., Lin, H.-N. (2013). The roles of infrastructure capability and customer orientation in enhancing customer-information quality in CRM systems: empirical evidence from Taiwan. *International Journal of Information Management*, Vol. 33, Iss. 2, pp. 271-281.
6. Danielak, W. (2012). *Kształtowanie kapitału relacyjnego w małym i średnim przedsiębiorstwie*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego.
7. Daspit, J.J., Long, R.G. (2014). Mitigating Moral Hazard in Entrepreneurial Networks: Examining Structural and Relational Social Capital in East Africa. *Entrepreneurship: Theory and Practice*, Vol. 38, Iss. 6, pp. 1343-1350.

8. de Castro, M.G., López, Sáez, P., Navas, López, J.E. (2004). The Role of Corporate Reputation in Developing Relational Capital. *Journal of Intellectual Capital*, Vol. 5, No. 4, pp. 575-585.
9. Deszczyński, B., Deszczyński, P. (2004). Customer Relationship Management konsekwencją globalizacji. *Zeszyty Naukowe Akademii Ekonomicznej w Poznaniu*, Vol. 18, pp. 169-174.
10. Ecclestone, K., Hayes, D. (2009). Changing the subject: the educational implications of developing emotional well-being. *Oxford Review of Education*, Vol. 35, pp. 371-389, <https://doi.org/10.1080/03054980902934662>.
11. Freeman, R.E., Mc Vea, J. (2001). A Stakeholders Approach to Strategic Management. In: M. Hitt, R.E. Freeman, J. Harrison (Eds.), *Handbook of Strategic Management*. Blackwell Publishing Oxford.
12. Gach, D. (2009). Kapitał relacyjny jako podstawa tworzenia układów kooperacyjnych. In: A. Adamik, S. Lachiewicz (Eds.), *Współpraca w rozwoju współczesnych organizacji*. Łódź: Wydawnictwo Politechniki Łódzkiej.
13. García-Pascual, F., Parra-Camacho, D., Aguado-Berenguer, S. (2023). Effect of service experience, engagement and satisfaction on the future intentions of customers of a sports services. *Heliyon*, Vol. 9, Iss. 7, e17850, doi: 10.1016/j.heliyon.2023.e17850.
14. Hair, J.F., Howard, M.C., Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory 631 composite analysis. *Journal of Business Research*, Vol. 109, pp. 101-110, doi:10.1016/j.jbusres.2019.11.069
15. Ioannou, M., Zolkiewski, J. (2019). Can retail bank-client relationships be developed online? *EuroMed Journal of Business*, Vol. 4, Iss. 3, pp. 254-269, doi: 10.1108/14502190910992684.
16. Ladhari, R. (2007). The effect of consumption emotions on satisfaction and word-of-mouth communications. *Psychology & Market*, Vol. 24, Iss. 12, pp. 1085-1108, <https://doi.org/10.1002/mar.20195>.
17. Łęgowski, S. (2017). Budowanie relacji z klientem jako determinanta lojalności i satysfakcji konsumenta na rynku telefonii komórkowej. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, Vol. 328, pp. 93-105.
18. Mithas, S., Krishnan, M.S., Fornell, C. (2005). Why do customer relationship management applications affect customer satisfaction? *Journal of Marketing*, Vol. 69, Iss. 4, pp. 201-209, <https://doi.org/10.1509/jmkg.2005.69.4.201>.
19. Moczydłowska, M., Bitkowska, A. (2020). Koncepcja zarządzania relacjami z klientami – istota, cele, zakres. *Marketing i Rynek*, No. 9, pp. 3-12.
20. Niewiadomski, P. (2009). Menedżer sprzedaży – model kluczowych kompetencji a efektywność działań. *Marketing i Rynek*, No. 9, pp. 13-18.
21. Nilashi, M., Abumalloh, R.A., Ahmadi, H., Samad, S., Alrizq, M., Abosaq, H., Alghamdi, A. (2023). The nexus between quality of customer relationship management systems and

- customers' satisfaction: Evidence from online customers' reviews. *Heliyon*, Vol. 9, Iss. 11, e21828, <https://doi.org/10.1016/j.heliyon.2023.e21828>.
22. Nowotarska-Romaniak, B. (2020). Lojalność klientów na rynku usług ubezpieczeniowych, *Marketing Instytucji Naukowych i Badawczych*, Vol. 36, Iss.2, pp. 77-89, doi: 10.2478/minib-2020-0018.
 23. Pakulska, T. (2020). *Elastyczność w biznesie. Skuteczna adaptacja*. Warszawa: Oficyna Wydawnicza SGH.
 24. Reeves, M., Deimler, M. (2011). Adaptability: The New Competitive Advantage, *Harvard Business Review*. Retrieved form: <https://hbr.org/2011/07/adaptability-the-new-competitive-advantage>.
 25. Roba, G.B., Maric, P. (2023). AI in Customer Relationship Management. In: N. Kryvinska, M. Greguš, S. Fedushko (Eds.), *Developments in Information and Knowledge Management Systems for Business Applications*. Studies in Systems, Decision and Control, Vol. 462. Cham: Springer. https://doi.org/10.1007/978-3-031-25695-0_21
 26. Robak, E. (2013). Satysfakcja z pracy i jej wpływ na zachowania pracownicze. *Zeszyty Naukowe Politechniki Częstochowskiej. Zarządzanie*, Vol. 9, pp. 73-83.
 27. Sheng, S., Zhou, K.Z., Li, J.J. (2011). The Effects of Business and Political Ties on Firm Performance: Evidence from China. *Journal of Marketing*, Vol. 75, Iss. 1, pp. 1-15, doi: doi.org/10.1509/jm.75.1.1.
 28. Stańczyk-Hugiet, E. (2012). Paradygmat relacji – czy to nowa jakość w zarządzaniu? *Studia i Prace Kolegium Zarządzania i Finansów*, Vol. 116, pp. 163-173.
 29. Suder, M., Okręglicka, M. (2023), Examining Moderating Effect of Environmental Dynamism and Hostility on Entrepreneurial Orientation/Performance Relationship Polish. *Journal of Management Studies*, Vol. 28, Iss. 2, pp. 305-322, doi: 10.17512/pjms.2023.28.2.18.
 30. Wang, Y., Lo, H.P., Chi, R., Yang, Y. (2004). An integrated framework for customer value and customer- relationship- management performance: a customer- based perspective from China. *Managing Service Quality*, Vol. 14, Iss. 2/3, pp. 169-182, doi: 10.1108/09604520410528590.
 31. Wasiluk, A., Tomaszuk, A. (2020). *Organizacja w sieci relacji*. Białystok: Politechnika Białostocka.
 32. Wolak-Tuzimek A. (2023). Factors influencing the competitiveness of polish enterprises from the consumer's perspective. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, No. 181, pp. 653-669, <http://dx.doi.org/10.29119/1641-3466.2023.181.41>.
 33. Zhang, G., Chen, Y., Fu, C. (2006). *A study on the relation between enterprise competitive advantage and CRM based on data mining*. 2006 International Technology and Innovation Conference (ITIC 2006), pp. 1710-1714.

WHY ORGANIZATIONS DO NOT USE THE INFORMATION OBTAINED DURING AUDITING FOR IMPROVEMENT – IDENTIFYING THE REASONS

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Purpose: The aim of the article is to examine the reasons why organizations do not use the information obtained in the audit process.

Design/methodology/approach: For the realization of the work we used the results of our own research of organizations that have certified quality management systems for compliance with the requirements of ISO 9001. The information obtained relates to organizations operating in the territory of Poland.

Findings: Organizations conducting quality management system audits acquire a variety of information that should be used for management purposes. Some organizations have serious problems with acquiring data and processing it, and using the information for decision-making and improvement-oriented activities. The paper identifies 10 potential reasons why organizations do not use information from the audit process. A comparison was made between the causes found in internal and external audits. An analysis of each of the identified causes was carried out, paying attention to their origins. Attention was paid to the connections between the causes. Directions for eliminating problems were indicated.

Practical implications: The results obtained have practical application. Organizations with an awareness of the causes of problems are able to take, both corrective action and preventive action. In the first case, it is about taking corrective actions to existing problems. In the second case, it is about preventive actions, which should prevent a problem from arising.

Social implications: The results obtained have social implications. They draw attention to the need to build a pro-quality and improvement-oriented awareness.

Originality/value: The article for the first time identifies the causes of problems arising in organizations in the context of the use of audit information. Attention is paid to the mechanism of disorders and ways to eliminate them are indicated. The article is especially recommended to the top management of organizations that conduct system audits.

Keywords: audit, information management, quality management system, improvement.

Category of the paper: viewpoint.

1. Introduction

Most compilations take 1993 as the first year of certification in Poland of quality management systems in accordance with the requirements of ISO 9001. Thus, in 2023 it will be 30 years since quality management systems were applied in organizations operating on the territory of our country. The creation of systems began with large manufacturing organizations, to be applied in subsequent years to service activities, administration and health care. Large enterprises were followed by medium-sized and then small organizations. Today it is difficult to point out an area of life where quality management systems are not used. Of course, the saturation of systems in different areas of life varies. Having a certified quality management system results in the periodic conduct of two types of audits. An internal audit conducted most often by properly prepared employees of the organization, and an external audit conducted by auditors of the certifying body. External audit refers to the certification audit, recertification audits after 3 years and surveillance audits during the validity period of the certificate. Thus, at least one internal audit and one external audit are conducted annually in each organization certified to ISO 9001 requirements. The organization thus obtains a large amount of information that should be used for management purposes. The main concern is to eliminate disorders and their causes, and to take actions aimed at improvement. Extensive English-language literature is available on auditing and its role in the organization (Pivka, 2004; Russell, 2007; Sampaio et al., 2009; Alic, Rusjan, 2010; Hernandez, 2010; Penini, Carmeli, 2010; Francis, 2011; Sun, Liu, 2011; Claver, Tari, 2013; Okwiri, 2013; Abuazza et al., 2019, Lenning et al., 2022). During the analyzed period, several compact publications on auditing were published in the Polish language (Kreier, Łuczak, 1998-2002; Jedynek, 2004; Pacana, Stadnicka, 2006; Jedynek, 2007; Łuczak, Kuklińska, 2007; Matuszak-Flejszman, 2010; Grudowski, 2010; Ejdyś, 2011; Lisiecka et al., 2017; Pacana, Stadnicka, 2017; Grzesiak, 2021). Added to this are standards on auditing terminology, requirements and guidelines, and journal articles. On this basis, it would seem that the issue of auditing and the use of information from it is well known, widely described and put into practice. The reality, however, turns out to be different. The author of the study conducted extensive research (Ligarski, 2007, 2010, 2012, 2014, 2018b; Książek, Ligarski, 2020). He has also prepared several publications on auditing (Ligarski, 2015, 2018a; Ligarski, 2020). Based on the results of his research and observations of organizations with certified quality management systems, he concluded that organizations conduct audits, while some of them do not use the information gained from auditing for management purposes. A paradox occurs, the organization conducts audits but does not use the results for improvement. To make matters worse, the passage of time is increasing the number of organizations that fail to use the information gained from auditing. The author, based on the results of research and 25 years of experience in consulting and auditing activities, has tried to identify the reasons for this situation. The following question was posed: why do organizations

fail to acquire data and use information obtained during an audit examination in the context of improvement?

The purpose of the study is to examine the reasons why organizations do not use the information obtained during the audit process.

2. Auditing standards and number of ISO 9001 certifications in Poland

When looking for reasons why audit information is not being used, one should start by checking whether the concept of auditing has been clearly defined, requirements and guidelines for auditing have been established. And whether these requirements are updated over time. A review of the three groups of standards indicates that the Polish Committee for Standardization issues Polish editions of all standards for establishing a quality management system and auditing it (Table 1).

Table 1.

Compilation of auditing standards in the Polish language in force from 1993 to 2023

No.	Compilation of auditing standards in Polish
1	<p style="text-align: center;">Terminology standards</p> <p>PN-EN 28402:1993 Jakość Terminologia. PN-ISO 8402:1996 Zarządzanie jakością i zapewnienie jakości Terminologia. PN-EN ISO 9000:2001 Systemy zarządzania jakością Podstawy i terminologia. PN-EN ISO 9000:2006 Systemy zarządzania jakością Podstawy i terminologia. PN-EN ISO 9000:2015 Systemy zarządzania jakością Podstawy i terminologia.</p>
2	<p style="text-align: center;">Standards containing requirements</p> <p>PN-EN 29001:1993 Systemy jakości Model zapewnienia jakości w projektowaniu/konstruowaniu, produkcji, instalowaniu i serwisie. PN-EN 9001:1996 Systemy jakości Model zapewnienia jakości w projektowaniu, pracach rozwojowych, produkcji, instalowaniu i serwisie. PN-EN ISO 9001:2001 Systemy zarządzania jakością Wymagania. PN-EN ISO 9001:2009 Systemy zarządzania jakością Wymagania. PN-EN ISO 9001:2015 Systemy zarządzania jakością Wymagania.</p>
3	<p style="text-align: center;">Standards providing guidance for auditing</p> <p>PN-ISO 10011-1:1994 Wytyczne do auditowania systemów jakości Auditowanie. PN-ISO 10011-2:1994 Wytyczne do audytowania systemów jakości Kryteria kwalifikacji auditorów systemów jakości. PN-ISO 10011-3:1995 Wytyczne do audytowania systemów jakości Zarządzanie programami auditów. PN-EN ISO 19011:2003 Wytyczne dotyczące auditowania systemów zarządzania jakością i/lub zarządzania środowiskowego. PN-EN ISO 19011:2012 Wytyczne dotyczące auditowania systemów zarządzania. PN-EN ISO 19011:2018 Wytyczne dotyczące auditowania systemów zarządzania.</p>

Source: Own work.

In all terminology standards, the term audit is clearly defined. The current PN-EN ISO 9000:2015 standard includes a definition of audit (PN-EN ISO 9000:2015). A subsection on internal auditing is included in all standards on quality management system requirements. The subsection includes requirements for the organization of the audit process and its objectives. The current standard PN-EN ISO 9001:2015 includes the requirement to

"ensure that the results of audits are presented to the relevant members of management" (PN-EN ISO 9001:2015). These individuals should make decisions and take actions based on the information obtained. The third group of standards providing guidance on auditing extensively describes how to manage an audit program, how to conduct audits, and how to prepare and evaluate auditors. Such guidelines are included in subsequent standards, with the caveat that successive editions of the standards deal with auditing an increasing number of systems. In the current PN-EN ISO 19011:2018 standard, the guidelines apply to all management systems built on the standards of the standards. Thus, there has been a unification of auditing guidelines. Regardless of the number of systems an organization has, it has general guidelines that can be applied to each system, which should also facilitate their integration. In conclusion, it should be said that Polish organizations have continuous access to auditing-related standards. All editions of the standards in Polish have been published, and the standards are being updated on an ongoing basis. This situation has been the case throughout the history related to the certification of quality management systems and the present times.

A comparison of the number of ISO 9001 certificates awarded in Poland, from 1993 to 2022, provides interesting information (Table 2).

Table 2.

Number of ISO 9001 certificates awarded in Poland from 1993 to 2022

Number of ISO 9001 certificates awarded in Poland in a given year										
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number	1	16	130	260	669	768	1012	2622	2622	3091
Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number	3216	5753	9718	8115	9184	10965	12707	12195	10984	10105
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number	10527	9574	10681	12152	11846	11294	11460	10218	10512	9494

Source: Own study based on data made available on The ISO Survey website (www.iso.org).

Since 1993 there has been a large increase in the number of certificates granted. Only between 2000 and 2001 is there a stabilization in this regard. After a clear increase in the number of certificates until 2005, there is a decline the following year. Then an increase until the highest number of certificates in 2009. Then a decrease for three years, a slight increase in 2013 and a decrease in 2014. An increase in the number of certificates from 2015 to 2016. And basically a gradual decline in the number of certificates from 2017 to 2022. Only in 2019 there is a slight increase in the number of certificates granted. Poland, compared to countries with similar populations in Europe, has a relatively small number of certified quality management systems. For example, in 2022, 9494 organizations were certified in Poland and 32059 organizations in Spain (ISO Survey 2022). A number of factors contribute to this state of affairs. One of them is the auditing process and the use of information from it.

3. Identify reasons for not using audit information

Reflecting on the reasons for not using the information obtained during the audit, the author attempted to identify them in the context of internal and third-party external audits. Based on the results of his own research and observations of certified quality management systems, he identified 10 basic reasons for this situation (Table 3).

Table 3.

Compilation of reasons for not using information obtained from auditing, broken down by internal audit and external third-party audit

Compilation of reasons for not using information obtained from auditing, broken down by:		
No.	Internal audit	External audit
1	Misunderstanding of the essence of auditing	Misunderstanding of the essence of auditing
2	Equating audit with control	Equating audit with control
3	Failure to achieve all audit objectives	Failure to achieve all audit objectives
4	Mistakes made at the stage of selection and preparation of auditors	Mistakes made at the stage of selecting a certification body
5	Difficulties in managing the audit program	Difficulties in managing cooperation with a certification body
6	Superficial audit activities	Agreeing to superficial audit activities
7	Inability to use audit information	Inability to use audit information
8	Undertaking fragmented post-audit activities	Undertaking fragmented post-audit activities
9	Misunderstanding of the importance of the audit cycle	Misunderstanding of the importance of the audit cycle
10	Lack of reliable auditor evaluation and development	Lack of reliable evaluation of the achievements of the certification body and the development of cooperation

Source: Own work.

All potential causes influencing the non-use of information obtained during the audit examination have been identified. Some of the causes are interrelated, the occurrence of one cause is related to another or more causes. Comparing the causes identified in internal audits and third-party audits, six of them were found to be the same. A difference was found in only four out of ten specified causes. This shows that the essence of the cause lies in the organization, its approach to auditing. The differences are only due to the specifics of the audit, whether it is an internal audit or an external third-party audit.

The first, and it seems the most dangerous cause, is a misunderstanding of the essence of auditing. An audit is a process, focused on compliance testing, with clearly defined characteristics. It has precisely defined objectives and specific tasks to fulfill. The result of the audit should be an objective picture of the system, in which compliance with the requirements is confirmed, effectiveness is determined, opportunities for improvement are identified, and if any, nonconformities and weaknesses in the system are detected. Particularly important is information on opportunities for development and improvement. If the management of the organization does not understand the essence of the audit then it will be very difficult to plan the process and make specific requirements for it. It will be difficult to understand why the organization should conduct these activities and what they should lead to. Since we don't know

why to conduct the activities, we begin to treat them as a necessary evil. Something has been imposed on us by customer requirements, corporate conditions or business conditions. We don't really see the point of these activities whereas if they are imposed then they have to be carried out. This approach has led to the marginalization of the audit process. We conduct audits because it has been imposed on us. We try to implement them with minimal effort and resources. Internal auditors become random people who have not been properly prepared for their role. The effects of the work of such people are mediocre. Which only reinforces management's belief that audits do not benefit the organization. We fall into a loop of unfavorable phenomena, as time passes, audits are more and more apparent and resentment of the whole process increases. If audits don't bring anything then why conduct them, except perhaps to meet requirements imposed on the organization from the outside. The organization takes a similar approach to third-party audits. We choose a random certification body, guided by the lowest price of services. Such a body usually does not engage in the audit process and does not have high requirements for the system. At a minimum, it confirms compliance, accepting sham and artificial solutions. This again only reinforces management's belief in the futility of all system supervision. The organization sees no benefit from auditing, either internally or externally, and resentment of the process grows over time. The presented scenario shows what kind of disorder can occur in an organization where management does not understand the essence of auditing. The situation presented seems extreme but is real. Failure to understand the essence of auditing can lead to very negative phenomena in the organization. To make matters worse, these phenomena will worsen over time and will be very difficult to eliminate.

The second reason is the equating of audit with control. Audit and control are two different types of activity that cannot be equated. An audit is an investigation. An auditor conducts a process of investigation, in which he wants to find out, to gather information. An control is a check, a juxtaposition of the actual state with the required state, in order to detect irregularities. In some organizations, audit is clearly equated with control. This misunderstanding of audit leads to narrow expectations and inappropriate audit activities. Instead of conducting an audit investigation focused on obtaining information, auditors focus on identifying nonconformities. Audit is understood as an examination activity that serves primarily to detect nonconformities. Since the main task of an audit understood in this way is to find nonconformities, the main task of post-audit activities is to eliminate nonconformities. The audit becomes a tool for identifying problems in the system. Such expectations are placed on internal auditors and the same expectations apply to third-party auditing. Even if third-party auditors identify improvement recommendations the organization considers them irrelevant and focuses on nonconformities. This misunderstanding of auditing can lead to serious consequences. The organization focuses only on problems, completely disregarding information that can be useful from a development and improvement perspective. It comes to a situation when the system is not improved and

therefore will perform worse and worse over time and will be disconnected from the current needs of the organization.

The third reason is the failure to achieve all the objectives of the audit. The audit has precisely defined objectives: to confirm the compliance of the system with the requirements, to determine its effectiveness, to identify opportunities for development and improvement, and to confirm compliance with the requirements of the regulations. It is also supposed to identify weaknesses in the system and detect nonconformities, if any. If we consciously or unconsciously focus on selected audit objectives then we significantly reduce the amount of information extracted from it. Some organizations focus on confirming compliance with requirements and detecting nonconformities. This is the expectation they place on internal auditors and what they expect from the certification body. Even if there is information on the other audit objectives, it is downplayed and not used at the post-audit stage. Over time, the auditors provide the information that the organization expects, which is to confirm compliance with requirements and identify nonconformities. By not meeting all audit objectives, the organization deprives itself of access to information that could have been used in the development and improvement perspective.

The fourth reason for not using audit information depends on the type of audit. In the case of internal audit, errors and negligence at the stage of selection and preparation of auditors will result in improper implementation of internal audits. Improperly selected and poorly prepared internal auditors will focus on basic audit activities and therefore on confirming compliance and finding non-compliance. It will be difficult for them to determine the effectiveness of the system and even more difficult to propose recommendations for improvement. Since they have not been prepared to do this, they will not do it. By improperly preparing the auditors, the organization agrees to fragmentary data obtained from their work. In the case of a third-party audit, the organization has the option of selecting a certification body. In the market for certification services there are good, average and poor units. If the organization makes mistakes at the stage of selecting a certification body, does not set specific requirements and still limits the costs provided for the process, it will probably find a random certification body. A weak certification body usually uses weak auditors and the quality of their work is low. The organization will therefore find a partner that does not engage in auditing, minimizing the activities carried out in the audit process. This will result in little data obtained from the audit. So there will be a lack of information that can be used for development and improvement. In both cases, internal audit and external audit, the organization will deprive itself of access to relevant data that could be used for decision-making.

The fifth reason also has to do with the type of audit. In the case of internal auditing, difficulties in managing the audit program will result in various disorders concerning the conduct of audits and, in turn, disorders in the use of audit data. The person who manages the audit program is responsible for the organization and conduct of audits, the management of audit results, and the review and improvement of the entire audit program. If this person makes

mistakes, neglects to act then this will have a direct impact on the quantity and quality of the data obtained from the audits. It will also affect post-audit activities and will affect the next audit cycle. Without going into details, it can be said that the attitude and actions of the person managing the audit program largely determine the entire course of the audit process and the use of information from it. In the case of an external audit, one can talk about the difficulty of managing cooperation with the certification body. The person responsible for cooperation with the certification body should clearly articulate expectations of the body and contact it to monitor the effects of cooperation. This person is indirectly responsible for the composition of audit teams conducting third-party audits and the involvement of auditors in the audit. Whether the certification body provides useful information to the organization on opportunities for development and improvement is also the result of this person's work.

The sixth reason is superficial audit activities. This term should be interpreted as audit activities carried out by auditors without the necessary involvement. The auditor conducts the audit with minimal effort, pays attention only to the basic issues, does not engage in explaining phenomena, avoids more difficult topics, does not see the need to determine the effectiveness of the system and seek information that could serve for improvement. In the case of internal audit, such activities are carried out by auditors and are accepted by management. In the case of an external audit, there is consent and acquiescence in the organization to conduct the audit in this way. Auditors conducting superficial audit activities will not collect the necessary data and the organization will experience a deficit of information, especially in the area of development and improvement. Lack of information in this area will result in decisions and actions not being taken for a simple reason - lack of needed information.

The seventh reason is the inability to use audit information. We assume that during an audit, whether internal or external, the auditors have collected data that can be useful in the context of improvement. The organization has the data but does not know how to process it and use it to make decisions and take action. The reasons for this can be various. First, the organization is not aware of the need to process data and make decisions. Second, the information doesn't go to places where it could be used. Third, for some reason, the information is not analyzed. Fourth, a superficial analysis of information is carried out on the basis of which it is difficult to determine the needed actions. The person directly responsible for the use of audit information is the audit program manager. Her responsibilities include convincing top management of the need to take action, passing information to the appropriate places and teams, moderating and supporting the work of teams analyzing audit information. She is also responsible for comprehensively monitoring the use of audit information.

The eighth reason is to take fragmented post-audit actions. Regardless of the outcome of an audit, post-audit actions should always be taken. There are three types of these actions: corrective, preventive and improvement. These actions should be taken in the right order. When nonconformities are detected, corrective actions take priority and subsequent actions should follow. This is where the problem arises in organizations. Usually corrective actions are

taken but preventive and improvement actions are forgotten. Some organizations believe that if no nonconformity is detected there is no need to take post-audit actions. Limiting post-audit activities only to corrective actions poses a serious threat to the organization. An organization focusing on fixing problems and their causes overlooks activities aimed at development and improvement, which can lead to a situation of no improvement. Despite having information on improvement, actions are not taken in this regard and all attention is focused on corrective actions.

The ninth reason is a misunderstanding of the importance of the audit cycle. An audit is a cyclical process that should be conducted at scheduled intervals. Audits should be conducted with such frequency as to ensure that the needed information is available. Excessive intervals between audits can result in an information deficit. While internal audits can be easily increased in frequency, external audits require arrangements to be made with the certification body. In any case, the organization should adjust the frequency of auditing to its needs. A financial problem arises here. If the organization increases the frequency of auditing then the cost of the process will increase, which will be particularly evident in external auditing. Some organizations apply austerity here. It conducts audits as infrequently as possible. The only question that remains is, if the organization does not periodically receive the information it needs, will it be possible to develop and improve?

The tenth reason has to do with the type of audit. If internal auditors do not provide sufficient audit information then they should be evaluated fairly and corrective action is needed. Failure to reliably evaluate and improve auditors will only result in worsening problems in this area. Auditors who are not evaluated will not even be aware that they are not doing their job properly. Failure to develop auditors will lead to a situation where they will perform their duties worse and worse as time goes by. The audit program manager should periodically evaluate the performance of internal auditors and work on their development. In the extreme case if the auditor, despite the creation of conditions, does not improve his performance, he should be removed from conducting audits. In the event that external auditors conducting third-party audits do not provide the necessary information, it is necessary to reliably assess the achievements of the certification body and improve cooperation decisively. Failure to reliably assess the achievements of the certification body and improve cooperation will result in the organization having an apparent partner that does not help the organization in its development. The person coordinating cooperation with the certification body should clearly articulate comments to the body and remind expectations from it. The certification body is obliged to significantly improve the results of its work. If the auditors of the certification body do not improve their work this is reason enough to seek, at a convenient time, another certification body. During the recertification stage of the system, the certification body can be changed without incurring additional costs.

4. Summary

Despite the passage of 30 years of certification of quality management systems in Poland and the availability of auditing standards, some organizations do not use the information obtained from the audit process. It is worrying that the number of such organizations has been increasing recently. Organizations conduct internal audits and are subjected to external audits, but are unable to use the information obtained in the context of development and improvement. The author of the study, based on his research and observation of certified management systems, identified 10 basic reasons for this situation. Each cause was described, with a breakdown of internal audit and external audit, if applicable. All identified causes were analyzed. Comparing the results obtained with Polish publications on auditing from recent years, one can find a lot of convergence. The authors pay special attention to the role of the human factor in the audit process (Lisiecka et al., 2017; Wojciechowski, 2020; Grzesiak, 2021). They emphasize the need to involve top management (Lisiecka et al., 2017; Wojciechowski, 2020; Grzesiak, 2021), acquire the necessary competencies (Lisiecka et al., 2017; Grzesiak 2021), adequately prepare and support auditors (Rogala, 2017; Wojciechowski, 2020), and have good communication in the audit process (Golińska, 2019; Szkiel, 2023). Therefore, it can be concluded that the identified causes allow us to identify the sources of potential disorders that can occur in any organization. On this basis, it can be concluded that there are two main types of problems. The first is the inability to obtain data, and the second is the inability to process data and use the information obtained. Inability to acquire data means that the organization is unable to acquire the data it needs. This may be due to a lack of or insufficient awareness of auditing on the part of management. If top management does not understand the nature of auditing and is unable to determine what the process is for then it will be very difficult to implement. If those managing the audit program make significant errors and omissions then the process cannot function properly. Paradoxically, there is a rich set of auditing standards that is constantly being updated. Why don't managers want to reach for it, or understand the requirements therein? There is a clear barrier in the flow of information: auditing standards - top management of the organization. Is it due to non-use of the standards or lack of understanding of their content, or perhaps both: selective use of the standards and lack of understanding of their content? The second problem is the inability to process the data and use the information obtained in a development and improvement perspective. The organization gets some data from auditing but mismanagement of audit results does not lead to decisions and actions. Information does not get to the right places for decision-making or gets to a limited extent. Information is not properly analyzed, decision makers do not take the needed decisions and actions. The audit program manager and top management are responsible for this state of affairs. The lack or insufficient awareness of management and the lack of needed knowledge regarding the use of audit information can again be traced here. There are many reasons for

this, but it would be worth considering whether there is audit information, interpretations of standards requirements, collections of good practices available in an understandable form that organizations could use? In the pursuit of new solutions and systems, have basic systems that have been in place for years been neglected? Hasn't the wrong assumption been made that everyone concerned knows what auditing is and what tasks it has to perform? It turns out that the passage of time only intensifies the emerging problems. The number of organizations that have problems with auditing is steadily increasing. There are opinions that the auditing process does not do much, and such opinions are spread among organizations. Perhaps here we should look for one of the reasons for the small number of certified quality management systems in Poland. The problem of auditing does not end with ISO 9001 compliant systems, but extends to other systems where auditing is carried out. Organizations are expanding systems, creating integrated systems. Initial auditing problems in one system are transferred to other systems. Serious disruptions can arise in the functioning of several systems and the organization as a whole. Simply diagnosing auditing problems is only the beginning of the necessary actions. Unfortunately, there are already considerable limitations here. Organizations don't recognize or don't want to recognize that they have problems using the information obtained during auditing. They don't accept that they can't get enough data out of the auditing process. They are unaware that they are mishandling audit data and not using the information obtained for development and improvement. To begin to combat any problem one must start with awareness of the problem. Without organizations realizing that there are problems, it will be difficult to change anything. That's why it's so important to educate about auditing, show good practices and disorders in the field, and share experiences between organizations.

Acknowledgements

The publication of the article received financial support from the Silesian University of Technology project BK-264/ROZ1/2024 (13/010/BK_24/0081).

References

1. Abuazza, O.A., Labib, A., Savage, B.M. (2019). Development of an auditing framework by integrating ISO 9001 principles within auditing. *International Journal of Quality & Reliability*, 37(2), 328-353.
2. Alic, M., Rusjan, B. (2010). Contribution of the ISO 9001 internal audit to business performance. *International Journal of Quality and Reliability Management*, 8, 916-937.

3. Claver, E., Tari, J.J. (2013). Levels of quality management in certified firms. *TQM & Business Excellence*, 4(9), 981-998.
4. Ejdys, J. (2011). *Model doskonalenia znormalizowanych systemów zarządzania oparty na wiedzy*. Białystok: Wyd. Politechniki Białostockiej.
5. Francis, J.R. (2011). A Framework for understanding and researching audit quality. *Auditing: A Journal of Practice & Theory*, 30(2), 125-152.
6. Golińska, E. (2019). Skuteczna komunikacja w procesie audytu wewnętrznego. *Marketing i Rynek*, 11, 55-62.
7. Grudowski, P. (2010). *Projektowanie nadzorowanie i doskonalenie systemu jakości według normy PN-EN ISO 9001:2009 w oparciu o podejście procesowe*. Gdańsk: ODDK.
8. Grzesiak, L. (2021). *Kapitał ludzki jako czynnik skuteczności audytu wewnętrznego*. Łódź: Wyd. Uniwersytetu Łódzkiego.
9. Hernandez, H. (2010). Quality audit as a driver for compliance to ISO 9001:2008 standards. *The TQM Journal*, 4, 454-466.
10. Jedynak, P. (2007). *Ocena znormalizowanych systemów zarządzania jakością Instrumenty i uwarunkowania wartości*. Kraków: Wyd. Uniwersytetu Jagiellońskiego.
11. Jedynak, P. (Ed.) (2004). *Audyt w zarządzaniu przedsiębiorstwem*. Kraków: Księgarnia Akademicka.
12. Kreier, E., Łuczak, J. (1998-2002). *Łatwy i skuteczny sposób uzyskania certyfikatu ISO 9000*. Poznań: Forum.
13. Książek, D., Ligarski, M.J. (2020). *Badania oddziaływania rozwiniętego systemu zarządzania jakością na doskonalenie wyrobu i procesu na przykładzie finalistów Polskiej Nagrody Jakości*. Gliwice: Wyd. Politechniki Śląskiej.
14. Lenning, J., Gremyr, I., Raharjo, H. (2022). What contributes to auditee satisfaction in external ISO 9001 audits? *The TQM Journal*, 34(6), 1877-1895.
15. Ligarski, M.J. (2007). Ocena systemu zarządzania jakością – wyniki badań. *Towaroznawcze Problemy Jakości*, 4(13), 25-35.
16. Ligarski, M.J. (2010). *Podejście systemowe do zarządzania jakością w organizacji*. Gliwice: Wyd. Politechniki Śląskiej.
17. Ligarski, M.J. (2012). Problem identification method in certified quality management systems. *Quality & Quantity*, 46, 315-321.
18. Ligarski, M.J. (2014). Diagnoza systemu zarządzania jakością w polskich organizacjach. *Problemy Jakości*, 5, 14-22.
19. Ligarski, M.J. (2015). Dobór i przygotowanie kandydatów do pełnienia funkcji audytora jakości – analiza krytyczna. *Systemy wspomagania w inżynierii produkcji Jakość i bezpieczeństwo*, 3(12), 99-108.
20. Ligarski, M.J. (2018a). Istota audytu i jego rola w systemie zarządzania jakością. In: R. Knosala (Ed.), *Innowacje w zarządzaniu i inżynierii produkcji*, t. 2 (pp. 261-271). Opole: Oficyna Wyd. Polskiego Towarzystwa Zarządzania Produkcją.

21. Ligarski, M.J. (2018b). Methodology of problem analysis in the quality management system with the use of systems approach. *Manage. Syst. Prod. Eng.*, 26(3), 157-161.
22. Ligarski, M.J. (2020). Zagrożenia dotyczące audytowania systemu zarządzania jakością w dobie Przemysłu 4.0. In: A. Michna, J. Kaźmierczak (Eds.) *Przemysł 4.0 w organizacjach. Wyzwania i szanse dla mikro, małych i średnich przedsiębiorstw* (pp. 161-171). Warszawa: CeDeWu.
23. Lisiecka, K., Czyż-Gwiazda, E., Lisiecka-Bielanowicz, M. (2017). *Kompetencje w certyfikowaniu i audytowaniu systemów zarządzania jakością produktów*. Katowice: Wyd. Uniwersytetu Ekonomicznego w Katowicach.
24. Łuczak, B., Kuklińska, D. (2007). *Audyty i audytowanie Jak sprawić by przynosiły jeszcze więcej korzyści*. Poznań: Wyd. Wyższej Szkoły Bankowej.
25. Matuszak-Flejszman, A. (Ed.) (2010). *Audit narzędziem utrzymania i doskonalenia znormalizowanych systemów zarządzania*. Poznań: Polskie Zrzeszenie Inżynierów i Techników Sanitarnych.
26. Okwiri, O.A. (2013). ISO 9001 quality management system audit as an organizational effectiveness evaluation tool. *International Journal of Information Technology and Business Management*, 20(1), 15-29.
27. Pacana, A., Stadnicka, D. (2006). *Wdrażanie i auditowanie systemów zarządzania jakością zgodnych z normą ISO 9001:2000*. Rzeszów: Wyd. Politechniki Rzeszowskiej.
28. Pacana, A., Stadnicka, D. (2017). *Nowoczesne systemy zarządzania jakością zgodne z ISO 9001:2015*. Rzeszów: Wyd. Politechniki Rzeszowskiej.
29. Penini, G., Carmeli, A. (2010). Auditing in organizations: A theoretical concept and empirical evidence. *System Research and Behavioral Science*, 27(1), 37-59.
30. Pivka, M. (2004). ISO 9000 value-added auditing. *TQM & Business Excellence*, 15(3), 345-353.
31. PN-EN ISO 9000:2015 Systemy zarządzania jakością Podstawy i terminologia.
32. PN-EN ISO 9001:2015 Systemy zarządzania jakością. Wymagania.
33. Rogala, P. (2017). Etyka zawodowa audytorów wewnętrznych – studium przypadku. *Problemy Jakości*, 3, 17-20.
34. Russell, J.P. (2007). Know and follow ISO 19011'a auditing principles. *Quality Progress*, 40(2), 29-34.
35. Sampaio, P., Saraiva, P., Rodrigues, A.G. (2009). ISO 9001 certification research: questions, answers and approaches. *International Journal of Quality and Reliability Management*, 1, 38-58.
36. Sun, J., Liu, G. (2011) Client-specific litigation risk and audit quality differentiation. *Managerial Auditing Journal*, 26(4), 300-316.
37. Szkiel, A. (2023). Ocena skuteczności procesu audytów wewnętrznych z wykorzystaniem metody ABCD Suzuki. *Problemy Jakości*, 1, 9-18.
38. *The ISO Survey 2022*. Retrieved from: <http://www.iso.org>, 17.01.2024.

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39. *The ISO Survey*. Retrieved from: <http://www.iso.org>, 15.01.2024.
40. Wojciechowski, P. (2020). Znaczenie audytów w systemach zarządzania jakością. *Zeszyt Naukowy Wyższej Szkoły Zarządzania i Bankowości w Krakowie*, 56, 28-39.

PRICE SENSITIVITY OF STUDENTS TO THEIR FAVORITE APPLICATIONS AND PROGRAMS

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Purpose: The aim of the article is to determine the price sensitivity of students to their favorite applications and programs.

Design/methodology/approach: The main research problem is: What is the price sensitivity of students to their favorite applications and programs? The study was conducted using the quantitative method, the survey technique on students in Krakow (Poland) in May and June 2023. The research sample was 424 people.

Findings: Every second student would not give up Messenger if it was paid at an affordable price, every third from Instagram and Spotify, every fourth from YouTube, and every fifth from TikTok. They would be less willing to pay, for example, for Facebook. Every third student would be willing to pay up to PLN 20 per month for their favorite application or program (above this amount, they would rather not use it than pay). Every fifth respondent indicated PLN 30 per month as the upper limit. The vast majority of students (71%) declared that if the respondents' favorite application or program was paid at an affordable price, they would continue to use it. One in four respondents said they would look for a replacement (25%).

Research limitations/implications: Studying price sensitivity in the new technologies sector is a complex problem and the research presented in this work covers only selected aspects in this field.

Practical implications: The research results show young people's declarations of price changes in the new technologies sector. Could raising the prices of their favorite apps cause them to use them less? The new technologies sector can use the research results to set prices for selected applications or programs.

Social implications: The research conclusions can be used to determine whether price manipulation for new technologies can result in less use of them by young people, and thus have a positive social effect.

Originality/value: The study provides insights into the willingness of students to pay for these services and identifies specific preferences and behaviors regarding the use of paid and free versions of applications. The research results can be used by owners of online platforms, marketers, educators and students.

Keywords: price elasticity of demand, consumer price sensitivity, willingness to pay, new technologies, social media.

Category of the paper: research paper.

1. Introduction

Currently, there is a strong development of various types of mobile and web applications (including social media, such as TikTok, Instagram), streaming platforms (e.g. Netflix, Spotify), artificial intelligence tools (e.g. Chat-GPT) and computer programs (e.g. Photoshop, MS Office) in the sector of new technologies that have a very large impact on the functioning of socio-economic life. This impact can be perceived both in positive aspects (e.g. unlimited access to knowledge, the possibility of real-time contact with any user connected to the Internet, the possibility of using music and film resources legally without having to download them from the Internet, support in creative processes and many others) and negative ones (e.g. addiction to these platforms, isolation of especially young people, depression, screen fatigue, threats related to cybercrime and many others). Considering these negative aspects in particular, it is worth examining various possibilities that would serve to limit the use of such platforms, especially among young people. Price could be some kind of barrier.

The aim of the research is to determine the price sensitivity of students to their favorite applications and programs. The implementation of this goal will allow to answer the question of what price of these platforms could be a barrier for young people to use them. The study provides insights into the willingness of students to pay for these services and identifies specific preferences and behaviors regarding the use of paid and free versions of applications.

The main research problem is: What is the price sensitivity of students to their favorite applications and programs? As a hypothesis, it was assumed that the surveyed students have purchased paid versions of their favorite applications and programs, such as Netflix, Spotify or YouTube. In the case of free applications or programs they use, such as TikTok or Instagram, they would not give them up if the price was affordable.

2. Consumer price sensitivity to selected applications and programs in theoretical approach

The price elasticity of demand is the ratio of the relative change in demand for a given good to the relative change in its price (Begg, Fisher, Vernasca, Dornbusch, 2014; Samuelson, Nordhaus, 2008). Flexibility examines the reactions of consumers to changes in the price of a specific one good, assuming *ceteris paribus* for the other determinants. It can be calculated according to the following formula (Perloff, 2007):

$$E = \frac{\Delta Q/Q}{\Delta P/P}, \quad (1)$$

where:

E – price elasticity of demand,

Q – the amount of demand,

P – the price of the good.

When a 1% change in price causes a change in demand of more than 1%, the demand for a good is said to be elastic with respect to price. However, when this change is less than 1%, we are dealing with demand inelastic with respect to price. An exceptional situation is created by demand with unit elasticity when the percentage change in the quantity of the good and its price are the same. The lower the negative values of the price elasticity, the more elastic the demand, reaching the limit value equal to – (perfectly elastic demand). When the price elasticity is zero, there is rigid demand. Income elasticity, on the other hand, means the percentage change in the quantity of the good demanded, taking into account the percentage change in income, assuming that other factors (e.g. price) are constant (Samuelson, Nordhaus, 2008).

The subject of research for the purposes of this article is the price sensitivity of students to selected services from the new technology sector: mobile and web applications (including social media, such as TikTok, Instagram), streaming platforms (eg. Netflix, Spotify), artificial intelligence tools (e.g. Chat-GPT) and computer programs (e.g. Photoshop, MS Office). The creators of these services (applications or programs) shape their business models and thus the prices of these services in different ways. Generally, however, one can indicate (Doligalski, et al., 2014; Michalak, 2016; Waliński, 2013; Wierzbiński, 2016):

- Free model, based on an advertising system (eg Facebook, Instagram, TikTok) - services are free for registered users; prices are for advertising (e.g. if users want to reach a wider or specific audience, they must purchase ads); most social media is based on this model;
- Freemium model (e.g. Spotify, LinkedIn, YouTube) - in this model, the basic functions of the platform are free, but if the user wants to unlock its full capabilities or additional options, he should purchase the premium version of the platform; this model also includes Chat-GPT, the older versions of which are free, and the latest one is paid;
- Subscription model (e.g. Netflix) - in this case, the user must purchase a paid subscription to use any of the platform's functions.

There are many factors influencing the price elasticity of demand (Moroz, 2005; Samuelson, Nordhaus, Varian, 1995; Wachowiak et al., 2006). Referring them to the new technology sector, one can indicate:

- Poor availability of substitutes – although the aforementioned platforms have competition (even compete with each other), each of them has unique features, specific functions, target groups, which result in a rather low propensity of users to completely replace one platform with another; rather, users use these applications simultaneously (according to the Digital 2023 Poland Report (2023) average number of social platforms used by users each month is 6.2).

- Free or relatively low prices in relation to the average income (e.g. the basic Netflix package costs PLN 29.99 per month, and sharing an account with a person from another household - PLN 9.99) – this contributes to relatively low price sensitivity.
- The need to use platforms due to the fulfillment of various types of needs by these platforms (the need to belong to a group, the need for contacts, building relationships, self-presentation, entertainment and others). Additionally, many of these platforms can be used for professional and/or commercial purposes. This definitely reduces the price sensitivity of consumers.
- Relatively high brand loyalty – users become attached to particular platforms and their brands (on average they spend 2h02M on these applications every day (Digital 2023 Poland, 2023)).
- Age matters – especially young people seem to become increasingly dependent on this type of platforms (Kanwal, Pitafi, Akhtar, Irfan, 2019), so they may be less sensitive to price changes than older people.
- There are several studies on the extent to which these platforms are addictive to users (see, for example, Tutgun-Ünal, 2020; Brooks, Wang, Schneider, 2020).

To sum up, there are strong reasons to assume that the market of the above-mentioned services from the new technology sector is characterized by low elasticity of demand.

3. Methods

The aim of the research is to determine the price sensitivity of students to their favorite applications and programs. The main research problem is: What is the price sensitivity of students to their favorite applications and programs?

The following research questions were formulated that detail the main problem:

- What are the favorite applications and programs of the surveyed students?
- Which of these applications and programs do respondents use for profit?
- Would respondents give up using their favorite applications and programs if they were paid?
- What is the upper price barrier of respondents' favorite application or program, above which they would rather not use that application or program than pay for it?
- What respondents have purchased paid versions of applications or programs?

As a hypothesis, it was assumed that the surveyed students have purchased paid versions of their favorite applications and programs, such as Netflix, Spotify or YouTube. In the case of free applications or programs they use, such as TikTok or Instagram, they would not give them up if the price was affordable.

The study was conducted using the quantitative method, a survey technique on students in Krakow (Poland) in May and June 2023. The research sample was 424 people. In the group of respondents, 71.7% were women and 28.3% - men. These were mainly people aged 20 (37.7%) and 21 (24%). The remaining persons were aged 19 (16%), 24 or older (10.4%), 22 (8%) or 23 (3.8%). Nearly 40% of the respondents live in a provincial capital, and 35% - in the countryside. The remaining people live in a city with the rights of a commune (14.6%) or a poviast city (10.8%). Slightly more than half of the surveyed students declared that they worked for money (55.2%).

From the point of view of the purpose of the research, data on the average monthly disposable income of the surveyed students (Figure 1) and average monthly savings after taking into account all expenses are also important (Figure 2).

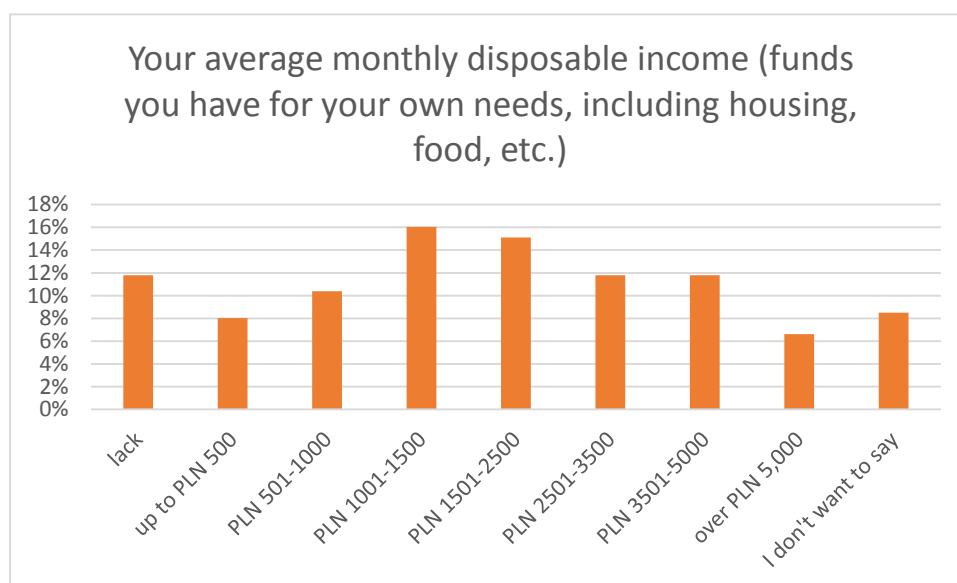


Figure 1. Respondents' average monthly disposable income (funds they have for own needs, including housing, food, etc.).

Source: own.

The level of disposable income of the surveyed students varies and ranges from PLN 0 (12%) to PLN 3500-5000 (11.8%) or more (6.6%). The largest percentage of students declared a disposable income of PLN 1001-1500 (16%) or PLN 1501-2500 (15%). It is worth comparing it to the average monthly disposable income in 2022 in Poland per capita, which amounted to PLN 2249.79 (Announcement..., 2022). About 61% of students declared income below this level.

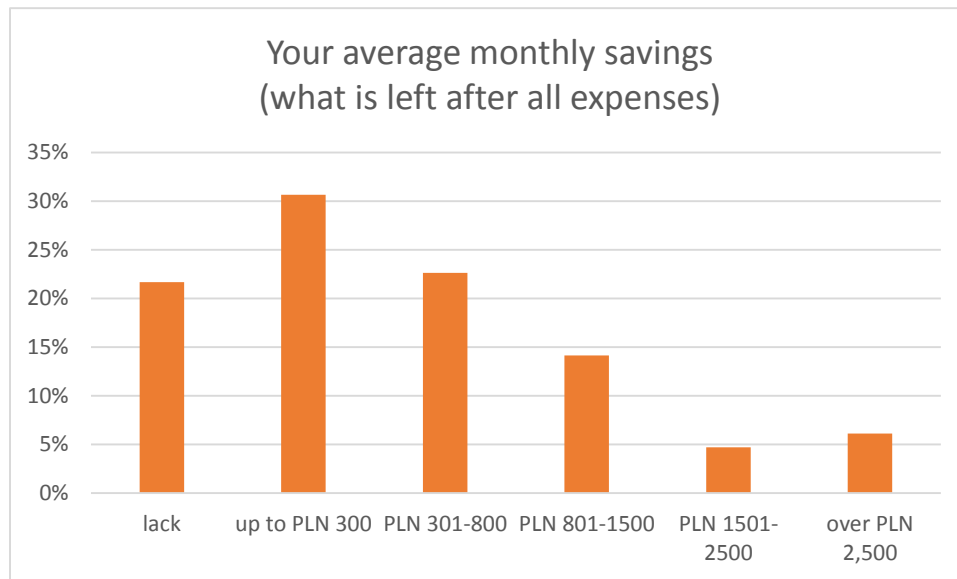


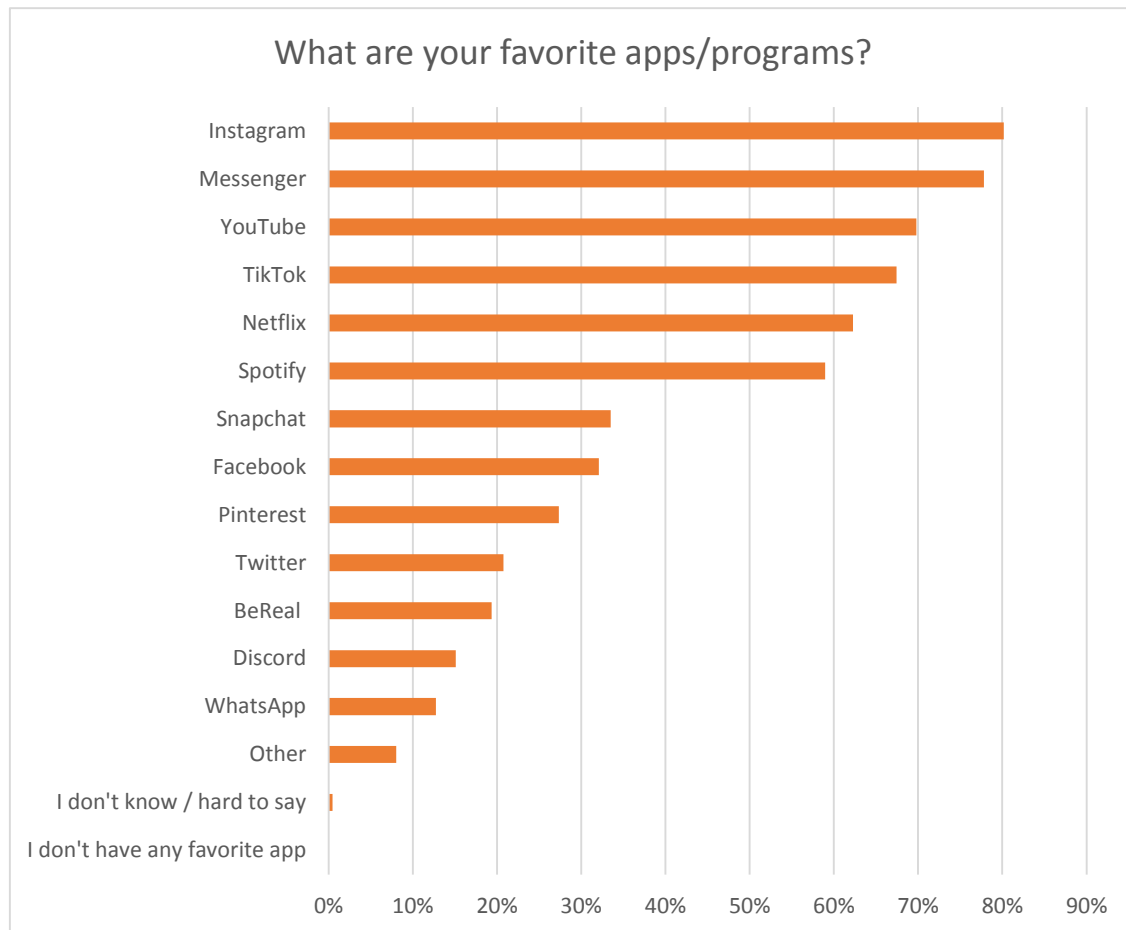
Figure 2. Respondents' average monthly savings (what is left after all expenses).

Source: own.

Monthly average savings of almost every third surveyed student amount to PLN 300 (30.7%). Every fifth respondent has no savings (21.7%) or has savings of PLN 301-800 (22.6%). Comparing this to the average monthly savings of Poles in 2022, which amounted to approx. PLN 830 (Sytuacja farms..., 2022), it should be noted that 75% of respondents have lower than average savings.

4. Findings

When determining the price sensitivity of students to their favorite applications and programs, the first thing to do is to select those applications and programs that are popular with respondents. Therefore, the first research question is: what are the favorite applications and programs of the surveyed students? Data in this area are presented in Figure 3.



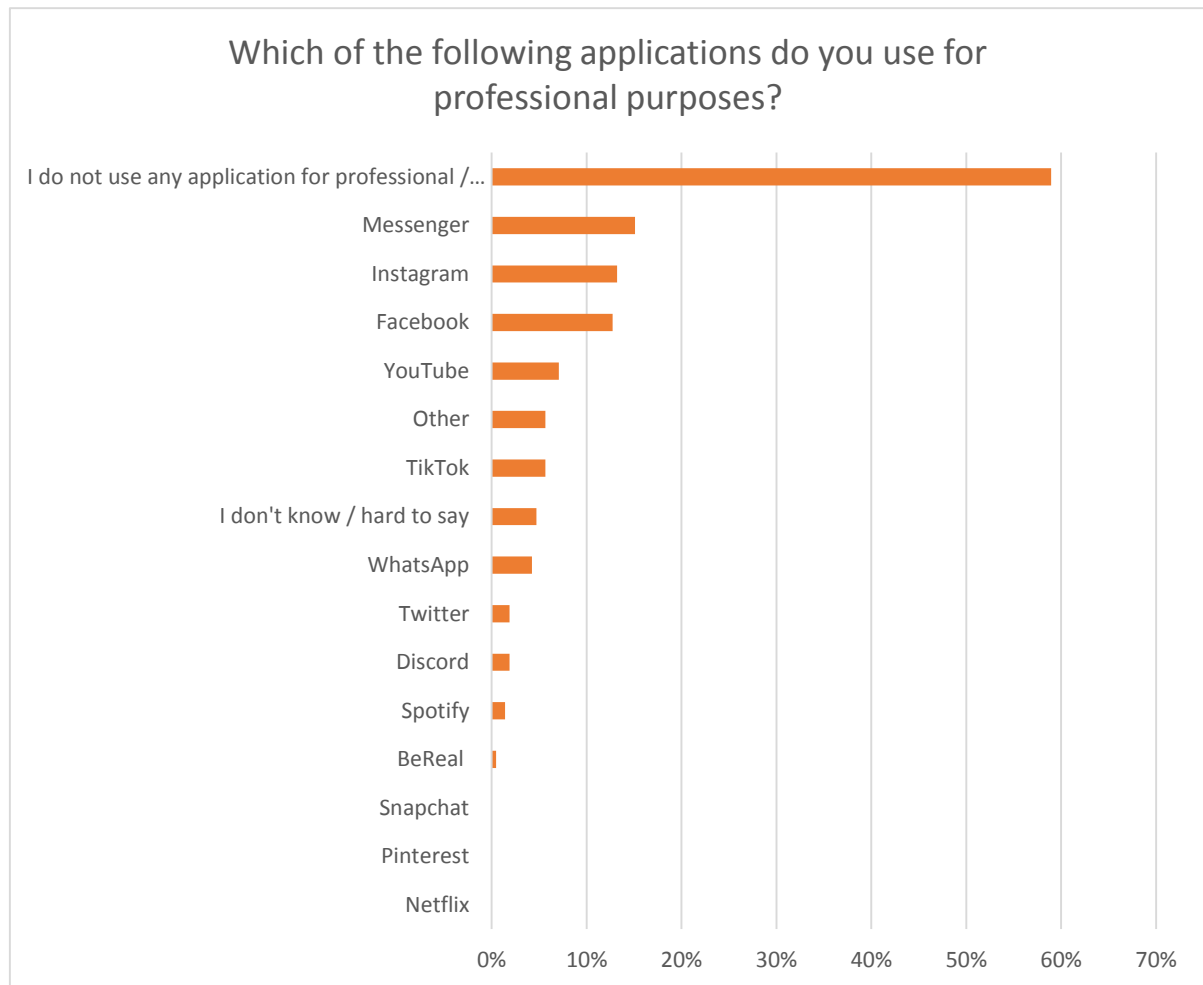
The sum in the graph is greater than 100% because respondents could indicate more than one answer.

Figure 3. Respondents' favorite platforms.

Source: own.

The most popular applications among the respondents are: Instagram (80.2%), Messenger (77.8%), YouTube (69.8%), TikTok (67.5%), Netflix (62.2%) and Spotify (58.9%). Other indications of favorite applications or programs are: Snapchat (33.5%), Facebook (32.1%), Pinterest (27.3%), Twitter (20.8%) and BeReal (19.3%). Some respondents also named Discord (15%), WhatsApp (12.7%) and others (8%) among their favorites.

The second research question was: which of these favorite applications and programs do respondents use for profit? Respondents' responses are summarized in Figure 4.



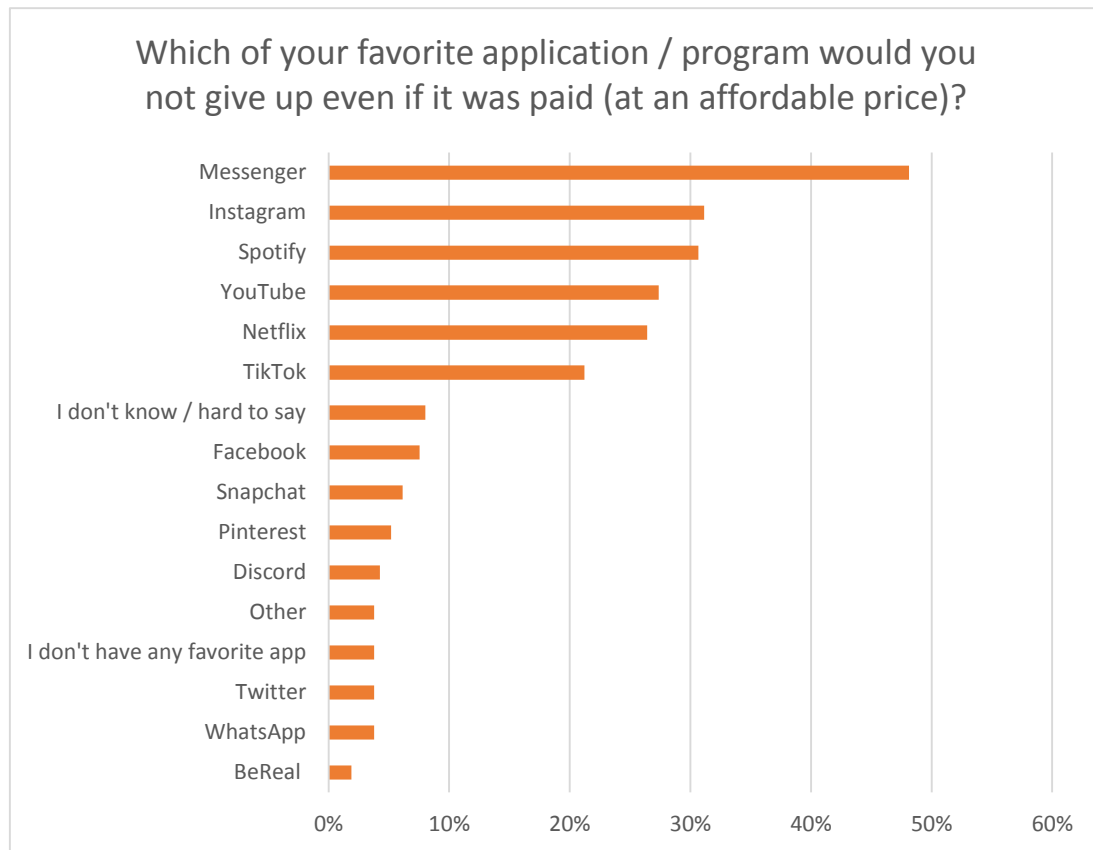
The sum in the graph is greater than 100% because respondents could indicate more than one answer.

Figure 4. Apps used by respondents for professional or commercial purposes.

Source: own.

Nearly 60% of respondents do not use any of these applications or programs for professional or commercial purposes. In addition, 15.1% of respondents declared that they use Messenger for these purposes, 13.2% – Instagram, 12.7% – Facebook, 7% – YouTube, 5.7% – Other, and 5.7% – TikTok. Some people use WhatsApp – 4.7%, Twitter – 1.9%, Discord – 1.9%, Spotify – 1.4% and BeReal – 0.5% for professional or commercial purposes. The price sensitivity of students who use these applications for professional or commercial purposes should be lower.

Most of respondents' favorite apps or programs are free. Some of them (YouTube, Spotify) have voluntary paid versions, while Netflix requires a fee to use it. Price sensitivity reveals a lot when respondents declare whether they would give up using their favorite apps and programs if they were paid at an affordable price (see Figure 5).



The sum in the graph is greater than 100% because respondents could indicate more than one answer.

Figure 5. Respondents' favorite apps/programs that they would not give up even if they were paid (at an affordable price).

Source: own.

According to the respondents' declarations, if their favorite applications were paid, they would not give up: Messenger (48.1%), Instagram (31.1%) and Spotify (30.7%). In addition, respondents would be willing to pay to use YouTube (27.4%), Netflix (26.4%) and TikTok (21.2%). Some would also like to continue using Facebook (7.5%), Snapchat (6.1%), Pinterest (5.2%), Discord (4.2%) and others (3.7%) for a fee. relatively low price sensitivity of the surveyed students. They are willing to pay for the continued use of their favorite applications. It is therefore worth defining the upper price barrier of the respondents' favorite application or program, above which they would rather not use this application or program than pay for it (Figure 6).

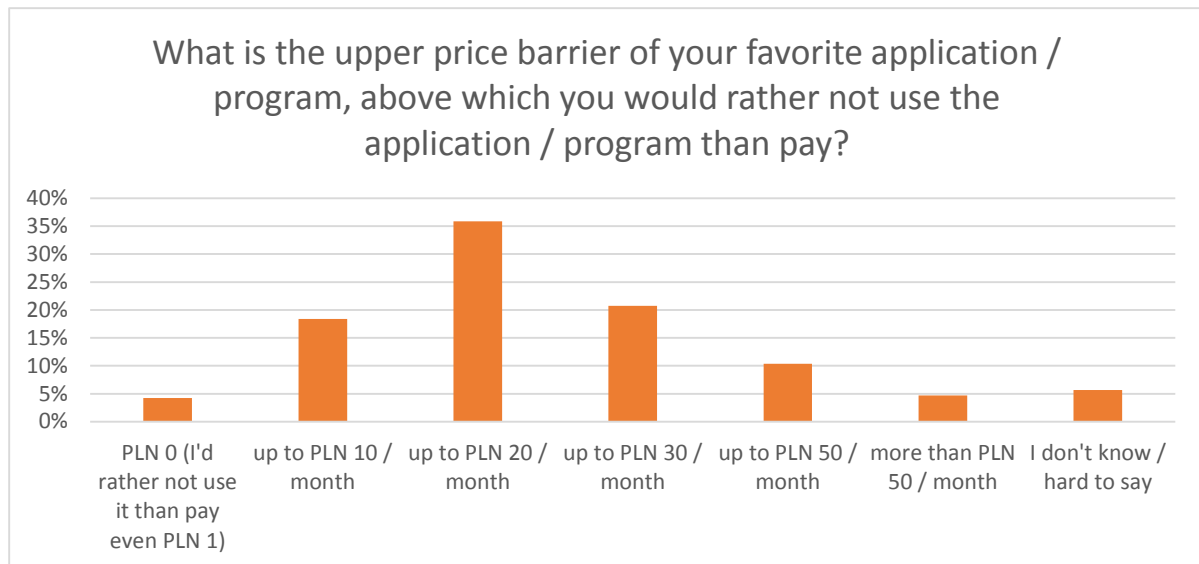


Figure 6. The upper price barrier of respondents' favorite application/program, above which they would rather not use the application / program than pay for it.

Source: own.

Every third student would be willing to pay up to PLN 20 per month for their favorite application or program (35.8%). Above this amount, he would rather not use it than pay. About 20% of the respondents indicated PLN 30 per month as the upper limit, and 18% - PLN 10. Every tenth student declared PLN 50 per month (10.4%). Only 4.2% answered that they would rather not use their favorite platform than pay for it. A similar percentage of respondents indicated that they would be willing to pay more than PLN 50 per month (4.7%). These answers largely show the rather low price sensitivity of students to the use of their favorite platforms. This is also evidenced by the data presented in Figure 7.

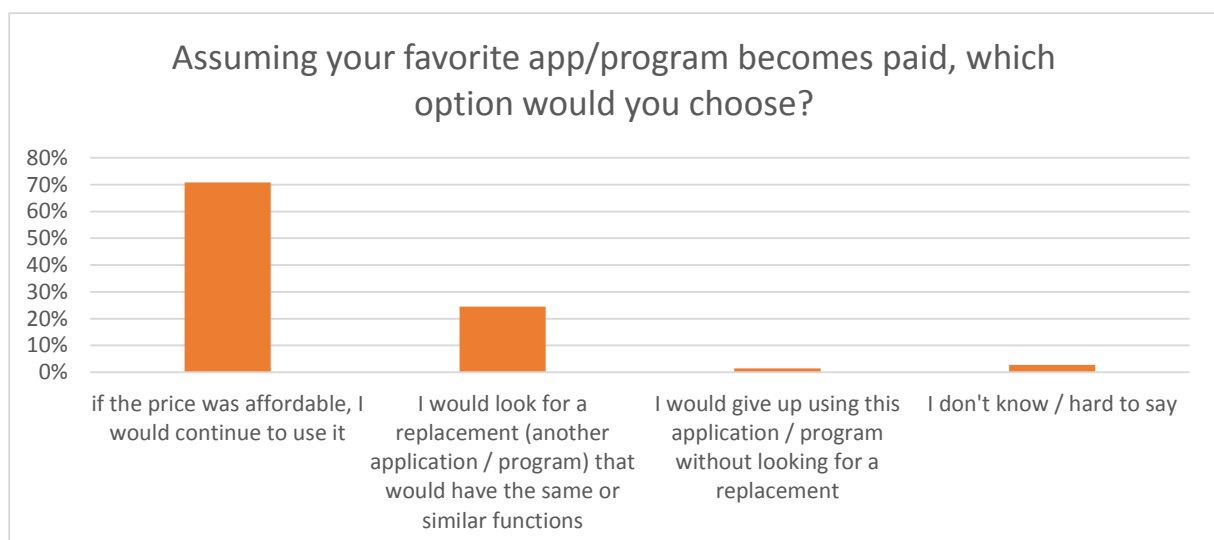
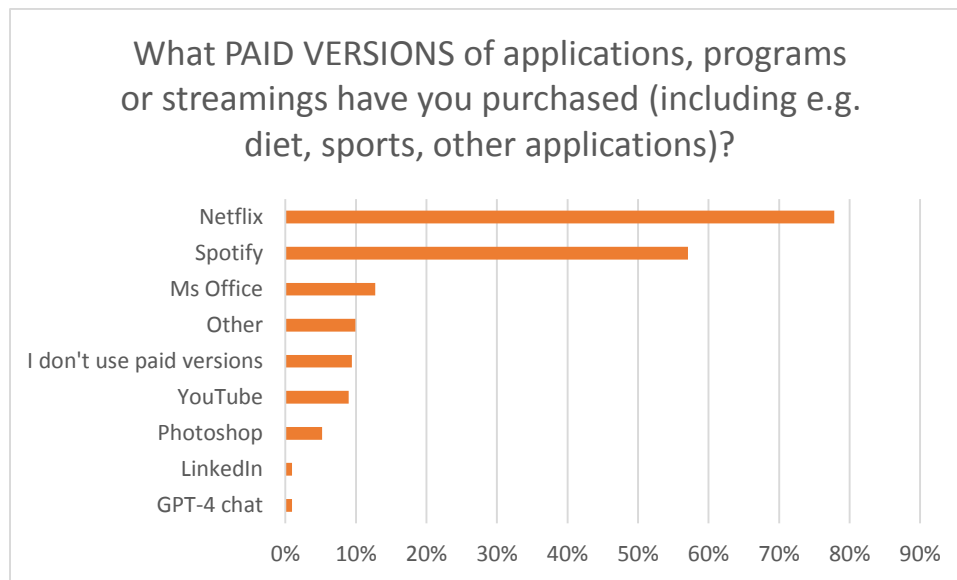


Figure 7. Respondents' declaration when their favorite application / program becomes payable.

Source: own.

The vast majority of students (70.8%) declared that if the respondents' favorite application or program was paid at an affordable price, they would continue to use it. Every fourth respondent said that he would look for a replacement (24.5%). Only 1.4% of respondents said that they would give up using their favorite application, and 2.8% had no opinion.

It is also worth presenting the declarations of the surveyed students regarding which paid applications, programs or streaming services they have purchased (including, for example, diet, sports and other applications). Data in this range are presented in Figure 8.



The sum in the graph is greater than 100% because respondents could indicate more than one answer.

Figure 8. Purchased paid versions of applications, programs or streaming (including e.g. diet, sports, other applications) by respondents.

Source: own.

The vast majority have purchased access to Netflix (77.8%). As mentioned, this app is only available in the paid version. In addition, 57% have a paid version of Spotify. Netflix and Spotify are therefore the two most paid applications by students. Some also have MS Office (12.7%), a paid version of YouTube (8.9%) or Photoshop (5%). Nearly every tenth student stated that she/he did not use paid versions of applications or programs (9.4%).

The respondents were asked how much, on average, they spend per month on the purchase (including subscriptions) of the above-mentioned applications, programs, streamings in total (Figure 9).

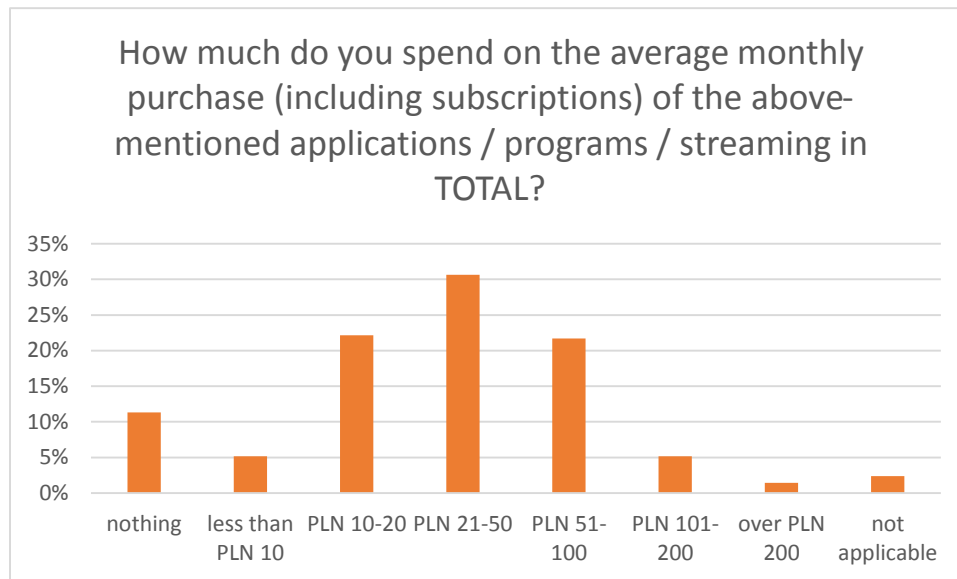


Figure 9. The amount that respondents spend on an average monthly for the purchase (including subscriptions) of the above-mentioned applications/programs/streaming.

Source: own.

According to the declarations of nearly every third student, on average, they spend from PLN 21 to PLN 50 (30.7%) per month on the purchase or subscription of the above-mentioned applications, programs or streaming services. Moreover, 22% spend PLN 10-20, while 21.7% - from PLN 51 to PLN 100. Only one in ten respondents stated that they did not spend any amount (11.3%).

To sum-up, key findings of the research are as follows:

- Every second student would not give up Messenger if it was paid at an affordable price.
- Every third from Instagram and Spotify, every fourth from YouTube, and every fifth from TikTok.
- Every third student would be willing to pay up to PLN 20 per month for their favorite application or program.
- 71% of students declared that if their favorite application or program was paid at an affordable price, they would continue to use it.
- 25% of respondents said they would look for a replacement if their favorite app or program became paid.

Based on the above research results, it should be noted that the price sensitivity of the surveyed students to their favorite applications or programs is rather low and they are willing to pay for using them, as long as the price is affordable.

5. Discussion

In this research, the price sensitivity of students towards their favorite applications and programs in the context of new technologies was established. The study provides insights into the willingness of students to pay for these services and identifies specific preferences and behaviors regarding the use of paid and free versions of applications. Research has shown that the price sensitivity of students to their favorite mobile and web applications or programs is rather low. Paying for their favorite applications would not be a problem if only the price was affordable (up to PLN 20 per month). This means that the price up to this amount would not be a barrier to limiting the use of these applications by young people. The relatively low price sensitivity in this case is influenced, among others, by factors such as: poor availability of substitutes, free or relatively low prices in relation to average income, the need to use platforms due to the fulfillment of various types of needs by these platforms (e.g. 40% of them use them for professional and/or commercial purposes), relatively high brand loyalty and dependence on these platforms, as well as the young age of users (younger people may be less sensitive to price changes than older people). The results of the research show the attachment of students to these applications, which increases the concerns about the risks associated with the use of these platforms (e.g. addiction to these platforms, isolation of young people in particular, depression, screen fatigue, risks associated with cybercrime and many more).

Previously, similar research was conducted on the willingness to pay in the technology sector. For example, Hebly (2012) investigated the willingness to pay for paid Mobile Applications (Paid Apps), especially the importance of antecedents on likelihood to purchase paid Apps. The study of Wang, Chang, Chou & Chen (2013) aims to advance our understanding of the factors that influence the intention to use and willingness to pay for mobile TV apps by triangulating the social cognitive theory, motivation theory and the notion of perceived value. Gundlach & Hofmann (2017) used a choice-based conjoint analysis to investigate whether consumers demonstrate willingness to pay for tablet news apps and whether online advertising is negatively related to consumers' willingness to pay. Furthermore, Furner & Zinko (2018) investigated which factors dispose an individual to be willing to pay for an app.

Price consistently emerges as a significant factor in willingness to pay across all presented studies. While other research focus on broader contexts or specific domains, this article narrows down to a specific demographic (students) and specific applications, providing a nuanced understanding of their preferences and limits. Prior to this research, there was a lack of focused studies on the price sensitivity of young people, specifically students, towards new technologies. This study contributes by addressing this gap and shedding light on the preferences and willingness to pay for various applications. It delves into the practical aspects of consumer behavior.

6. Conclusions

The conclusions drawn from the research emphasize that students exhibit relatively low price sensitivity when it comes to their favorite applications and programs. Affordability seems to be a crucial factor, with a significant proportion expressing a willingness to pay for these services. The findings highlight the attachment of students to these applications and the importance of considering price as a potential barrier to limit their use.

The results confirm the hypothesis that students would be willing to pay for their favorite applications at an affordable price. The hypothesis assumed that students who already purchase paid versions of some applications would not give up using free applications if they were reasonably priced, and this assumption finds support in the survey results.

The research employs a quantitative method, providing statistical insights into the preferences of students. Clear formulation of research questions and a structured methodology contribute to the study's reliability. However some limitations related to the research conducted should be indicated. The research is geographically limited to students in Krakow, Poland, potentially limiting the generalizability of findings to a broader population. The study focuses on a specific demographic (students), limiting the applicability of results to other age groups. The research assumes a willingness to pay based on the affordability of prices, but individual financial situations and priorities may vary.

The study adds to the existing knowledge by providing specific insights into the price sensitivity of students towards new technologies, a topic with limited prior research. Lessons learned include the importance of considering affordability in understanding consumer behavior in the context of technology. The research holds significance for platform owners, marketers, and educators in understanding how price influences students' choices. The information obtained can inform pricing strategies and marketing efforts in the new technologies sector. The results can serve as a basis for further investigations into the evolving dynamics of consumer behavior in the digital era.

Future research could explore in more detail the factors influencing students' decisions to pay for specific applications. Additionally, investigating the long-term effects of increased prices on usage patterns and potential behavioral shifts would contribute to a comprehensive understanding of the dynamics in the new technologies sector.

In conclusion, the study contributes valuable insights despite its limitations, providing a foundation for future research and practical applications in the field of new technologies.

References

1. Begg, D., Fisher, S., Vernasca, G., Dornbusch, R. (2014). *Mikroekonomia*. Warszawa: PWE.
2. Brooks, S., Wang, X., Schneider, C. (2020). Technology Addictions and Technostress: An Examination of the U.S. and China. *J. Organ. End User Comput.* <https://doi.org/10.4018/joeuc.2020040101>.
3. Digital 2023 Poland (2023). <https://datareportal.com/reports/digital-2023-poland>, 15.06.2023.
4. Doligalski, T. et al. (2014). *Modele biznesu w Internecie*. Warszawa: PWN.
5. Furner, C.P., Zinko, R. (2018). Willingness to pay and disposition toward paying for apps: The influence of application reviews. *International Journal of E-Services and Mobile Applications (IJESMA)*, 10(1), 13-33.
6. Gundlach, H., Hofmann, J. (2017). Preferences and willingness to pay for tablet news apps. *Journal of Media Business Studies*, 14(4), 257-281.
7. Hebly, P. (2012). Willingness to pay for mobile apps. *Management*, 27(6).
8. Kanwal, S., Pitafi, A., Akhtar, S., Irfan, M. (2019). *Online Self-Disclosure Through Social Networking Sites Addiction: A Case Study of Pakistani University Students. Interdisciplinary Description of Complex Systems*. <https://doi.org/10.7906/INDECS.17.1.18>.
9. Michalak, J. (2016). *Model biznesu przedsiębiorstw*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.
10. Moroz, E. (2005). *Podstawy mikroekonomii*. Warszawa: PWE.
11. Obwieszczenie Prezesa Głównego Urzędu Statystycznego z dnia 28 marca 2023 r. w sprawie przeciętnego miesięcznego dochodu rozporządzalnego na 1 osobę ogółem w 2022 r. (2022). <https://sip.lex.pl/akty-prawne/mp-monitor-polski/przecietny-miesieczny-dochod-rozporzadzalny-na-1-osobe-ogolem-w-2022-r-21811730>, 15.06.2023.
12. Perloff, M.J. (2007). *Microeconomics*. Boston: Pearson International Edition.
13. Ramírez, E., Goldsmith, R. (2009). Some Antecedents of Price Sensitivity. *Journal of Marketing Theory and Practice*. <https://doi.org/10.2753/MTP1069-6679170301>.
14. Samuelson, P., Nordhaus, W. (2004). *Ekonomia*. Warszawa: PWN.
15. Samuelson P.A., Nordhaus W.D. (2008). *Ekonomia. T. 1*. Warszawa: PWN.
16. Sytuacja gospodarstw domowych w 2022 r. w świetle badania budżetów gospodarstw domowych (2022). <https://stat.gov.pl/obszary-tematyczne/warunki-zycia/dochody-wydatki-i-warunki-zycia-ludnosci/sytuacja-gospodarstw-domowych-w-2022-r-w-swietle-badania-budzetow-gospodarstw-domowych,3,22.html>, 15.06.2023.
17. Tutgun-Ünal, A. (2020). Social Media Addiction of New Media and Journalism Students. *Turkish Online Journal of Educational Technology*.

18. Varian, H.R. (1995). *Mikroekonomia*. Warszawa: PWN.
19. Wachowiak, P. et al. (2006). *Funkcjonowanie przedsiębiorstwa w gospodarce rynkowej*. Warszawa: Stowarzyszenie Księgowych w Polsce.
20. Waliński, J. (2013). *Ekonomia bez ograniczeń*. Łódź: Polskie Towarzystwo Ekonomiczne.
21. Wang, C.Y., Chang, H.C., Chou, S.C.T., Chen, F.F. (2013). *Acceptance and willingness to pay for mobile TV apps*. PACIS 2013 Proceedings, 260.
22. Wierzbiński, M. (2016). *Model przychodowy w kształtowaniu modelu biznesu*. Szczecin: Wydawnictwo Naukowe Uniwersytetu Szczecińskiego.

STRATEGIC COHERENCE IN THE WORLD OF VUCA – CASE STUDY ANALYSIS

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Purpose: The purpose of this study is to evaluate the potential of the study of strategic cohesion in the form of case study analysis. In addition to the theoretical part, the study presents a case study analysis of the strategic cohesion of two companies.

Design/methodology/approach: The paper highlights the methodology in the research approach: reductive approach vs holistic approach. To this end, based on the analysis of the literature, the main areas and relationships of the occurrence of strategic coherence were identified, both in the holistic and reductive research approaches. In the next stage of the research - a case study was used as a tool for studying the strategic coherence of enterprises.

Findings: The results of the analysis of the two cases suggest that achieving strategic coherence of an organization is important from the perspectives of its development and survival in the market. Crucial to achieving coherence appears to be the commitment of the organization's CEO to support strategic coherence.

Research limitations/implications: The analysis of the literature indicates methodological difficulties in defining research methods for studying the strategic coherence of an enterprise (Romanowska, 2018; Mielcarek, 2020). The future research process, due to the complexity and difficulty of implementing tools to measure the strategic cohesion of an enterprise, requires great care in interpretation. Trying to propose a universal tool requires the decision to choose a holistic or reductionist approach. The holistic approach seems the most appropriate yet difficult to implement (Romanowska, 2018). The weaknesses of the reductionist approach are due to the subjective reduction of relevant variables. Limitations in the conducted research stem from the use of the case study as a research method. Its weaknesses include: the inability to create generalizations, random data collection, and the degree of structuring of individual cases (Czakon, 2011).

Practical implications: Awareness of the importance of strategic consistency by the organization's CEO in the area of managerial decision-making can have a significant impact on the effectiveness and efficiency of business management.

Social implications: The research construct (originally addressed to the analysis of the strategic coherence of enterprises) can be adapted to the study of the strategic coherence of public organizations (Latham, 2017) at different levels and areas of operation. The direct implications for society can manifest in more coherent strategies of individual municipalities, cities or provinces. The study of cohesion should ensure a more balanced and harmonious development of society.

Originality/value: This paper appears to systematize research approaches in the area of strategic coherence. It is pointed out that case study analysis can be a tool for studying strategic coherence in the VUCA world in a holistic approach.

Keywords: strategic coherence, strategic change, strategic leadership, VUCA.

Category of the paper: case studies.

1. Introduction

Modern companies operate under conditions of permanent change defined as a VUCA world. It is becoming a fundamental problem not only to maintain competitive advantage and even to survive in a turbulent environment. The managers in charge work on creating and implementing winning enterprise strategies (Obłój, 2010), which should explain in a simple understandable way how the organization will achieve its goals. Implementing a strategy involves making clear choices about how to be competitive (Obłój, 2009) One famous manager of the 20th century claimed that in reality strategy is something very simple: *you take a direction and follow it with all your might*. (Welsh, 2005). K. Obloj points to three characteristics of a good strategy. These are: choice, simplicity and consistency of strategy (Obłój, 2009). In practice, a company's strategy can be considered from two perspectives: first, strategic choice and strategic consistency in action (Obłój, 2009). With the assumption that coherent organizations perform better than organizations with less coherent strategies, it seems quite obvious that any organization should have a high level of strategic coherence. In view of the above, the question can be asked how to maintain a high level of strategic coherence? Crucial in the process of management and thus achieving strategic coherence is the role of the top manager, who is responsible for executing the strategy and achieving the set goals. Good leadership is expected of a manager who carries out specific tasks and organizational goals in an efficient and effective manner (Gryffin, 2021). Efficiency is about making the best use of the organization's resources. It is about ensuring that the organization's resources are not wasted or destroyed. Proper organization of work will have a great impact on the efficiency of the organization's management. When we evaluate the work of a manager, we do so mainly through his effectiveness (Dudycz, Osbert-Pociecha, Brycz, 2012), i.e. the ability to achieve the desired goals using specific resources. Effectiveness (Drucker, 1963) is not only making the right decisions but, above all, the ability to implement them in a diverse organization in a turbulent environment. Leadership effectiveness and the ability to maintain strategic coherence translates into the ability to execute the company's strategy (Burgelman, 2014). Strategic consistency should enhance the effectiveness of the managing director. Efficiency and effectiveness in the work of a manager are the most important qualities of his work (Kowal, 2013), which will contribute to the success of the organization. Managers, depending on their position in the structure, are responsible for achieving strategic, tactical and operational goals. In the case of

micro and small organizations, success and strategic consistency can be derived from good work organization, efficiency in the operation of individual managers. Efficiency will be derived from order, order, which become apparent in the internal processes of the organization (Kozun-Cieślak, 2013). The larger the organization, the greater the complexity of internal processes. The number and detail of processes is adequate to the size and functions that each organization performs. From this perspective, for success, the efficiency of the entire organization is crucial and this can be achieved with a high level of internal and external strategic coherence of the enterprise.

Goal effectiveness is primarily an activity in the area of strategic nature concerning past, present and future decisions made by top managers (Drucker, 1963). From the perspective of the functioning of the enterprise, the short- and long-term goals set before it, full coherence can be expected at the level of the entire organization as well as its individual components. The problem of strategic coherence is a problem identified in the field of strategic management. In strategy, we define the goals, initiatives or objectives we want to achieve and how to achieve them within a certain period of time. Lack of strategic coherence is a problem concerning the discrepancy between the declaration of strategy and its implementation. Strategy theory assumes that strategies at different levels should be consistent to ensure competitive advantage (Hofer, Schendel, 1978; Miles, Snow, 1978; Oblój, 2007; Romanowska, 2018). Discrepancies in strategic coherence can apply to any of the strategic areas that strategy can play in a company (Mintzberg, 1998):

1. (*strategy is a plan*), strategy as a result of strategic planning, action plan;
2. (*strategy can be a ploy*), a specific action within a strategic plan, a strategic maneuver directed at opponents or competitors;
3. (*strategy is a pattern*), a template, a pattern of behavior according to certain rules of conduct;
4. (*strategy is a position*), the position of an organization compared to its environment, compared to other *participants*;
5. (*strategy is a perspective*), as an innate perception of the world. Some organizations build benevolent marketing or ideologies according to which they operate and on which they focus their activities.

The essence of the management process is the functioning of the organization in the most efficient, effective, orderly manner possible, and all in order to ultimately achieve the organization's goal with an appropriate amount of resources. An attempt to determine the level of strategic coherence of the organization seems to be essential for the functioning of enterprises in terms of achieving success in the long term.

2. Strategic coherence

Effective management for corporate success in the context of strategic coherence has been a phenomenon of interest to researchers for more than 40 years (Venkatraman, Camillus, 1984; Peters Waterma 1982; Venkatraman, Prescott, 1990). Among the various approaches to the occurrence of strategic coherence, Peters and Waterman's 7 S concept can be mentioned as one of the first. In the 7S model, it consists of seven components of an organization whose central part (management context) is shared values. Values provide the intra-organizational context and the link for the three hard and three soft components of each organization. The "hard components" include strategy, structure and management system. The other "soft components" are skills, management style and personnel (Peters, Waterman, 1982). Waterman and Peters were the first to put forth the thesis that it is not organizational structure but cohesion within a system of interconnected organizational values that affects the success of an organization.

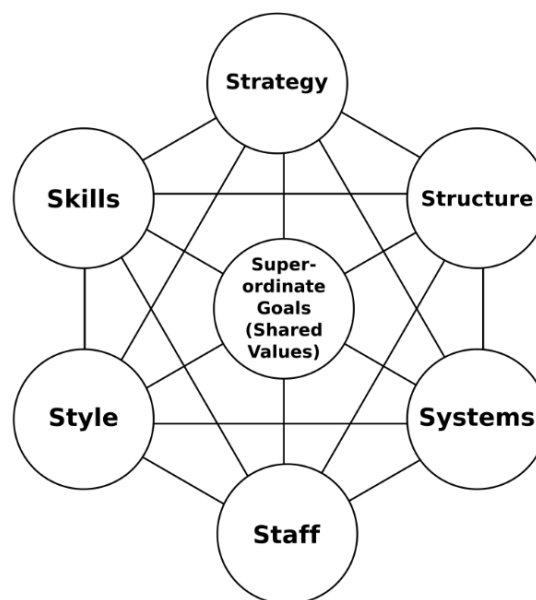


Figure 1. Strategic coherence as McKinsey 7S Framework.

Source: Peters, Waterman, 1982, p. 28.

Strategic coherence is an approach to organizational management that assumes that all components of strategy, such as goals, sub-strategies, processes, organizational resources and organizational culture should be interrelated and complementary in a harmonious way.

Strategic coherence is crucial to the effectiveness of an organization's operations. In practice, the pursuit of strategic coherence can be applied at various levels of the organization from the management of the entire enterprise to the management of specific projects or processes (Hass, 2011). Its purpose is to ensure that all decisions and actions made in the organization are coordinated and serve a common goal - the realization of the organization's strategy. Strategic coherence is formed between the process of strategy formulation and the

process of strategy implementation (de Wit, Mayer, 2007). When analyzing strategic coherence, it is necessary to study the compatibility of three areas: 1) the organization's environment, 2) strategic choices, and 3) internal processes (Romanowska, 2018).

The issue of strategic coherence emerged in the literature in the late 20th century. The term refers to the logical coherence of multiple initiatives and programs implemented in a single organization at a given time. When strategic coherence exists, different organizational policies and practices complement and reinforce each other. In the absence of strategic coherence, these activities can be implemented haphazardly and even contradict each other. Such behavior contributes to the failure of the organization. Separate efforts may be based on contradictory (inconsistent) decisions and personnel may be placed under opposing demands. The concepts of coherence in enterprise management are presented by the concept of organizational coherence and strategic coherence. Coherence at the level of enterprise management should be understood as the mutual alignment of decisions made by managers at all levels of management in such a way that, regardless of their place in the organizational structure or organizational process, they are aligned with each other. Strategic coherence describes the compatibility of an organization's strategy with the various elements of the organization's interior and its environment (Romanowska, 2018). Table 1 presents a chronological summary of definitions of strategic coherence.

Table 1.
Summary of definitions of strategic coherence

Author	Definition of the concept of coherence in chronological terms
Hofer, Schendel, 1978	Internal alignment refers to relationships involving company-wide strategy, sector-specific strategies, and functional strategies.
Petrers, Waterman, 1980	Consistency of 7 elements with common values as their glue : strategy (strategy), structure (structure), procedures (systems), staff (staff), leadership style (styles) and skills (skill).
Venkatermann, Cailus, 1984	Consistency between the strategy and various elements within the organization, external consistency between the environment and the company's strategy, and consistency between the strategy formulation process and the implementation process. Alignment is the result of the configuration of the organization's elements, and as a process it manifests the need to accumulate appropriate resources for the enterprise in response to opportunities and threats that will arise in its environment.
Venkatermann, Prescott, 1990	Coherence includes 3 types of relationships: between the strategy and various elements within the organization, external coherence between the environment and the company's strategy, coherence between the strategy formulation process and the strategy implementation process.
Tece et al. 1994, 1997	The ability of a multi-product and multi-branch corporation to generate and exploit synergies of various types and cause and make different parts of the organization act as one entity. Corporate coherence is the ability of a multi-product and multi-branch corporation to generate and exploit synergies of various types and make different parts of the organization act and be managed as one entity.
Grant, 1998	Strategic fit means that there must be compatibility between the company's goals and values, with the external environment, with resources and competencies, as well as the organization and systems.
Gunasekaren, 1998	Agility is the ability to survive and cope in a competitive environment full of unpredictable changes, which requires quick and effective responses to market changes.

Cont. table 1.

Zott, Amit, 2008	Fit, viewed as a state, is characterized by the consistency of the configuration of elements, i.e., one at which peak performance is achieved.
Thompson, Peteraf, Gamble, Strickland, 2012	Analyzing and comparing the consistency of the value chains of individual businesses (identifying cross-business strategic fit along the value chain).

Source: Elaboration based on Romanowska, 2018; Mielcarek, 2020.

Strategic coherence emerges as an effort to define the company's most important challenges and develop strategies to meet them (Rumelt, 2022a). The vast majority of researchers believe that strategic coherence supports the functioning of an organization, improves its effectiveness and efficiency in achieving its intended goals (Peters, Watreman, 1982; Romanowska, 2018; Obłój, 2009). Striving to achieve strategic coherence at the level of intentions, declarations or goal setting seems obvious in small organizations. The larger the organization, the greater the complexity and the problem with communicating and understanding strategy by employees (Wołeczek, 2016). The greater the complexity the more difficult it is to coordinate and implement competing goals (Hass, 2011). The question arises as to how to define it and measure strategic cohesion of a company?

From the perspective of companies, cohesion research is quite difficult and ambiguous. This is due to the high complexity and many concepts of studying cohesion both inside and outside the organization (Mielcarek, 2020; Gadomska-Lila, 2013). Researchers have a problem in measuring strategic cohesion (Romanowska, 2018).

Over the years, it has been proposed to create concepts for studying strategic coherence, understood as intra- and extra-organizational alignment of activities with the organization's strategy.

A fundamental problem in the study of consistency concerns the choice of the reductionism vs. holism approach.

Table 2.

Comparison of research approaches in the process of studying the strategic coherence of the organization

Characteristics of the approach	Reductionist approach	Holistic approach
After a break in research	Consistency of several features of the environment, for example, the life phase of the sector, several features of the strategy, for example, resource allocation.	A wide range of relationships between characteristics of both strategy and environment
Strengths	The ability to accurately isolate variables in the beginning of the links between them and systematically repeat the study which allows the accumulation of knowledge	The ability to maintain a systemic, comprehensive view of the complex relationships between variables
Weaknesses	Possible error due to omission of the broad context of the relationship between the variables under study	The complexity of the cohesion problem makes it difficult to pose and verify research hypotheses about the nature of cohesion and the difficulty of generalizing research findings
Proper testing methods	Multiple regression with interactions, analysis of variance, subgroup analysis	cluster analysis benchmark analysis second-order factor analysis canonical analysis

Source: Elaboration based on: Romanowska, 2018; Mielcarek, 2020.

Adopting a holistic approach seems most appropriate from a systems perspective. A holistic view of an enterprise's success provides more objective knowledge in this area than a reductionist approach. The drawback of such a research approach is its cost and complicated implementation. The reductionist approach will contract a larger-scale study of a specific piece of strategic coherence.

3. VUCA environment

The term VUCA was used to describe the post-Cold War geo-military environment. Just as the word strategy once derived from the Greek *strategos* (Oblój, 2007) has its etymology from military terms, the term VUCA has similarly found its way into the language describing the turbulent corporate environment. Originally, the terms of the new, in many respects volatile environment were outlined in the document "USAWC Strategy Research Project - Training and Educating Army Officers for the 21st Century: Implications for the United States Military Academy (Whitman, 1998). The document, approved as a training manual at West Point, notes the ambiguity of the changing external environment. PP³k Whitman analyzed the forces shaping the situation in the 21st century and drew attention to the new paradigm in which the military as an organization will find itself.

Nowadays, the acronym VUCA is used to describe the unpredictable nature of turbulent changes in the business environment. VUCA refers to the first letters describing the volatility of the business environment of enterprises (Barman, Chandibai, 2017):

- V for Volatility. It is becoming increasingly difficult to predict trends, events and situations (both their speed and their scope).
- U for Uncertainty. Uncertainty stems largely from a sense of being out of control and unable to predict variables.
- C for Complexity. The changes involve many phenomena, areas and cover an ever-increasing range of information. This range is so large that it is difficult for us to assimilate all possible variables.
- A as Ambiguity. It turns out that the indicated phenomena can not always be explained by logic and analysis. Many situations and events require a broader perspective and new experiences. All because of ambiguity. The world of VUCA has become a new environment for enterprises. (Dilon, Nguyen, 2021).

As the E&Y researchers point out, the concept of managing a business in a VUCA environment requires that it is not so much about planning specific steps as it is about nurturing the vision of the business. A leader's approach turns out to be crucial. The leadership (Sulkowski, 2009) that a leader brings defines the vision that gives direction to the enterprise's aspirations. Actions focused on the planning function can stiffen the enterprise. Looking at the vision enables one to respond to changing conditions in a way that is consistent with

a predetermined concept and set goals. It is also important to demonstrate an understanding of possible difficulties or challenges. In response to this complexity, a clear system of action supported by the organization's vision and mission should be established. The mission and organizational values accepted by all employees will help define the tasks and processes that will provide security in a moment of dispute or chaos. The approach to change in a VUCA world can be presented in the form of three actions: analyze the organization's environment such as central and peripheral changes (odd things, different things); interpret events and observations; consider what resources and organizational skills I can use to meet future challenges in a changing VUCA world (Oblój, 2022).

All internal activities should follow the company's vision, while ensuring internal strategic consistency.

4. Case study analysis

The empirical part analyzes the example of two organizations that have demonstrated different internal approaches to strategic coherence. The first is the analysis of Nokia and the second is Microsoft. The NOKIA example can be divided into two stages: the first period of dynamic growth associated with the development and entry into new technologies, and the second stage of Nokia's corrosion.

Both organizations went through various stages of development, stagnation and subsequent growth. Both companies were active in the new technology sector and both operated in the global market. Both Nokia and Microsoft were market leaders in the international arena. Nokia failed as a result of strategic misalignment. Microsoft, after changing its CEO in 2014, began to grow again. When comparing the two organizations, one should ask what was different? What caused the failure of the Nokia brand, and why did Microsoft record such significant growth (Gotsch, Lienhard, Schögel, 2019)? Was the difference due to a lack of internal and external cohesion at Nokia after 2004?

Based on the analysis of Finnish researchers, Table 1 presents four attributes of success and failure analysis of NOKIA over the years. The success attributes were defined as strategic leadership organizational projects, capabilities and the organization's environment.

Table 3.

Summary of activities, factors in perspective of feelings about managerial activities in four research perspectives

NOKIA's success in the 20th century	NOKIA's failure in the 21st century
(1) strategic leadership	
<p>Kairamo, the company's CEO from 1977 to 1988, is also recognized in many texts as an important contributor to the company's success. He is seen as a charismatic and extroverted personality who was the driving force behind Nokia's initial international expansion and a staunch supporter of a flexible, dynamic and constantly learning organization. Jorma Ollila was Nokia's CEO when the company went from near bankruptcy to remarkable growth in the 1990s. Ollila's financial experience was considered crucial in transforming the company from a failed conglomerate into a successful telecommunications company. Moreover, many accounts praise Ollila's personality and skills as the source of Nokia's success. Whether it is Ollila's public presentations (organizational skills, innovation, vision, or negotiation skills, many authors recognize him as a major contributor to Nokia's success story. "Time and again in its history, Nokia has taken the opportunity to enter exciting new businesses with high risk but great growth prospects"; "Only a handful of people and key decisions were responsible for Nokia's success".</p>	<p>An interesting feature of the narratives highlighting strategic leadership as a cause of failure is the personification of the corporation. In the texts, Nokia was seen as corrupt, arrogant, lazy, slow, inconsistent, focused on internal competition and threatened. Two business researchers offered the following interpretation: "Kallasvuo now sees that the company has not paid enough attention to the emotional overtones caused by internal competition for resources to develop a wide range of phone models". Former Nokia director Frank Nuovo highlighted the laziness and stagnation resulting from a combination of the company's normal evolution and large size: "I look back and think that Nokia was simply a very large company that began more to maintain its position than to innovate for new opportunities. There was a realization within the company that touch was increasingly important, and they were working to achieve that, but when a company is really busy maintaining what it has created, it's hard to put enough pressure on something so drastically new and create urgency".</p>
(2) organizational design	
<p>Conscious and continuous thinking about the company's structure is considered an important innovation on par with product innovation". Nokia's strength is effective intra-organizational communication and the company's values, strategies and vision, as well as the rapid dissemination of daily information in an easily accessible manner throughout the company. Finally, many authors argued that one of the key factors in Nokia's success was the mastery it demonstrated of international expansion. Nokia was able to expand rapidly internationally, thereby gaining first-mover advantage in many emerging markets and enjoying economies of scale that would have been unattainable in its small domestic market.</p>	<p>In the spring of 2009, I started receiving messages from the Nokia organization that the company was not being managed consistently. Problems began to pile up, decision-making was slow, and discussion was moved to large committees where focus was lost". What followed was three years of massive restructuring. Costs were being cut, but revenues were not being generated. Successful restructuring can revive failing corporate giants, but in Nokia's case things went terribly wrong.</p>
(3) opportunities	
<p>Nokia emphasized lifestyle in communications in building its brand - a strategy that explains an important part of its breakthrough". Nokia had products for every consumer in the world... We avoided pushing the same model everywhere. Instead, we tailored our products to local expectations and changing consumer habits. The habits of consumers. And very often we have succeeded".</p>	<p>"The arguments of failure based on capabilities focused on three failure is epitomized by the corporation. In the texts analyzed by the researchers, Nokia was seen as corrupt, arrogant, lazy, phone business) and Elop's insufficient knowledge of the industry as a problem: slow, inconsistent, focused on internal competition and threatened. Two business academics offered categories: insufficient technological knowledge in top management, incorrect approach to consumer marketing and inferior products to competitors.</p>

Cont. table 3.

(4) environment	
<p>The explanation for the success focused on the role of Finnish government policies. The government's policies on competition and deregulation in the telecommunications sector were important to the evolution of the Finnish telecommunications cluster and Nokia's success. Moreover, the liberalization of the Finnish capital market provided Nokia in the early 1990s with the foreign investment it needed to finance the company's focus on telecommunications and its resulting rapid growth. Various texts - especially by government-sponsored academics - portrayed public funding as an important source of early radio development and later R&D programs.</p>	<p>Lack of ability to adapt to a changing environment: Until the launch of Apple's iPhone in 2007 and Google's Android in 2009. Nokia and Microsoft were the undisputed leaders in their respective industries. Since then, both have been gripped by the rapid convergence of digital communications, information systems, consumer electronics, as well as software and various types of digital content. This convergence has broken down pre-existing sector silos and replaced them with the rapidly evolving Internet. Both companies faced new and unfamiliar competition and were forced to develop new strategies tailored to the new market regime. "In recent years, Nokia has not only tried to produce better phones. It has had difficulty culturally adapting to the new business environment. It is difficult to determine exactly what cultural changes were needed".</p>

Source: Elaboration based on Laamanen, Lamberg, Vaara, 2016.

When analyzing the internal causes of Nokia's crisis, it is important to note the reallocation of important leadership roles and the poorly executed 2004 reorganization toward a matrix structure (Doz, 2017). This led to internal conflicts and the departure of key executives, which led to a deterioration of strategic thinking and leadership in mission setting and creation (Doz, Wilson, 2017; Doz, 2017). By the same token, after 2004, top management no longer had sufficient technological knowledge or strategic integration to prioritize and resolve conflicts as a result of using a matrix structure, which was paradoxically intended to aid internal cohesion. At the same time, the cost-cutting measures introduced made Nokia's strategy of product differentiation through market segmentation ineffective and resulted in the proliferation of inferior products (Doz, Wilson, 2017) During this period, chaos reigned at Nokia as a result of sudden market changes. Activities within the organization were not consistent. The lack of internal consistency translated into an even bigger problem with a faster runaway market and external inconsistency. All attempts at change were either misguided or late (Doz, Wilson, 2017). Less than 3 years of operating under the VUCA environment and internal chaos led to Nokia's collapse.

Analysis of the determinants (Table 3), indicates that Nokia in the 1990s was an organization with a high degree of strategic coherence both internally and externally. This is evidenced by numerous reports describing the genesis of its success (Laamanen, Lamberg, Vaara, 2016). In fact, it is difficult to conclusively determine whether the key in Nokia's decline as a leading manufacturer of phones and later smartphones was only external factors. The sudden mismatch with the external market was some consequence of problems with strategic consistency within the organization. In 2011, a year after CEO Stephan Elop was hired, an internal memo came to light, from Nokia's first non-Finnish CEO. It drew attention to the problem of Nokia's loss of market competitiveness. Elop argued in order to compete in a changing market one should focus not on the phone but on the ecosystem: *The battle for*

devices has now become an ecosystem war, where ecosystems include not only the device's hardware and software, but also developers, applications, e-commerce, advertising, search, social applications, location-based services, unified communications and many other things. Our competitors are not taking our market share with devices; they are taking our market share with the entire ecosystem. This means that we will have to decide how we will build, catalyze the ecosystem or join it (Doz, Wilson, 2017). Nokia's board of directors considered the content of the announcement to be an act of misjudgment. It failed to note that there was a loss of external coherence. Shortly thereafter, Nokia's CEO announced a new strategy for Nokia, which included a "strategic partnership" with Microsoft and a shift in smartphone strategy to Microsoft Windows Mobile. Two years later, in a further erosion of the business, Microsoft acquired a division of Nokia called "Devices & Services," the entire division that manufactures and sells phones, as well as provides services to end customers (Doz, 2017). It was headed by former Nokia CEO Stephane Elop. With no operating system of its own, Nokia was doomed to rely on Microsoft. Especially since its development work on the first Windows Phone smartphones was supported by the American conglomerate. Microsoft wanted to have, after all, a smartphone manufacturer that would launch devices in line with its new lineup and target the iPhone directly (Doz, Wilson, 2017).

The second analysis of strategic coherence is the example of Microsoft in the middle stage of development. During the smartphone era, Microsoft CEO Steve Ballmer, through the acquisition of Nokia, tried to bring Microsoft into the smartphone manufacturer market. Two years after that decision, Ballmer stepped down as Microsoft CEO. Problems with the consistency of Ballmer's earlier strategic decision to acquire Nokia are evidenced by the fact that on news of his resignation from the CEO's chair, stock prices rose 7%. Microsoft's new CEO is Satay Nadella. Nadella, in his inaugural speech, when talking about the future did not mention Windows even once. The key for him was to change the strategy and rebuild the organization's value system. The change of CEO meant not only a change in business direction (abandoning mobile products and services such as Nokia/Microsoft Lumia and at the same time developing the business towards cloud services for business), but most importantly an internal change in the organization's value area (Nadella, Show, Triace, 2017). Sat Nadella, said that organizational culture can be a term that is not clear and amorphous to the participants of the organization. He claimed that Microsoft's culture renewal is a top priority for him, "... I am committed to ruthlessly removing barriers to innovation so that Microsoft can get back to what everyone joined the company for - 'to change the world' " (Nadella, Show, Triace, 2017).

The Microsoft CEO, speaking about refreshing the Microsoft spirit and culture, said as follows: "We organized focus groups to allow people to share their opinions anonymously as well. Listening was the most important thing I implemented every day, because it built the foundation of my leadership for the years to come. To my first question about why Microsoft exists, the message was loud and clear. We exist to create products that empower others.

This is the meaning we all want to give to our work. I heard it from hundreds of employees at every level and in every part of the company. Employees wanted a CEO who would make meaningful changes, but at the same time respect Microsoft's original ideals, which have always been to change the world. They wanted something clear, tangible and inspiring. They wanted to hear more often about progress in a clear and simple way. Engineers wanted to lead again, not follow. We had the technology that the press raved about in Silicon Valley, such as state-of-the-art artificial intelligence, but we weren't showing it off. What employees were really demanding was a roadmap to remove organizational paralysis" (Nadella, Show, Triace, 2017).

The above excerpt shows that the culture change that Sat Nadel wanted to achieve was implemented at a strategic level. The message and values were consistent with actions. They did not remain a mere declaration. Microsoft's CEO was personally involved in ensuring consistency by creating a value system. These activities were aimed at creating strategic consistency within the organization. The refreshed value system was intended to ensure internal consistency in the long term. In a theoretical sense, this resembled Peters and Waterman's implementation of the 7S's concept (Peters, Waterm, 1982).

Microsoft's new CEO believed that one cannot be an empathetic leader by sitting in an office behind a computer screen all day. An empathetic leader must participate, be in the world, meet people where they live. A leader should see how the technology he creates affects their daily activities. These values were to translate into an approach to innovation, improvements, enhancements carried out by all possible means so that tomorrow is better than today. For consumer products, the key was to be modern software design, which included online products updated through constant experimentation to be better suited to the needs of today's and tomorrow's customers. "We needed to build a deeper empathy for our customers and their unarticulated and unmet needs. It was time for a refresh (Nadella, Show, Triace, 2017). Microsoft's leadership has been changing its approach to business by modifying the company's internal values. A key one in the context of software production is timeless trust. Nadella, attempting to define the overarching value in Microsoft's changing culture as a culture of long-term trust supporting the company's strategy, described it as the sum of the following values: empathy + shared values + security and reliability (Nadella, Show, Triace, 2017). In further reflection, Nadella writes that he keeps coming back to a simplified equation, which, in his view, accounts for economic growth and thus the achievement of business goals through a specific strategy. In his view, the basis for growth in the global world is the sum of education and innovation multiplied (supported) by intensity in the use of technology. The Microsoft leader claimed that he could not change Microsoft's strategy without changing the organizational culture. A key element in the strategic change process was not just the identification of new directions, but the daily work of realizing strategic coherence. Nadela wrote about the role of the CEO as follows:

"The CEO is the curator of the organization's culture. Anything is possible for a company if its culture is based on listening, learning and leveraging individual passions and talents in the company's mission. Creating such a culture is my main task as CEO" (Nadella, Show, Triace, 2017). To implement these changes, the ranking performance management system responsible for low morale in teams was abolished. Individual managers were given more influence, allowing them to collaborate more freely or innovate their products (Gotsch, Lienhard, Schögel, 2019).

Nadella said: "I believe we can do magical things when we come together with a common mission, a clear strategy and a culture that brings out the best in us individually and collectively. Last week I talked about how we are aligning our structure with our strategy. Today I want to share with you the broader context and connective tissue between our mission, worldview, strategy and culture. It is critical that we begin the new fiscal year with a shared vision of what we can do and who we want to become." (Bishop 2015). Above what previous statements by Microsoft's CEO were backed up by his activity in implementing strategic intentions. Based on the above, it can be concluded that these activities were aimed at achieving strategic coherence internally and externally.

Nadella continued his reorganization efforts to create a "more agile, communicative, collaborative, determined and motivated company" (Dhillon, Gupta, 2015, p. 60). During one meeting with employees, he said; "The world is diverse. We will better serve everyone on the planet by representing everyone on the planet. We will be open to learning our own biases and changing our behavior so that we can harness the collective power of everyone at Microsoft. We not only value differences, we seek them out and invite them" (Gotsch, Lienhard, Schögel, 2019).

In organizational terms, Nadella has set the following goals for changing the company's culture and achieving his vision of "One Microsoft" (Gotsch, Lienhard, Schögel, 2019):

- Clearly and regularly communicate our sense of mission, worldview, and business and innovation ambitions.
- Make cultural changes from the top down and get the right team in the right place.
- Build new and surprising partnerships so we can create new value and delight customers.
- Get ready for the next wave of innovation and platform changes. Let's redesign our capabilities toward a primarily mobile and cloud-based world and diligently guide our execution.
- Advocate for timeless values and bring productivity and growth back to everyone.

The direction of activities in the VUCA environment aimed at achieving external consistency was manifested in activities relating to Microsoft's competitive environment. In one conference, he outlined the purpose of the meeting: to debate and create a cultural Microsoft mindset for the future. He presented the company's new official mission statement as

the main business goal: "Enabling every person and every organization in the world to achieve more" (Bishop, 2015).

The implementation of the new mission was to be based on the jointly developed three pillars of the company's future (Bishop, 2015):

- Customer-obsessed. We will get to know our customers and their businesses through the eyes of a beginner, and then present solutions to meet their needs. We will be insatiably eager to learn from the outside and bring that knowledge to Microsoft, while innovating to surprise and delight our users.
- Diverse and inclusive. The world is diverse. We will better serve everyone on the planet by representing everyone on the planet. We will be open to learning our own biases and changing our behavior so that we can harness the collective power of everyone at Microsoft. We don't just value differences, we seek them out and invite them in.

As a result, our ideas are better, our products are better, and our customers are better served.

- One Microsoft. We are a family of individuals united by one common mission. It is our ability to work together that makes our dreams believable and ultimately achievable. We will build on each other's ideas and collaborate across boundaries to bring the best of Microsoft to our customers in a single solution. We are proud to be part of the team Microsoft.

In Satya Nadelia's subsequent speeches and declarations, one can see a direction geared toward constant change, so that Microsoft will adapt to and win in the changing world of VUCA. In announcements and future actions, he points to achieving strategic consistency externally and internally: *I believe that culture is not static. It evolves every day based on the behavior of everyone in the organization. We are in an incredible position to achieve new growth this year. We will have to innovate in new areas, execute our plans, make hard choices in areas where something is not working, and solve difficult problems in a way that increases customer value. I truly believe that we can achieve magical things when we unite as one team and focus. I look forward to seeing what we can accomplish together in financial year* (Bishop, 2015).

5. Result

In the world of VUCA, achieving strategic coherence is particularly difficult. Internal and external strategic coherence is a desirable state in any organization.

As literature reports indicate, the key in evaluating a strategic coherence study is to adopt an appropriate research perspective. Adopting a holistic perspective aims to identify all the determinants affecting strategic coherence on both the internal and external conditions side. Strategic coherence within an organization is concerned with assessing the fit and supporting

relationships of strategy, organizational culture, organizational structure, planning and decision-making. When examining the external determinants of strategic coherence, attention should be paid to how the organization's strategy is created in the context of the concept of creating competitive advantage (inside-out vs. outside-in) (Krupski, 2011).

Analyzing the example of NOKIA and Microsoft, it can be concluded that the company's CEO and leadership play a key role in the strategic alignment process. It is crucial to implement the strategy from the perspective of internal and external strategic coherence. The VUCA environment makes achieving high strategic coherence fleeting. The more difficult it is to maintain consistency in the long term, the greater the role of strategic thinking, execution leadership in strategy implementation. Similar findings were presented by Burgelman, who identified a series of transformations during the strategic evolution of long-lived companies (Burgelman, 2014, 2018). Analyzing HP's six-fold transformation over 77 years of existence, he identified a framework of "strategic leadership" to facilitate successful strategic transformation and achieve strategic alignment. This framework includes (1) defining the key tasks of strategic leadership, and (2) identifying four key elements of the company's strategic leadership capabilities: (a) adopting a strategic leadership system that integrates top-down and bottom-up strategic processes; (b) managing the often winding relationship between evolving corporate strategy and existing corporate culture; (c) balancing the strategic allocation of resources between alignment (with the existing product market environment) and evolution (the ability to search for new viable product market environments) in the internal ecology of strategy formation; and (d) maintaining constructive relationships in the dynamic interactions between the CEO and the board of directors (Burgelman, 2014, 2018).

Analysis of leadership activities in achieving strategic coherence points to the key role of the organization's CEO.

The use of the case study method to study strategic coherence in the VUCA world seems apt because of the systemic approach that the VUCA environment requires.

Discussion

The purpose of the article is to assess the potential of strategic coherence research in the form of case study analysis.

The discussion of strategic coherence (Romanowska, 2018; Mielcarek, 2020) has been going on for more than 30 years. The article analyzes an example of two organizations from the perspective of strategic coherence using a case study as a research method.

On the one hand, a study conducted using case study analysis can be theoretically creative (Czakoń, 2011). On the other hand, the case study analysis, by virtue of its limitations, does not entitle to derive generalizable conclusions regarding strategic coherence. Case study analysis

allows the study to be carried out from a near holistic perspective. An example of such research is the case study description and valuation of strategic coherence based on three measures of strategic coherence: (1) how the strategy is implemented, (2) the core competency system, and (3) product and service alignment (Leinwand, Mainardi, 2016). Strategic coherence at the highest level means that the company meets the three conditions management, managers and employees at every level of the company understand how the company creates customer value, the customer value proposition is based on the company's four to six core competencies, and all of the company's products and services use the same core competencies (Romanowska 2018). P. Leinwand and C. Mainardi confirmed in their research the positive effect of coherence on financial success, calling this positive coherence premium. Comparing the description of NOKIA's situation in the period 1995-2004 and Microsoft's after 2014, one can get the impression that the author's observations on the study of strategic coherence with the use of case study analysis, correspond with the results of Leinwand and Mainardi.

In conclusion (abstracting from all the advantages and disadvantages of testing theory through case studies), it can be said that case study analysis is an accepted tool for studying strategic coherence in descriptive terms. This approach, can form the background of a detailed study of strategic coherence. It can be assumed that if the researcher choose a holistic approach, he can use case study analysis. In the case of a reductionist approach in the study of strategic coherence, a detailing study will be an indication. An example of such a study is "Learning for Action" carried out to evaluate the introduction of a new secondary education program in Hawaii with a quantitative charter (Lahtan, 2017). This study used a reductionist approach. The operationalization of strategic coherence considered three areas of coherence: the quality of planning for strategy implementation, the understanding of the meaning of the new strategy by all staff, and the actual coordination of strategy implementation (Lahtan, 2017).

The adoption of quantitative methods and their operationalization is fraught with the dilemma of choosing a holistic vs. reductive approach in the construction of a research tool. As M. Romanowska points out, "constructing a research method for studying multidimensional strategic coherence and conducting research that allows generalization of research results is currently too challenging for researchers" (Romanowska, 2018).

In conclusion, in future research on strategic coherence it is worthwhile to use triangulation of research methods. The search for research tools provides opportunities to develop answers to the following questions about strategic coherence research:

1. Identify the strategic coherence factors of their relationship.
2. Definition of criteria and measures for assessing strategic coherence.
3. Create a model for assessing strategic coherence.

Conclusion

Is strategic coherence possible in the era of VUCA? Analysis of two cases shows that yes. Its implementation is the responsibility of management and especially the Managing Director.

A key element is management pressure in the area of producing an organization's value system that supports its strategy. The idea is that this action should lead to the penetration and adoption of values by all employees at all levels of the organizational structure. In the era of VUCA, strategic consistency is not and will not be a permanent attribute of the company. The example of refreshing the value system and making changes as part of the culture, paradoxically, should be a constant in the process of achieving strategic coherence.

In the process of designing further research in the area of strategic cohesion using case study analysis, a holistic approach should be followed. In a quantitative research design situation, a reductionist approach should be used.

It should be remembered that the essence of the management process is the realization of the organization's goal in the most, efficient and effective way possible (Gryffin, 2021; Drucker, 1966), orderly and all in order to ultimately achieve the organization's goal with the appropriate amount of resources. The pursuit of an appropriate level of strategic coherence of the organization appears to be essential for the operation of enterprises in terms of achieving success in the long term.

The future research process, due to the complexity and difficulty of implementing tools to measure the strategic cohesion of an enterprise, requires great care in interpretation.

References

1. Ali-Yrkkö, J., Kalm, M., Pajarinen, M., Rouvinen, P., Seppälä, T., Tahvanainen, A.J. (2013). Microsoft przejmuję Nokię: konsekwencje dla obu firm i Finlandii. *Streszczenie ETLA*, 16(3).
2. Barman, A., Cahndibai, P. (2017). Shifts of Strategic Paradigms in the VUCA World—Does “outside the box thinking” a meaningful cliché for the business world. *Conference: Managing Change and Creativity and Innovation in a Dynamic Environment, At Sonarpur, Kolkata, Vol. 7*.
3. Bishop, T. (2015). *Exclusive: Satya Nadella reveals Microsoft's new mission statement, sees 'tough choices' ahead*, <https://www.geekwire.com/2015/exclusive-satya-nadella-reveals-microsofts-new-mission-statement-sees-more-tough-choices-ahead/>

4. Burgelman, R. (2014). Built to become: Corporate longevity and strategic leadership. *Stanford University Graduate School of Business Research Paper*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2480501
5. Burgelman, R., McKinney, W., Meza, P.E. (2018). *Becoming Hewlett Packard Why Strategic Leadership Matters*. Oxford University Press.
6. Czakon, W. (2011). *Podstawy metodologii badań w naukach o zarządzaniu*. Wolters Kluwer
7. de Wit, B., Meyer, R. (2007). *Synteza strategii*. Warszawa: PWE.
8. Dhillon, I., Gupta, S. (2015). Organizational Restructuring and Collaborative Creativity: The Case of Microsoft and Sony. *Journal of Business Strategy*.
9. Doz, Y. (2017). <https://knowledge.insead.edu/strategy/strategic-decisions-caused-nokias-failure>
10. Doz, Y., Wilson, K. (2018). *Ringtone: Exploring the rise and fall of Nokia in mobile phones*. Oxford, UK: Oxford University Press.
11. Doz, Y.L. (2017). *Ringtone: Exploring the Rise and Fall of Nokia in Mobile Phones*. Oxford University Press.
12. Drucker, P. (2014). *Menedżer skuteczny*. MT Biznes.
13. Drucker, P. (1963). Managing for Business Effectiveness. *Harvard Business Review*, Vol. 41, No. 3, pp. 53-60.
14. Dudycz, T.G., Osbert-Pociecha, G., Brycz, B.U. (2012). Efektywność – rozważania nad istotą i pomiarem. *Prace naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, nr 261, wstęp.
15. Evans, W. (2021). <https://www.leadingagile.com/2021/03/strategic-coherence-you-cant-hope-your-way-to-strategic-alignment/>
16. Gadowska-Lila K., (2013). *Dopasowanie organizacyjne. Aspekt strategii, kultury organizacyjnej i zarządzania zasobami ludzkimi*. Difin.
17. Gotsch, M.L., Lienhard, S.D., Schögel, M. (2019). Case Study: Change Management & Leadership at Microsoft. alexandria.unisg.ch
18. Hass, K.B. (2011). *The Enterprise Business Analyst: Developing Creative Solutions to Complex Business Problems*. Vienna: Berrett-Koehler Publishers.
19. Hitt, M.A., Ireland, R.D., Camp, S.M., Sexton, D.L. (eds.) (2002). *Strategic Entrepreneurship. Creating a New Mindset*. Oxford: Sexton, Blackwell.
20. <https://news.microsoft.com/hitrefresh/>
21. <https://www.alexandria.unisg.ch/server/api/core/bitstreams/2bc723ea-cca7-4141-a75d-9380bac780b3/content>
22. https://www.ey.com/pl_pl/workforce/swiat-vuca-co-to-jest
23. <https://www.fastcompany.com/40457741/satya-nadella-the-c-in-ceo-stands-for-culture>
24. Kowal, W. (2013). Skuteczność i efektywność – zróżnicowane aspekty interpretacji. *Organization and Management*, 157.

25. Kozuń-Cieślak, G. (2013). Efektywność-rozważania nad istotą i typologią. *Kwartalnik Kolegium Ekonomiczno-Społecznego „Studia i Prace”*, 16(4), 13-42.
26. Krupski, R. (2011). Kontekst turbulencji otoczenia w badaniach empirycznych nad strategiami przedsiębiorstw. *Przegląd Organizacji*, no. 9, Warszawa: TNOiK.
27. Laamanen, T., Lamberg, J.A., Vaara, E. (2016). Explanations of success and failure in management learning: What can we learn from Nokia's rise and fall? *Academy of Management Learning & Education*, 15(1), 2-25.
28. Latham, N. (2017). *Why the Concept of Strategic Coherence is Important for Understanding Implementation Success*. <http://learningforaction.com/lfa-blogpost/strategic-coherenc>, 4.09.2023.
29. Leinwand, P., Mainardi, C. (2016). *Strategy That Works: How Winning Companies Close the Strategy to Execution Gap*. HBR Press.
30. Mielcarek, P. (2020). Kształtowanie spójności strategicznej i dojrzałości procesowej a oburęczność przedsiębiorstwa. Warszawa: C.H.Beck.
31. Miles, R.E., Snow, C.C. (1978). *Organizational Strategy, Structure and Processes*. New York: McGraw-Hill.
32. Mintzberg, H. (1988). Opening up the definition of strategy. In: Quinn, Mintzberg, James, *The Strategy process. Concepts, Contexts, and Cases* (pp. 13-20). New Jersey: Prentice Hall.
33. Nadella, S., Show, G., Nichols, J.T. (2017). *Hit refresh*. Harper Business.
34. Obłój, K. (2010). *Pasja i dyscyplina strategii jak z marzeń i decyzji zbudować sukces firmy*. Warszawa: Poltex.
35. Obłój, K. (2022). *Myśl strategicznie! Jak przygotować jak przygotować i zmieniać organizację w odpowiedzi na wyzwania otoczenia*.
36. Peters, T.J., Waterman, R.H. Jr (1982). *In search of excellence: Lessons from Americas's Best-Run Companies*. New York: Harper Trade.
37. Romanowska, M. (2018). Idea spójności w zarządzaniu strategicznym. *Przegląd Organizacji*, 6, 3-9.
38. Rumelt, R. (2022a). *Strategic coherence for tumultuous times*, <https://www.pwc.com/gx/en/issues/transformation/strategic-coherence-for-tumultuous-times.html>
39. Rumelt, R. (2022b). *The Crux: How Leaders Become Strategists*. Public affairs.
40. Sułkowski, Ł. (2009). Myślenie strategiczne trzeciego szympansa. In: *Zarządzanie strategiczne Problemy, kierunki badań* (pp. 125-136).
41. Venkatraman, N., Camillus, J. (1984). Exploring the Concept of 'Fit' in Strategic Management. *Academy of Management Review*, No. 9(3), pp. 513-525.
42. Venkatraman, N., Prescott, J.E. (1990). Environment-strategy Co-alignment: An Empirical Test of its Performance Implications. *Strategic Management Journal*, Vol. 11, No. 1, pp. 1-23.

43. Welsh, J., Welsh, S. (2005). *Winning*. Harper Business.
44. Wilson, I. (2000). From Scenario Thinking to Strategic Action. *Technological Forecasting and Social Change*, Vol. 65, No. 1.
45. Wołczek, P. (2016). Cechy strategii generujące problemy wdrożeniowe a wielkość przedsiębiorstwa. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, No. 444, pp. 559-570.

THE MANAGEMENT OF POWER SUPPLY SECURITY OF MINE WATER PUMPING STATION

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Purpose: Growing global warming increases the threat of energy supply security in the form of the “blackout” phenomenon. Pumping stations pump out approximately 100 million m³ of water annually (data from 2023). Discontinuation of mine water pumping would expose neighbouring mines and lower-lying areas to flooding.

Design/methodology/approach: For the designed database of functional scenarios of the mine water pumping station, the optimal variant was selected based on economic and ecological criteria as well as the energy security criterion.

Findings: The research analyzed five technically feasible variants of modernization of mine water pumping stations. Each variant is characterized by a different degree of security of energy supply and a different level of meeting energy demand.

Research limitations/implications: All variants of modernization of the pumping station provide for the production of electricity for own needs. All investment attractiveness factors should be taken into account while making investment decisions. It is up to the decision-maker to make the final multi-criteria decision so as to implement the selected variant.

Practical implications: One of the challenge is to ensure security of energy supplies in the event of a sudden energy shortage. Pumping stations have some retention, nevertheless a longer shutdown time could lead to environmental problems. Removing the damage would definitely require large financial expenditures and would take several years.

Social implications: The planned project of the energy supply security can have a positive impact on the local community and economy. The projects discussed will create new markets related to “green energy”.

Originality/value: The aim of the article is to assess the investment relevance of safety projects for power supply to mine water pumping stations. The combination of the problems of drainage of liquidated mines, the use of renewable energy sources and energy storage to improve the security of power supply to pumping stations has not been the subject of scientific research so far.

Keywords: drainage of liquidated mines, energy storage, renewable sources of energy, hydrogen extraction, revitalization of post-mining installations.

Category of the paper: Research paper, conceptual paper, case study.

1. Introduction

Worsening global warming, more frequent wildfires, and other natural disasters are increasing threats to energy security known as "blackouts" (Tokarski et al., 2021). A blackout is a prolonged interruption in energy supply. Blackouts can occur in both winter and summer. In winter, blackouts can be caused by broken transmission grids, while in summer, they can be caused by grid overloads during a heat wave or prolonged droughts that cause power plants to shut down. The phenomenon of power shortages in the national grid will be possible in Poland as early as the middle of this decade during the processes of phasing out coal-based power generation. The largest blackout in Poland to date occurred in Szczecin in the winter of 2008. It was caused by strong winds and heavy snow that tore down power lines, leaving up to 500,000 people without electricity for three days. It is estimated that between 2025 and 2030 there could be several hours of blackouts per year, and after 2030 several hundred hours per year.

The European Union (EU) has adopted policies to achieve climate neutrality by 2050. One of the priorities is to shift from burning fossil fuels, including coal, to producing energy from renewable energy sources (RES). Poland is currently making several investments in renewable energy, and nuclear power plants. According to the current schedule, construction will begin in 2026, with the first of the three planned units coming online in 2033. Until these investments are completed, coal will be the main source of energy. Coal will generate almost 63% of all electricity in Poland in 2023 (about 105 TWh). The current situation of security of electricity supply is not bad, but Poland may soon run out of energy. The first blackouts could occur as early as 2025. Poland is also exposed to this risk due to its aging power grid. In Poland, the greater risk of power system inefficiency occurs in the summer, when significant amounts of energy are consumed by cooling systems. Major problems may arise when the liquidation of old coal-fired power plants begins. The threat of a blackout increased after Russia's aggression against Ukraine, when European countries, including Poland, decided to stop or reduce imports of energy resources from Russia.

In Poland, Spółka Restrukturyzacji Kopalń S.A. (SRK S.A. - Mines Restructuring Company) manages the assets of mines in liquidation (Bluszcz, Smoliło, 2012). One of the basic tasks of SRK S.A. is to protect the neighboring mines from water hazards and to take care of the environment. An important asset of SRK S.A. are mine water pumping stations, whose task is to pump, manage and discharge mine water (Michlowicz, Wojciechowski, 2021; Wysocka et al., 2019). The operation of pumping stations not only protects neighboring mines and lower-lying areas from flooding, but also protects near-surface aquifers from contamination (Biały et al., 2020; Bondaruk et al., 2015; Wysocka et al., 2019). The process of pumping mine water must continue even after mining has ceased. Pumping stations owned by SRK S.A. pump approximately 100 million m³ of water annually (data for 2023). The pumping of this volume of water is associated with high electricity purchase costs (Bondaruk et al., 2015; Chmielewska

et al., 2020). The main challenge for SRK S.A. is to purchase electricity, which is one of the largest components of the Company's operating costs, and to maintain security of energy supply (Maruszewska et al., 2023; Schoenmaker, Schramade, 2019). The energy consumption of the Company's branches in 2023 amounted to approximately 300 GWh. Most of the electricity consumed by SRK S.A. is used by pumping stations for dewatering abandoned mines. Blackout as an unforeseen long-term interruption of electricity supply will cause unexpected and unpredictable consequences (Fernández-Muñiz et al., 2020; Gajdzik et al., 2022). In a blackout situation, large industrial facilities such as SRK S.A. are the first to be cut off. Although SRK S.A.'s pumping stations have a certain level of retention, a prolonged outage could result in minor or major environmental problems (Kaczmarek, 2022; Kaczmarek et al., 2022).

The purpose of the article is to evaluate the investment appropriateness of feasible projects for energy security and energy self-sufficiency of mine water pumping stations in the current economic conditions (Gawęda, Sajnóg, 2020; Gawęda, Złoty, 2023). To achieve this goal, several technically feasible projects for ensuring energy supply security and energy self-sufficiency in the situation of prolonged lack of power supply from the national grid are proposed for the district pumping station. The combination of the problems of dewatering abandoned mines with the application of RES and energy storage to improve the security of power supply to pumping stations has not yet been the subject of scientific research. The study evaluated the investment attractiveness of the proposed projects in terms of technical, economic, environmental, and social values (Bobruk, 2019). The results of the study proved that the available energy self-sufficiency projects are characterized by different investment attractiveness depending on the applied evaluation criterion, but those projects should be considered the most desirable in which the balance between investment expenditures and the projected assurance of security of electricity supply, energy, and social needs is the most favourable (Gawęda, 2021; 2022).

2. Materials and methods

SRK S.A., which carries out liquidation and post-liquidation activities at former coal mining sites, aims to maximize the reduction of negative environmental externalities resulting from its operational activities (Mhlongo, Amponsah-Dacosta, 2016; Mhlongo, 2023; Mucha et al., 2016; Salom, Kivinen, 2020). Spółka Restrukturyzacji Kopalń S.A. (SRK S.A.) intends to undertake investment activities to acquire alternative renewable energy sources, including photovoltaic farms with adapted energy storage and hydrogen. This is in line with the directions set by the European Commission. To this end, SRK S.A. is considering the possibility of building a number of photovoltaic farms on its sites, which would partially secure the Company's energy needs and to some extent protect the pumping stations from a sudden lack

of power from the grid (Prakash, Prasad, 2022; Woszczyński et al., 2023). The term "blackout" is used to describe a sudden and severe failure of the power system that results in a lack of power from the national grid over a large area (Bazaluk et al., 2021; Doorga et al., 2022). Such an interruption in power supply may last only a few minutes, but usually a blackout is understood as a longer power outage of even several days (Fidalgo-Valverde et al., 2023; Kamiński et al., 2022). The main causes of blackouts are:

- extreme weather events (sudden downpours, gusty winds, or hot weather),
- overloading of the power grid,
- lack of energy resources on the market,
- armed conflict and terrorism.

To reduce the vulnerability of mine liquidation processes to unforeseen changes (Łabaj et al., 2020; Mercado et al., 2021; Rubio et al., 2019), SRK S.A. conducted energy efficiency audits of its liquidation and post-liquidation operations. The recommendations from the audits point to a number of projects, the implementation of which can significantly improve energy security and reduce the impact of mine restructuring on the local community. One of the recommendations is to reduce energy consumption and reduce the company's operating costs (Prusek, Turek, 2018; Shnorhokian, Mitri, 2022; Tokarski et al., 2021) through the construction of photovoltaic farms, on industrial land for production purposes. The "green" energy, produced on the post-mining land by means of photovoltaic panels, could significantly improve the safety of operations and significantly cover the energy needs of the company's branches. The economic impact of the investment would be a reduction in the need for a budget subsidy and the creation of new alternative jobs to mining for retrained miners. The environmental effect of the investments proposed in the audit would be a reduction of equivalent CO₂ emissions into the atmosphere (Wojtacha-Rychter et al., 2021; Doorga et al., 2022).

The use of RES depends on weather conditions, which poses many challenges (Krzemień et al., 2022; 2023a; Riesgo Fernández et al., 2020). On sunny days, the company's energy needs will be met by photovoltaic farms. During the period of electricity production at SRK S.A., it will be possible to use only part of the electricity generated. Thus, the remaining part of the generated energy will be a surplus that can be stored for use in periods of deficit. Energy storage through battery systems or shaft installations allows short-term storage (Chmiela, Smoliło, 2023; Chmiela et al., 2023). Efficient use of RES is only possible with the use of storage of surplus generated energy and its use in periods of shortage. Hydrogen is an environmentally friendly energy carrier suitable for storing surplus "green" energy generated by photovoltaic farms (Barszczowska 2023a; 2023b). This type of storage has been included in one of the options for energy security and energy self-sufficiency (Krzemień et al., 2023a; Villar et al., 2020). In a part of the proposed energy self-sufficiency projects, the storage of excess energy by hydrogen extraction was adopted, and battery storage was adopted only for buffering the generated energy or for the possible needs of stabilizing the operation of electrolyzers. Water electrolysis is considered the most promising and recommended technology for energy

storage through hydrogen production (Smolinski, Howaniec, 2020; Wojtacha-Rychter et al., 2019). In the event of a blackout, it will be possible to use previously stored energy, and the energy security effect will increase the independence of pumping stations from external electricity supplies.

The selection of the size of the photovoltaic farms for variants 1 and 2 was based on the maximum area that does not generate the necessary surplus for feeding into the national grid, and for variants 3, 4 and 5 on the maximum available area of the former main plant of the abandoned mine. Revenues from the sale of hydrogen and oxygen and thermal energy will be used to purchase the missing part of electricity, which will reduce the need for a budget subsidy and reduce CO₂ emissions into the atmosphere (Wojtacha-Rychter et al., 2021). The calculations were performed for an exemplary district stationary pumping station located in a large city in the Silesian agglomeration. The pumping station pumps about 10 million m³ of water per year. The pumping station is accompanied by a reclaimed post-mining area of about 23 hectares, suitable for the construction of a photovoltaic farm.

In terms of energy security and self-sufficiency, two groups of variants for the modernization of underground water pumping stations were designed (Smoliło, Chmiela 2021a; 2021b; 2021c), assuming the maximum use of the generated electricity. Due to legal restrictions preventing electricity trading, all variants were abandoned to apply for an electricity distribution license. A total of 5 decision alternatives were provided for evaluation, varying in the amount of required expenditures and in the degree of satisfaction of the security of electricity supply and the energy needs of the pumping station.

At the upgraded district pumping station, the photovoltaic panels and power consumers are located on the same property. The electricity consumers are infrastructure related to the pumping of mine water. The largest consumers are the pumping systems and the main ventilation systems. The options for upgrading the district pumping station were designed in two variations. In one group, the photovoltaic farm is small enough that all the "green" energy generated (i.e. energy from renewable sources) is consumed continuously by the pumping station - operation on a separate grid (variant 1). In the second case, the photovoltaic system produces more energy than the pumping station could consume continuously. In such a model of energy security and self-sufficiency, there is a surplus of usable energy after storage.

Option 2 involves the installation of a battery energy storage system. The size of the photovoltaic farm has been chosen so that the energy generated is partly consumed by the pumping station equipment at the time of generation and partly stored in the battery energy storage. On the same billing day, the stored energy is completely consumed by the pumping station equipment. In the study, the billing day is defined as the day from sunrise together with the immediately following night.

Variants 3, 4 and 5 use the entire available area of the former main plant of the abandoned mine for the development of photovoltaic panels. In order to avoid feeding excess electricity back into the national grid, these options also include infrastructure to store temporary excess

electricity in the form of electrolytically harvested hydrogen. In Option 3, the stored hydrogen would be used to power cogeneration engines or hydrogen cells to generate electricity for the pumping station's own needs during periods of energy shortage. In variants 4 and 5, the hydrogen produced is to be sold wholesale to a local distributor (variant 4) or retail at the company's own vehicle filling station (variant 5). The sale of hydrogen is intended to be a form of virtual long-term storage of excess energy.

3. Results and discussion

3.1. Option 1 - photovoltaic farm

Option 1 is the simplest and cheapest example of an energy security project possible at the district pumping station under study. The project involves the construction of a 4.5 MWp photovoltaic farm with the necessary equipment and infrastructure at the existing district mine water pumping station. In order to buffer the power supply for the operation of the pumping station equipment with the energy generated by the photovoltaic farm, the additional development of a battery energy storage with a capacity of 2.5 MWh is envisaged. In the study, all expenses and costs were converted to the purchase of 1 GWh (for the unit purchase price of energy in the first quarter of 2024). The size of the farm and its power will be adapted to the energy needs of the pumping station equipment. The energy produced by the photovoltaic farm will not exceed the fluctuations in the pumping station's energy demand and will be completely consumed by the pumping station on a continuous basis, without even temporarily feeding energy back into the national grid.

Variant 1 of the pumping station upgrade will ensure security of energy supply only during sunshine hours. The pump station can only operate in primary mode. On sunny days during the sunshine hours, it will be possible to replace up to 99.9% of the pumping station's demand with "green" energy during this time, which is about 40% of the pumping station's daily electricity demand and about 18% of the pumping station's total energy demand (Table 1).

Table 1.

Parameters of the analyzed district pumping station after modernization in variant 1

Expenditures for modernization of pumping stations	Employee costs per year	Payback time
[Expenditures and costs per 1 GWh purchase] (for the unit purchase price of energy in the first quarter of 2024)		[years]
35.3	0.3	6.2
Energy security of pumping stations	Additional financial security for energy purchases	Securing the energy needs of the pumping station
18.25%	0.00%	18.25%

Source: own study.

The implementation of this option does not generate any additional revenue that could be used to cover additional electricity purchases. The "green energy" generated by the farm is equivalent to the CO₂ emissions into the atmosphere of approximately 5.000 Mg CO₂. For the unit purchase price of electricity and the unit employee cost in Q1 2024, the expected payback time is estimated at approximately 6 years. The option will provide 1 job for relocated SRK S.A. employees.

3.2. Option 2 - battery storage of surplus energy

Storage of electricity in batteries is only possible in the short term (preferably within the same billing day). For this reason, the decision model of Option 2 provides for the storage of excess electricity generated only for own operation of pumping station equipment during the non-sunny period of the solar day (Khomenko, Jelonek, 2023; Magdziarczyk et al., 2023). Option 2 involves the construction of a 9.13 MWp photovoltaic farm and a battery energy storage system with a capacity of approximately 52 MWh. On non-sunny days, the most energy-intensive pumping station equipment will be operated, if possible, during the period with the lowest electricity purchase price. On sunny days, there will be a shift and the most energy-intensive equipment will be operated during the time of electricity generation to maximize the continuous effect of the photovoltaic farm. The farm will be sized so that the excess electricity it generates, after being stored in battery energy storage, will be used on the same billing day to power the pumping station. The model foresees the generation of electricity only for the pumping station's own needs. There will be no need to supply energy to the outside in any form.

The decision model provides energy security only during sunny billing days and ensures the security of power supply to the equipment both day and night. The pump station can only operate in its primary mode. On sunny days, depending on the duration of the power outage, it will be possible to power the pumping station at 100% during sunny periods and up to approximately 99.9% of the pumping station's daily power requirements during non-sunny periods. The generated energy will supply the pumping station with approximately 36% of the annual demand (Table 2).

Table 2.

Parameters of the analyzed district pumping station after modernization in variant 2

Expenditures for modernization of pumping stations	Employee costs per year	Payback time
[Expenditures and costs per 1 GWh purchase] (for the unit purchase price of energy in the first quarter of 2024)		[years]
402.4	0.3	35.2
Energy security of pumping stations	Additional financial security for energy purchases	Securing the energy needs of the pumping station
35.59%	0.00%	35.59%

Source: own study.

Implementation of Option 2 will not provide additional revenues that would cover the purchase of the missing electricity from the national grid. However, the "green energy" generated by the farm will result in a reduction in equivalent CO₂ emissions to the atmosphere by about 10.300 Mg CO₂. For the unit purchase price of electricity, the unit purchase price of battery energy storage and the unit employee cost in Q1 2024, the expected payback time is estimated at about 35 years. Option 2 provides for a reduction of 1 job reduction.

3.3. Option 3 - storage in the form of hydrogen from the electrolysis process

Option 3 proposes not to sell electricity to the national grid and to store excess electricity produced by the photovoltaic farm in the form of hydrogen. In addition to the construction of the basic 16.95 MWp photovoltaic panel plant, the so-called farm, and the necessary equipment and infrastructure, additional equipment is required for water electrolysis, hydrogen storage and combustion. The auxiliary equipment consists of electrolyzers, hydrogen and oxygen compressors, cogeneration engines or hydrogen cells, oxygen and hydrogen storage tanks, and thermal energy storage. In order to buffer the power supply of the pumping station equipment operation with energy obtained from the photovoltaic farm, an additional 2.5 MWh battery energy storage development is provided. The process of water electrolysis is a process associated with the incidental production of thermal energy. During the sunny periods associated with the farm's electricity production and the conduct of the electrolysis process, the heat demand is minimal. However, during the periods without sunshine, there is a heat deficit. Therefore, it is planned to build an underground thermal energy storage to provide "own" heat during the remaining period.

During periods of excess electricity production, excess energy will be stored in the form of hydrogen produced by electrolysis. The hydrogen produced, after being compressed to its nominal value, will be transferred to a tank where it will await periods of energy shortage at the pumping station. If there is no external power supply or if there is an energy shortage at the pumping station, the hydrogen will be directed to cogeneration engines or hydrogen cells, which will produce electricity for the pumping station's own use. The thermal energy produced is used for the station's own needs, and the surplus can be sold to the local operator's district heating network for a fee. The pumping station can operate in primary and emergency mode. In emergency situations, the hydrogen can be transported to another pump station to generate electricity and heat.

Electricity is purchased from a local supplier at the currently negotiated unit energy purchase price. The sale of the oxygen and thermal energy produced will provide additional financing for the purchase of energy from a local supplier. This will provide approximately 7.5% of the pumping station's energy needs (Table 3).

Table 3.

Parameters of the analyzed district pumping station after upgrading in variant 3 in the basic mode

Expenditures for modernization of pumping stations	Employee costs per year	Payback time
[Expenditures and costs per 1 GWh purchase] (for the unit purchase price of energy in the first quarter of 2024)		[years]
281.7	1.5	193.7
Energy security of pumping stations	Additional financial security for energy purchases	Securing the energy needs of the pumping station
50.26%	7.51%	57.77%

Source: own study.

In an emergency situation, in the emergency operation mode of the pumping station, the revenue from the sale of oxygen and thermal energy will allow the purchase of hydrogen on the market and additional coverage of the energy needs of the pumping station. Conversion of the entire financial surplus into hydrogen will allow additional generation of up to about 0.36% of the pumping station's energy needs. Due to the low efficiency of the electrolysis process and the hydrogen combustion process, it is estimated that about 68% of the generated surplus "green" energy will be usable. In this decision model, the security of power supply to the pumping station is ensured for all days of the year. In the basic operation mode, depending on the duration of the power failure, it will be possible to cover more than 50% of the annual demand of the pumping station with energy from the plant's own photovoltaic farm. The energy generated in the basic operation mode of the pumping station in Option 3, combined with the sale of oxygen and thermal energy, will reduce the purchase of electricity by about 58%. The "green energy" generated by the farm will result in a reduction of equivalent CO₂ emissions to the atmosphere by approximately 14.600 Mg CO₂. Under the economic conditions of Q1 2024, the expected payback period for Option 3 in the primary operation mode of the pumping station is estimated to be about 194 years. The emergency operation will further extend the payback period. Due to the fact that emergency operation will be incidental work, the extension of the payback period will not be significant. Option 3 provides for a reduction in employment at SRK S.A. by approximately 5 jobs.

3.4. Option 4 - with wholesale of hydrogen

Variant 4 is similar to Variant 3 and will have very similar equipment. In determining the operating model for Variant 4, the storage of hydrogen in tanks was abandoned for economic reasons in favor of virtual storage of hydrogen in the form of cash. This is to be realized through the wholesale sale of hydrogen to a local distributor. A smaller hydrogen storage facility will be built on the site of the pumping station, with a capacity to cover only a few days of the pumping station's own energy needs in the event of an external power shortage. The reduction in capital expenditure for upgrading the pumping station by constructing a smaller hydrogen storage facility will be partially offset by additional investment in the construction of a wholesale hydrogen distribution facility. The projected capital expenditures for Option 4 are

slightly lower than those for Option 3 (Table 4). The decision model for variant 4 of the pumping station upgrade includes a basic pumping station operation mode and two emergency operation modes during periods of power failure, a "short" emergency mode and a "long" emergency mode.

Table 4.

Parameters of the analyzed district pumping station after upgrading in variant 4 in the basic mode

Expenditures for modernization of pumping stations	Employee costs per year	Payback time
[Expenditures and costs per 1 GWh purchase] (for the unit purchase price of energy in the first quarter of 2024)		[years]
276.9	1.2	11.6
Energy security of pumping stations	Additional financial security for energy purchases	Securing the energy needs of the pumping station
18.25%	56.96%	75.22%

Source: own study.

In the basic operation mode of the pumping station, the energy efficiency model assumed a mechanism for maximum consumption of the produced "green" energy for own needs and sale of the produced surplus "green" energy stored in the form of hydrogen to a local distributor at wholesale prices. Since the cost of hydrogen supply is difficult to determine at this stage of the design, it was assumed that hydrogen would be sold at 60% of the current retail price. To increase energy efficiency during the non-solar period, it is assumed that energy will be purchased from a local supplier with proceeds from the early sale of surplus "green" hydrogen and oxygen. Energy will be purchased from the local supplier at the currently negotiated energy purchase price.

In the event of a power outage during full sunshine, the entire energy demand will be met by the operation of the photovoltaic system. Despite the emergency situation, the pumping station will operate in basic mode. If the power outage is prolonged or occurs during non-sunny periods, the pumping station will enter one of the emergency modes, depending on the duration of the outage. Initially, the pump station will enter a "short" emergency mode and the on-site stored hydrogen will be used to power the pump station from cogeneration engines or hydrogen cells. If all the stored hydrogen is used up and there is still no power supply, the pumping station will enter another "long" mode of operation. In this mode, the financial surplus from earlier oxygen and hydrogen sales is used to purchase hydrogen at retail prices from a local distributor. Conversion of the entire financial surplus to hydrogen will generate up to an additional 11% of the pumping station's energy needs.

It is estimated that the operation of the pumping station in baseload mode as an element of energy self-sufficiency of SRK S.A. would provide more than 18% of the annual demand of the pumping station with energy directly from the photovoltaic system and an additional 57% of the cost of the annual energy demand of the pumping station from the sale of oxygen and hydrogen (Table 4). In baseload mode, Option 4 provides financing for up to approximately

75% of the pumping station's annual electricity needs. The "green energy" generated by the plant will result in a reduction of equivalent CO₂ emissions to the atmosphere of approximately 5.000 Mg CO₂. Under the economic conditions of Q1 2024, the expected payback time for Option 4 in the pump station's primary mode of operation is estimated to be approximately 12 years. Operation in one of the emergency modes will further extend the payback period, but it should be assumed that operation of the pump station in emergency modes will be incidental. For this reason, a detailed economic analysis of operation in these modes was not carried out. Option 4 provides for 4 new non-mining jobs for SRK S.A. employees.

3.5. Option 5 - with retail sales of hydrogen

In Variant 5, all of the hydrogen produced is to be sold to the local community at the pump station's own fueling station at near-retail prices. In the baseline operation of the pumping station, the revenue from the sale of oxygen and hydrogen will be used to purchase energy to power the pumping station equipment during non-sunny periods (Howaniec et al., 2023; Wojtacha-Rychter et al., 2022). Selling the harvested hydrogen is a form of long-term storage for the excess electricity generated. Variant 5 requires, in addition to the construction of a basic photovoltaic panel plant with the necessary equipment and infrastructure, additional equipment related to water electrolysis, storage, combustion and distribution of hydrogen. The additional equipment consists of H35 or H70 standard hydrogen compressors (necessary for refueling hydrogen vehicles) and a hydrogen filling station.

In the basic mode of operation of the pumping station, during periods of overproduction of "green" electricity, the excess of this energy is stored by electrolysis in the form of hydrogen. The hydrogen produced, after being compressed to its nominal value, will be transferred to the tank, from where it will be sold at the filling station on an ongoing basis at prices close to retail prices. It is planned to leave a reserve of hydrogen to cover the electricity needs of the pumping station for several days.

Because distribution costs are difficult to determine at this stage of the design, it is assumed that the selling price of hydrogen will be 90% of the current retail price. During the non-solar period, energy will be purchased from a local supplier from the proceeds of the previous hydrogen and oxygen trading. The purchase of energy from the local supplier will be at the currently negotiated unit energy purchase price.

In case of a power outage, as in variants 3 and 4, during full sunshine, the entire energy demand will be covered by the operation of the photovoltaic system and there will be no change in the operation of the pumping station. Similarly to Variant 4, the prolongation of the power outage into a non-sunny period or the occurrence of a power outage during non-sunny periods will cause the pumping station to switch to one of the emergency operating modes. The emergency modes are the same as in Option 4. In Option 5, the financial surplus from the early sale of oxygen and hydrogen will be much greater, allowing more hydrogen to be purchased at retail prices from a local distributor than in Option 4. By converting the entire

financial surplus to hydrogen, up to an additional 14% of the pumping station's energy needs can be generated. It is estimated that the basic mode of operation of the upgraded pumping station under Option 5 could finance up to approximately 95% of the pumping station's electricity needs at the unit purchase price of electricity from Q1 2024 (Table 5).

Table 5.

Parameters of the analyzed district pumping station after upgrading in variant 5 in the basic mode

Expenditures for modernization of pumping stations	Employee costs per year	Payback time
[Expenditures and costs per 1 GWh purchase] (for the unit purchase price of energy in the first quarter of 2024)		[years]
296.0	1.9	9.9
Energy security of pumping stations	Additional financial security for energy purchases	Securing the energy needs of the pumping station
18.25%	76.10%	94.37%

Source: own study.

The "green energy" generated by the farm will result in a reduction of CO₂ equivalent emissions to the atmosphere of approximately 5.000 Mg CO₂. For the economic conditions of Q1 2024, the expected payback time for Option 5 in the primary mode of operation of the pump station is estimated at 10 years. Operation in one of the emergency modes will further extend the payback period, but due to the incidental nature of emergency operation, a detailed economic analysis of pump station operation in these modes has not been performed. Option 5 provides 6 new jobs for relocated SRK S.A. employees.

3.6. Analysis of the feasibility of the developed options for upgrading mine water pumping stations

The study analyzed selected variants of power supply security and energy self-sufficiency that can be applied to the analyzed mine water district pumping station. 5 technically feasible variants of energy self-sufficiency elements discussed above were presented for analysis. Each of the variants is characterized by a different level of initial investment, a different level of security of energy supply and a different level of satisfaction of the pumping station's demand for electricity (Tables 1, 2, 3, 4 and 5). On the basis of the conducted price survey (in December 2023), the amount of current expenditures necessary for the modernization of the pumping stations in the different variants was determined, and all expenditures and costs were converted into the purchase of 1 GWh (for the unit purchase price of energy in the first quarter of 2024).

From a financial point of view, the lowest expenditure and the shortest payback period would be the implementation of variant 1 (Tables 1, 2, 3, 4 and 5). The disadvantages of this variant are the relatively low guarantee of the independence of the pumping station from external supplies and the relatively low satisfaction of the energy needs of the pumping station. The pumping station is independent from the national grid only during sunny periods, when the photovoltaic system covers up to about 99.9% of the pumping station's energy needs.

The generated energy will only cover up to about 18% of the pumping station's annual energy needs. The technical system of variant 1 can only operate in basic mode, and the only way to protect the pumping station from long-term power failure is to adjust the operation of the most energy-intensive equipment to the time of electricity generation by the photovoltaic system.

Variant 2, with battery storage of excess energy generated for its own use, provides about 99.9% security of power supply to the pumping station on all solar days, which will provide about 35% of the annual energy needs of the pumping station. The operation model of the pumping station also includes only one basic operation mode. Adjusting the operating time of the most energy-intensive equipment to the time of electricity generation by the photovoltaic system can slightly extend the independence of the pumping station from external electricity supply. The disadvantages of this option are the high cost of project implementation - more than eleven times higher than in option 1 - and the long payback period of more than 35 years. For these reasons, the implementation of this option should be considered ineffective.

The variants with storage of the generated excess electricity in the form of hydrogen obtained by electrolysis (variants 3, 4 and 5) are characterized by a high implementation potential. The case of these variants is that the initial expenditure is more than eight times higher than that of variant 1. The advantage is the possibility of long-term storage of excess energy. The functional model of these variants protects the pumping station, to varying degrees, from a long-term lack of power from the national grid on all days of the year. However, there were doubts about variant 3, which provides for storing excess energy in the form of hydrogen obtained by electrolysis and burning it completely during periods of energy shortage. This variant protects the pumping station to the greatest extent from external power shortages. Thanks to such a technical and organizational arrangement of the pumping station's operation, up to about 50% of the pumping station's annual independence from external supplies is achieved. This variant can be operated in two modes: basic and emergency mode. Functionally, the basic mode of operation of variant 3 corresponds to the "short" emergency mode of variants 4 and 5, and the emergency mode corresponds to the "long" emergency mode of variants 4 and 5. This results in a very long payback time (almost 200 years), and although this variant should be considered the safest in the event of a "blackout", its implementation in this form is inefficient. The decision to implement it can only be based on concern for the highest possible level of protection of the system against external power failure.

For economic reasons, it has been proposed to implement variants 4 and 5, which are extensions of variant 3. In both variants, the excess electricity stored in the form of hydrogen is virtually stored by selling it wholesale (variant 4) or retail (variant 5). In variants 4 and 5, for technical reasons and to protect the pumping station from "blackouts", it is planned to store a volume of hydrogen in the pumping station's own storage tanks, so that the pumping station's equipment can be supplied with energy for several days by its own cogeneration engines or hydrogen cells. In this arrangement, however, it is questionable whether it makes sense to purchase these cogeneration engines or hydrogen cells, which, in the theoretical absence of

a blackout, would be installed unnecessarily and never put into operation. However, for reasons of security of energy supply from the grid, it would be advisable to consider the purchase of a mobile version of these devices, which can be used in various locations.

Settlements in hydrogen trading, as a commercial product, may make it possible to purchase more energy than was originally stored. It is estimated that a lower unit purchase price for electricity would increase the amount of energy available for purchase from hydrogen sales revenues. For example, a very likely decrease in the price of electricity of only 7 percentage points compared to Q1 2024 would make it possible, under Option 5 with retail sales of hydrogen, to meet all of the pumping station's annual energy needs with energy generated by the photovoltaic system and energy purchased from revenues from the sale of oxygen and hydrogen on the gas market. The implementation of options 4 and 5 will also ensure the operation of the pumping station in the absence of an external power supply. The only difference is the amount of financial surplus generated (Table 4 and 5) that can be converted into the eventual purchase of hydrogen. With similar capital expenditures, a comparable payback period of 12 years is obtained for Variant 4 and 10 years for Variant 5. Economically, both options are recommended for implementation, although it is noted that Option 5 provides greater operational savings. Both variants fully protect the pumping station from a lack of power supply from the national grid during sunshine periods and, depending on the size of the hydrogen reserve in its storage facilities, will secure the operation of the pumping station during the remaining period.

Table 6 shows a comparison of the degree of protection of pumping stations against loss of external power. Variants 2 and 3 have the highest level of protection of pumping stations and the largest reduction of equivalent CO₂ emissions to the atmosphere. For financial reasons, their implementation seems inefficient, but considerations of security of supply or reduction of greenhouse gas emissions may lead to the decision to implement them.

Table 6.

Comparison of the degree of protection of pumping stations against loss of external power supply by the analyzed pumping station upgrade options

Protection period	Option 1	Option 2	Option 3	Option 4	Option 5
Sunshine period	99.9%	100%	100%	100%	100%
Non-sunny period of a sunny day	-	99.9%	100%	100%	100%
Non-sunny days	-	-	32.4%	11%	14%

Source: own study.

For image and social reasons, the creation of new jobs, variants 3 and 5 are promoted. The high labor costs, the low efficiency of the electrolysis process, and the subsequent hydrogen combustion process implement option 3 appear inefficient.

All analyzed options of pumping station modernization provide electricity generation only for own consumption and require only basic external permits. It can be assumed that their implementation will not be difficult from a legal point of view.

Making investment decisions primarily through the prism of the amount of initial expenditure required to implement the project is incorrect and indicates that the perspective on the project in question is too narrow. Other factors should also be considered in determining the attractiveness of an investment. It is up to the decision maker to make the final decision to adopt one of the implementation options presented.

4. Conclusions

The main reason for investing in RES and storing excess energy generated is to reduce the Company's operating costs and protect the environment.

- Reducing the financial expenditures for the purchase of electricity, one of the largest components of the Company's operating costs, would reduce SRK S.A.'s need for budget subsidies. In addition to meeting the energy needs of the pumping stations with "green" energy and environmental aspects, the projects undertaken by SRK S.A. are aimed at maintaining existing and possibly creating new alternative jobs in the mining industry. The modernization of existing pumping stations, combined with new technologies that also serve the local community, will be a form of self-financing technical solution with a positive social and image perception.
- The challenge for SRK S.A. in the current reality is to ensure the security of energy supply in a situation of sudden shortage in the national grid. SRK S.A.'s pumping stations have a certain retention capacity, but a prolonged shutdown could cause minor or major environmental problems. Blackout as an unforeseen, unexpected and prolonged lack of electricity supply from the national grid could cause a threat to public safety or other social, economic or technical consequences. The cessation of mine water pumping would expose the operations of neighboring mines and lower-lying areas to flooding or could cause contamination of near-surface aquifers. Remediation of the resulting damage would require significant financial resources and would likely take up to several years.
- In addition to the power security aspects, participation in the activities described above will promote the development of other economic sectors through the introduction of new technologies and the possibility of rehabilitating post-mining areas and facilities. The development of SRK S.A.'s assets and the use of post-industrial areas will be positively perceived by local governments and the local community in terms of image. In the long term, the implementation of the described investments will make it possible to attract new investors to the restructured and revitalized post-mining assets and enable the creation of alternative jobs to mining.

- The planned energy security and self-sufficiency projects can have a positive impact on the local community and the economy of the Upper Silesian mining region. The projects are part of the European Union's activities in the field of sustainable development, in particular the Fair Transition process. The projects under discussion will create new markets related to modern transport and "green energy". Energy security and self-sufficiency projects are an opportunity to revitalize post-mining areas degraded by intensive mining.

References

1. Barszczowska, B. (2023a). Hydrogen valleys as opportunities for SME in Poland. In: K. Jurčević, L.K. Lipovčan, R. Medić, O. Ramljak (Eds.), *Preserving, Evaluating And Developing The Mediterranean* (pp. 379-386). Institute of Social Sciences Ivo Pilar, VERN' University, ISBN 978-953-8404-20-7
2. Barszczowska, B. (2023b). Polish Hydrogen Strategy. The role of hydrogen valleys. *Scientific Journals of the Institute of Mineral Raw Materials and Energy Management of the Polish Academy of Sciences, 1(111). Issues of energy resources and energy in the national economy. Threats to the energy security of Poland and the EU*, 109-116. <https://doi.org/10.33223/zn/2023/09>.
3. Bazaluk, O., Sadovenko, I., Zahrytsenko, A., Saik, P., Lozynskyi, V., Dychkovskiy, R. (2021). Forecasting Underground Water Dynamics within the Technogenic Environment of a Mine Field. Case Study. *Sustainability*. <https://doi.org/10.3390/su13137161>.
4. Biały, W., Grebski, W., Galecki, G., Kaniak, W. (2020). Environmental Impact of The Mechanical Coal Processing Plant. *Acta Montanistica Slovaca, 25(2)*. <https://doi.org/10.46544/AMS.v25i2.1>.
5. Bluszcz, A., Smoliło, J. (eds.) (2021). Conditions for the transformation of mining areas. In: *Selected problems of the natural environment from a scientific perspective*. Lublin: Wyd. Naukowe Tygiel.
6. Bobruk, M. (2019). Application of economic analysis in decision-making processes in the area of innovation management. *Economic and Political Thought, 1*, 95-114. [https://doi.org/10.26399/meip.1\(72\).2022.05/m.bobruk](https://doi.org/10.26399/meip.1(72).2022.05/m.bobruk).
7. Bondaruk, J., Janson, E., Wysocka, M., Chałupnik, S. (2015). Identification of hazards for water environment in the Upper Silesian Coal Basin caused by the discharge of salt mine water containing particularly harmful substances and radionuclides. *Journal of Sustainable Mining*. <https://doi.org/10.1016/j.jsm.2016.01.001>.

8. Chmiela, A., Smoliło, J. (2023). The method of preliminary estimation of outlays and time necessary to carry out the processes of liquidation of a mining plant. *Mining Machines*, Vol. 41, Iss. 2. <https://doi.org/10.32056/KOMAG2023.2.1>
9. Chmiela, A., Wysocka, M., Smoliński, A. (2023). Multi-criteria analysis of the possibility of retrofitting the system of rainwater drainage from subsidence basins in a liquidated mine. *Journal of Sustainable Mining*, Vol. 22, Iss. 4, Article 2. <https://doi.org/10.46873/2300-3960.1395>
10. Chmielewska, I., Chałupnik, S., Wysocka, M., Smoliński, A. (2020). Radium measurements in bottled natural mineral-, spring- and medicinal waters from Poland. *Water Resources and Industry*, <https://doi.org/10.1016/j.wri.2020.100133>
11. Doorga, J.R.S., Hall, J.W., Eyre, N. (2022). Geospatial multi-criteria analysis for identifying optimum wind and solar sites in Africa: Towards effective power sector decarbonization, *Renewable and Sustainable Energy Reviews*. <https://doi.org/10.1016/j.rser.2022.112107>
12. Fernández-Muñiz, Z., Pallero, J.L.G., Fernández-Martínez, J.L. (2020). Anomaly shape inversion via model reduction and PSO. *Computers & Geosciences*, Vol. 140, 104492, ISSN 0098-3004, <https://doi.org/10.1016/j.cageo.2020.104492>
13. Fidalgo-Valverde, G., Menéndez-Díaz, A., Krzemień, A., Riesgo-Fernández, P., Marqués Sierra, A.L. (2023). *Environmental risk assessment in coal mining with methane degassing*. 11th International Symposium on Occupational Health and Safety (SESAM). <https://doi.org/10.1051/mateconf/202438900039>
14. Gajdzik, B., Sujova, E., Małysa, T., Biały, W. (2022). The accident rate in Polish mining. Current status and forecast. *Acta Montanistica Slovaca*, 27(3). <https://doi.org/10.46544/AMS.v27i3>
15. Gawęda, A. (2021). Sustainability Reporting: Case of European Stock Companies. *European Journal of Sustainable Development*, 10(4), 41-53. <https://doi.org/10.14207/ejsd.2021.v10n4p41>
16. Gawęda, A. (2022). ESG Rating and Market Valuation of the Firm: Sector Approach. *European Journal of Sustainable Development*, 11(4), 91. <https://doi.org/10.14207/ejsd.2022.v11n4p91>
17. Gawęda, A., Sajnóg, A. (2020). Cross-sectoral detection of the Return on Equity determinants based on the 7-factor DuPont model. *Studia Prawno-Ekonomiczne*, 114, 217-234. <https://doi.org/10.26485/SPE/2020/114/12>
18. Gawęda, A., Złoty, M. (2023). The impact of ESG ratings on the market performance of commodity stock sector before and during the COVID-19 pandemic. *Economics and Law*. Vol. 22, No. 3, 531-553. <https://doi.org/10.12775/EiP.2023.029>
19. Howaniec, N., Zdeb, J., Gogola, K., Smoliński, A. (2023). Utilization of Carbon Dioxide and Fluidized Bed Fly Ash in Post-Industrial Land Remediation. *Materials*. <https://doi.org/10.3390/ma16134572>

20. Kaczmarek, J. (2022). The Balance of Outlays and Effects of Restructuring Hard Coal Mining Companies in Terms of Energy Policy of Poland PEP 2040. *Energies*. <https://doi.org/10.3390/en15051853>
21. Kaczmarek, J., Kolegowicz, K., Szymba, W. (2022). Restructuring of the Coal Mining Industry and the Challenges of Energy Transition in Poland (1990-2020). *Energies*. <https://doi.org/10.3390/en15103518>
22. Kamiński, P., Niedbalski, Z., Małkowski, P., Bozic, D. (2022). Application of composite materials in underground mining industry—fore-shaft closing platform. *Mining Machines*, 40(1). <https://doi.org/10.32056/KOMAG2022.1.3>
23. Khomenko, D., Jelonek, I. (2023). Study of a Low-Cost Method for Estimating Energy Fuel Resources in Anthropogenic Sediments. *Management Systems in Production Engineering*, 31(4), 434-441. <https://doi.org/10.2478/mspe-2023-0049>
24. Krzemień, A., Álvarez Fernández, J.J., Riesgo Fernández, P., Fidalgo Valverde, G., Garcia-Cortes, S. (2023a). Valuation of Ecosystem Services Based on EU Carbon Allowances—Optimal Recovery for a Coal Mining Area. *International Journal of Environmental Research and Public Health*. 20(1), 381. <https://doi.org/10.3390/ijerph20010381>
25. Krzemień, A., Álvarez Fernández, J.J., Riesgo Fernández, P., Fidalgo Valverde, G., Garcia-Cortes, S. (2022). Restoring Coal Mining-Affected Areas: The Missing Ecosystem Services. *International Journal of Environmental Research and Public Health*. <https://doi.org/10.3390/ijerph192114200>
26. Krzemień, A., Frejowski, A., Fidalgo Valverde, G., Riesgo Fernández, P., Garcia-Cortes, S. (2023b). Repurposing End-of-Life Coal Mines with Business Models Based on Renewable Energy and Circular Economy Technologies. *Energies*, 16(22), p. 7617. <https://doi.org/10.3390/en16227617>
27. Łabaj, P., Wysocka, M., Janson, E., Deska, M. (2020). Application of the Unified Stream Assessment Method to Determine the Direction of Revitalization of Heavily Transformed Urban Rivers. *Water Resources*, 47(4), <https://doi.org/10.1134/S0097807820040120>
28. Magdziarczyk, M., Smoliło, J., Chmiela, A., Smoliński, A. (2023). Method of estimating the expenditures required to carry out the liquidation processes of a mining site. *Scientific Papers of Silesian University of Technology, Organization and Management Series*, No. 182, <http://dx.doi.org/10.29119/1641-3466.2023.182.12>
29. Maruszewska, E.W., Kołodziej, S., Boitan, I. (2023). Intention to Pay Higher Taxes Dedicated to Reduction of Coal Energy -A Case of Young Central Eastern Europeans. *Acta Montanistica Slovaca*, 28(3), 579-591, <https://doi.org/10.46544/AMS.v28i3.05>
30. Mercado, J.M.R., Kawamura, A., Amaguchi, H., Rubio, C.J.P. (2021). Fuzzy based multi-criteria M&E of the integrated flood risk management performance using priority ranking methodology: A case study in Metro Manila, Philippines. *International Journal of Disaster Risk Reduction*. <https://doi.org/10.1016/j.ijdrr.2021.102498>.

31. Mhlongo, S.E. (2023). Evaluating the post-mining land uses of former mine sites for sustainable purposes in South Africa. *Journal of Sustainable Mining*. <https://doi.org/10.46873/2300-3960.1381>.
32. Mhlongo, S.E., Amponsah-Dacosta, F. (2016). A review of problems and solutions of abandoned mines in South Africa. *International Journal of Mining, Reclamation and Environment*, 279-294. <https://doi.org/10.1080/17480930.2015.1044046>.
33. Michlowicz, E., Wojciechowski, J. (2021). Analysis of energy consumption of main drainage pumps in underground mines. *Mining - Informatics, Automation, and Electrical Engineering*, vol. 546, no. 2, 55-62.
34. Mucha, Z., Generowicz, A., Wójcik, W., Józwiakowski, K., Baran, S. (2016). Application of multi-criterial analysis to evaluate the method of utilization of sludge from small wastewater treatment plants with sustainable development of rural areas. *Environment Protection Engineering*. <https://doi.org/10.5277/epe160408>
35. Prakash Pandey, B., Prasad Mishra, D. (2022). Improved Methodology for Monitoring the Impact of Mining Activities on Socio-Economic Conditions of Local Communities. *Journal of Sustainable Mining*. <https://doi.org/10.46873/2300-3960.1348>
36. Prusek, S., Turek, M. (2018). Improving the Management of a Mining Enterprise a Condition for Increasing the Efficiency of Hard Coal Production. *Journal of the Polish Mineral Engineering Society*.
37. Riesgo Fernández, P., Rodríguez Granda, G., Krzemień, A., García Cortés, S., Fidalgo Valverde, G. (2020). Subsidence versus natural landslides when dealing with property damage liabilities in underground coal mines. *International Journal of Rock Mechanics and Mining Sciences*, 126. <https://doi.org/10.1016/j.ijrmms.2019.104175>
38. Rubio, C.J.P., Yu, I., Kim, H., Kim, S., Jeong, S. (2019). An investigation of the adequacy of urban evacuation centers using index-based flood risk assessment. *Journal of the Korean Society of Hazard Mitigation*, 19(2), 197-207. <https://doi.org/10.9798/KOSHAM.2019.19.2.197>.
39. Salom, A.T., Kivinen, S. (2020). Closed and abandoned mines in Namibia: a critical review of environmental impacts and constraints to rehabilitation. *South African Geographical Journal*, vol. 102, no. 3, 389-405. <https://doi.org/10.1080/03736245.2019.1698450>.
40. Schoenmaker, D., Schramade, W. (2019). *Principles of Sustainable Finance*. London: Oxford University Press.
41. Shnorhokian, S., Mitri, H. (2022). Quantifying the Influence of Variations in Rock Mass Properties on Stope Stability. *Journal of Sustainable Mining*. <https://doi.org/10.46873/2300-3960.1368>
42. Smoliło, J., Chmiela, A. (2021a). A liquidation of the mine in SRK S.A. in a processive approach. *Scientific Papers of Silesian University of Technology, Organization and Management*, 151. <http://dx.doi.org/10.29119/1641-3466.2021.151.42>

43. Smoliło, J., Chmiela, A. (2021b). The mine liquidation processes in SRK S.A. in a cost approach. *Scientific Papers of Silesian University of Technology, Organization and Management*, 153. <http://dx.doi.org/10.29119/1641-3466.2021.153.30>
44. Smoliło, J., Chmiela, A., Lubosz, A., Wróblewski, P. (2021c). Dynamics of bearing of costs in processes leading to revitalization of mine assets in SRK SA. *Scientific Papers of Silesian University of Technology, Organization and Management*, 153. <http://dx.doi.org/10.29119/1641-3466.2021.153.29>
45. Smoliński, A., Howaniec, N. (2020). Hydrogen energy, electrolyzers and fuel cells – The future of modern energy sector. *International Journal of Hydrogen Energy*, 45(9). <https://doi.org/10.1016/j.ijhydene.2019.11.076>
46. Tokarski, S., Magdziarczyk, M., Smoliński, A. (2021). Risk management scenarios for investment program delays in the Polish power industry. *Energies*. <https://doi.org/10.3390/en14165210>
47. Villar, Y., Menéndez, M., Fernández, Z., Bernardo, A. (2020). Sustainable earthworks: Optimization with the ICOM method. *Energy Reports*, Vol. 6, Suppl. 6, 404-419. <https://doi.org/10.1016/j.egy.2020.08.060>
48. Wojtacha-Rychter, K., Król, M., Gołaszewska, M., Całus-Moszek, J., Magdziarczyk, M., Smolinski, A. (2022). Dust from chlorine bypass installation as cementitious materials replacement in concrete making. *Journal of Building Engineering*, 51, 104309. <https://doi.org/10.1016/j.job.2022.104309>
49. Wojtacha-Rychter, K., Kucharski, P., Smoliński, A. (2021). Conventional and alternative sources of thermal energy in the production of cement an impact on CO₂ emission. *Energies*. <https://doi.org/10.3390/ma15124176>
50. Woszczyński, M., Jasiulek, D., Jagoda, J., Kaczmarczyk, K., Matusiak, P., Kowol, D., Marciniak, B. (2023). Monitoring of the mining waste neutralization facility of LW Bogdanka. *Acta Montanistica Slovaca*, 28(1). <https://doi.org/10.46544/AMS.v28i1.19>
51. Wysocka, M., Chałupnik, S., Chmielewska, I., Janson, E., Radziejowski, W., Samolej, K. (2019). Natural Radioactivity in Polish Coal Mines: An Attempt to Assess the Trend of Radium Release into the Environment. *International Journal of Mine Water*. <https://doi.org/10.1007/s10230-019-00626-0>

MAIN OBJECTIVES OF THE STRATEGY, AS WELL AS MOTIVATIONS FOR THE TRANSFORMATION OF HARD COAL MINING IN POLAND

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Your goal must be to get everything
without destroying anything.
Sun Zi

Purpose: in the cognitive space, the article focuses on the issue of dynamically growing social awareness of the impact of hard coal on climate change - which determines the need to implement a strategy to abandon this raw material. The authors of the article also point out that in connection with this process - as the world strives for sustainable and more ecological development - the transformation of the hard coal mining sector becomes an inevitable challenge.

Methodology: the theses presented in the article were verified using the following methods: literature review, critical analysis of literature, analysis and comparison of documents and an example of good practices.

Resultat: properly managing the transformation of the hard coal mining sector is key to ensuring that it delivers long-term social and economic benefits - while minimizing the negative impact of the transformation on mining communities and workers in the hard coal mining sector. Therefore, a holistic approach is important in this space, taking into account the ecological, economic, political and social context of transformation.

Originality: the transformation of mining is necessary due to the sustainable development goals, environmental protection and the fight against climate change. It is also a political challenge that requires well-thought-out investments, policies and regulations to minimize the negative socio-economic effects of the transformation and to use the development potential of the transformed areas in all their dimensions.

Keywords: mining, strategy, transforming.

1. Introduction

The global energy and ecological context has changed dramatically in recent years. As awareness of the impact of hard coal on climate change increases, more and more countries are seeking to develop and implement strategies to phase out this raw material. The strategies aim to reduce greenhouse gas emissions, protect the environment and resources, and energy diversification (Gawlikowska-Fyk, 2022). However, as the world strives for sustainable and more ecological development, the transformation of the hard coal mining sector becomes an inevitable challenge (Wojtkowska-Łodej, 2022). One of the key aspects of this process is the development of policies and regulations aimed at minimizing negative socio-economic effects, the most important of which are (Variantowe Ramy Transformation..., 2022):

- Losses in the number of jobs. The transition from traditional coal mining to other economic sectors may lead to job losses, which may pose important challenges for communities in mining areas.
- The need to retrain employees. Workers in coal mining and coal-related industries need to retrain to work in new sectors, requiring investment in education and training.
- Impact on regional economies. In some hard coal mining regions, the transition may have a serious impact on the economy in the mining areas, which may lead to social and political problems.
- Investment costs. Investments in new technologies and infrastructure can be expensive, posing a challenge for governments and businesses.
- Social and political issues. The transformation of the hard coal mining sector is often accompanied by protests and social tensions related to concerns about the work and existence of traditional mining communities.
- Social equality. There is a risk that some social groups in mining areas may suffer more than others during the transition, which may increase social inequalities.

Given this prospect, properly managing these challenges is key to ensuring that the transformation of the hard coal mining sector delivers long-term social and economic benefits - while minimizing its negative impact on mining communities and workers in the hard coal mining sector. Therefore, a holistic approach is important in this space, taking into account the ecological, economic, political and social aspects of the transformation of the hard coal mining sector.

2. Discussion

2.1. Main strategic goals

One of the main goals of the strategy to phase out hard coal is to reduce greenhouse gas emissions, especially carbon dioxide. Coal is one of the main sources of CO₂ emissions in the world. Switching to more sustainable energy sources, such as renewable energy, helps reduce the energy sector's impact on climate change. From this perspective, climate change is one of the most serious challenges facing humanity. Scientific evidence shows that the increase in global temperature is mainly the result of greenhouse gas emissions that result from human activities, in particular the burning of coal, oil and natural gas (Climate Change in the Light of Law..., 2021). The effects of this climate change are becoming more and more visible, including extreme weather events, rising sea levels, melting glaciers and much more. Coal phase-out strategies are based on replacing traditional energy sources, such as coal, with more ecological alternatives, such as renewable energy (e.g., solar, wind, water) or energy efficiency. As has already been noted, the main goal of these strategies is to reduce CO₂ emissions into the atmosphere. Here are some key ways carbon transition strategies help reduce greenhouse gas emissions. Investments in renewable energy sources that allow the production of energy without emitting CO₂. Solar panels, wind turbines and hydroelectric power plants constitute an increasing share of the global energy mix. Another example is reducing energy consumption through the use of effective technologies and practices, which contributes to reducing greenhouse gas emissions. The indicated action includes, among others: building insulation, more energy-efficient vehicles and developing smart energy networks. It is important to develop public transport, electromobility and other low-emission means of transport, which contributes to reducing greenhouse gas emissions from the transport sector, which is one of the main sources of emissions. In these perspectives, education and public awareness are a very important factor. Shaping the attitudes of society and business towards a sustainable and greener lifestyle is crucial. Improving public awareness can reduce energy consumption and promote sustainable practices (Greenhouse Gas Emissions, 2020).

It is worth emphasizing the benefits resulting from the reduction of greenhouse gas emissions. Firstly, reduction contributes to limiting climate change, which may reduce the risk of extreme weather phenomena and natural disasters. Secondly, improve air quality, which has a positive impact on human health. Third, it creates new business opportunities in sectors related to renewable energy and energy efficiency (Environmental benefits from reducing..., 2019). To conclude, reducing greenhouse gas emissions is one of the main goals of the coal phase-out strategy. This is a necessary goal in the fight against the global climate crisis and is of great importance for the future of our planet. Actions taken under these strategies contribute to creating a more sustainable, ecological and healthier environment for current and future generations.

Environmental protection is an equally important strategic goal. Hard coal mining has serious negative effects on the environment. Coal mining is associated with the erosion of nature, soil degradation, water and air pollution, as well as the degradation of urban areas. Carbon phase-out strategies seek to reduce these negative impacts and restore ecosystems to their original state. In this light, as awareness of the impact of human activities on the climate and environment increases, coal transition strategies are becoming a key tool in the effort to protect our ecosystem. One of the primary goals of these strategies is environmental protection (Territorial Plan for Just Transformation..., 2022).

To understand why environmental protection is so important in the context of phasing out coal, it is important to realize the negative impact of coal on our environment. Coal mining and combustion of this raw material in power plants are associated with many unfavorable effects, such as greenhouse gas emissions. As has already been noted, coal combustion is one of the main sources of carbon dioxide (CO₂) emissions, which is the main greenhouse gas responsible for global warming and climate change. Another adverse effect is air pollution. Coal contains pollutants such as sulfur, nitrogen and particulate matter, which lead to smog, acid rain and negatively impact human health and ecosystems. Soil degradation is another negative effect of mining activities, which can lead to loss of natural habitats and reduced soil quality. Finally, water pollution. The process of coal mining and storage of mining waste can lead to contamination of ground and surface waters, which has a negative impact on aquatic ecosystems and the quality of drinking water. In turn, transforming coal mining can help protect these valuable ecosystems and biodiversity. Reducing air pollution caused by coal burning helps improve human health by reducing the risk of respiratory diseases and other health problems. As a result, the transformation of coal mining opens up space for sustainable development, creating jobs in sectors with a lower environmental impact and promoting more sustainable social development (State ecological policy 2030..., 2019). In summary, the energy transition and reducing greenhouse gas emissions are key to preserving our planet and reducing the effects of climate change. However, achieving this goal requires cooperation at many levels, including governments, industry and society, to create a more sustainable and greener society.

The third key goal of the coal phase-out strategy is energy diversification. Basing energy security on coal as the main energy source carries the risk of energy homogeneity, which may lead to instability of supplies and an increase in energy prices. However, diversification of energy sources, including investments in renewable energy sources - contrary to energy homogeneity - ensures greater energy independence and stability of energy supplies. To understand the need and importance of diversifying energy sources, it is worth looking at the role of coal as the dominant energy source. Coal has traditionally been one of the world's main energy sources, especially in the energy sector. However, coal burning is associated with numerous negative effects, such as the already mentioned greenhouse gas emissions, air pollution and environmental degradation. These are also the main premises determining the need to diversify energy sources (Energy Security of Poland..., 2019). In this perspective,

diversification of energy sources means diversifying the sources from which we obtain energy. This is a key goal of the coal transition strategy for several reasons. To achieve the goal of diversifying energy sources, specific actions are necessary, examples of which are:

- Investing in renewable energy sources: Governments and businesses should invest in developing and deploying renewable energy technologies such as solar panels, wind turbines and hydropower.
- Promoting energy efficiency. Improving energy efficiency in buildings, industry and transport is crucial. This includes modernizing infrastructure, using more efficient technologies and educating the public on energy efficiency.
- Support for research and development. Investments in research into new technologies and energy solutions are necessary to develop new, greener technologies and increase energy efficiency.
- Promoting pro-ecological policies. Governments should introduce regulations and policies that promote the production of energy from renewable sources, reduce greenhouse gas emissions and provide an appropriate legal framework for the development of an energy sector based on sustainable energy sources.

To sum up, diversification of energy sources is another key goal of the coal phase-out strategy. In this space, the energy transition aims to reduce greenhouse gas emissions, increase energy independence, protect the environment and public health, and stimulate innovation and the economy. With the right investments, regulations and promotion of green technologies, we can achieve this goal while contributing to a more sustainable and greener future for our globe. Diversification of energy sources is not only an ecological necessity, but also an economic and strategic one that will benefit societies around the world (Popławska, 2018).

In view of the above strategic goals of moving away from coal, the political motivations determining the transformation of mining are extremely important. One of the first motivations are international obligations. As part of the Paris Agreement, numerous countries have committed to limiting global warming to below 2 degrees Celsius (Selosse, 2019). To achieve this goal, it is necessary to drastically reduce greenhouse gas emissions, which requires phasing out coal. The indicated space includes the factor of social pressure. As public awareness of climate change and the impact of coal on public health increases, public pressure on governments to take action to phase out coal also increases. Protests and social campaigns put pressure on politicians to introduce greener energy solutions. Social pressure determines numerous premises shaping political motivation related to the need to transform mining, the most important of which are (Marszowski, 2021):

- Public health. The coal industry is often associated with serious health problems for residents of mining areas, such as asthma, respiratory diseases and cancer. The transition to cleaner energy sources aims to improve people's quality of life and reduce negative impacts on public health.

- **Creating jobs.** The transformation of mining may be an opportunity to create new jobs in sectors related to renewable energy, technology and innovation. This could contribute to economic growth and reduce unemployment in mining areas.
- **Long-term savings.** Investments in renewable energy sources can lead to long-term savings. Renewable energy sources have lower operating costs and do not require constant access to raw materials such as coal.
- **New business opportunities.** The mining transformation opens the door to new business opportunities related to renewable energy, energy storage technology and energy efficiency. Companies that engage in these areas early can benefit from a growing market.

To conclude, strategies to phase out coal are aimed - as already mentioned several times - not only at reducing greenhouse gas emissions, but also at environmental protection, energy diversification and generating political, social and economic benefits. As the world moves towards a sustainable future, the transformation of coal mining becomes an inevitable step towards a greener and more sustainable society.

In the already mentioned political area, strategic planning is key (Yegorov, 2020). Politics plays a key role in planning the transformation of the hard coal mining industry. Governments and local government institutions should cooperate with representatives of the hard coal mining sector and independent experts to develop strategic solutions in the transformation space. The solutions and strategies developed should take into account sustainable development goals and determine the introduction of strict environmental protection regulations in mining activities. Mining companies should be obliged to apply best ecological practices and bear responsibility for the reconstruction of degraded areas (Polluter Pays..., 2021). Governments should promote the mining transformation by investing in the development of new renewable energy sources that can replace traditional coal-based energy sources. This not only reduces emissions, but also creates new jobs in the renewable energy sector. The policy should support educational and retraining programs for employees of the transformed mining industry, because - as has already been noted - the mining transformation may lead to job losses in the coal sector, therefore it is important to provide employees with the skills needed to work in other economic sectors.

When planning the transformation of mining, consultations with mining communities are necessary (Ślimko, 2019). Governments and companies should involve residents of mining areas in the decision-making process to take into account their needs and concerns - building a policy of participation and social solidarity. Mining communities that depend on mining may suffer from the transition. In this perspective, policies should include support measures such as infrastructure investments, job creation and social assistance programs to create an enabling environment for these communities to adapt to change. The need to learn from past mistakes is also important. Examples of past failures, such as environmental and social negligence related

to mining, should be used to develop better regulations and practices in the current mining transformation (Analysis of the consequences of liquidation..., 2022).

In conclusion, the transformation of mining is inevitable in the context of striving for a sustainable future (Territorial Plan for Just Transformation..., 2022). However, its success depends on appropriate policies and regulations that protect the interests of mining communities and workers in the hard coal mining sector. Governments, local governments, mining companies and mining communities should work together to shape a transformation that incorporates the Sustainable Development Goals, environmental protection and support for those most affected by transformational change. Only a policy shaped in this way will enable a long-term and fair process of mining transformation to be achieved.

2.2. Main motivations

In terms of key motivations determining the transformation of the hard coal mining industry, it should be clearly stated that these are extremely important social and economic issues in Poland. This issue is particularly related to the implementation of the European Green Deal. In the perspective of the plan, the green economy becomes particularly important, which is defined as an economy that improves human well-being and increases social justice - while reducing environmental risk and the consumption of natural resources (Environmental Indicator Report, 2012). From another perspective, the green economy is a low-emission economy, economical in the use of raw materials and socially inclusive (Measuring Progress Towards..., 2012). The importance and importance of activities developing the green economy are emphasized by the European Union and national policies - including Polish ones, which have some of the strictest environmental protection standards in the world. The EU and national governments have set clear goals to guide European environmental policy by 2020 and beyond, 2050. These goals include (A Greener and More Sustainable Europe, 2022):

- protecting, conserving and improving the EU's natural capital,
- transforming the EU economy into a resource-efficient, green and competitive low-emission economy,
- protecting Europeans from environmental pressures and threats to health and well-being.

A milestone in the transformation of EU countries towards a green economy - which assumes the need to decarbonize the energy industry - is the Horizon Europe program (Horizon Europe - a new program..., 2022). Horizon Europe promotes excellence and provides valuable support to the best scientists and innovators, thereby driving the systemic changes needed to ensure a Europe that is green, healthy and resilient.

In turn, the already mentioned European Green Deal plan is the path to the first climate-neutral continent. The European Green Deal is:

- plan to build a sustainable economy,
- resource efficiency and clean economy,
- covering all sectors of the economy,
- the need for additional investments and a fair transition mechanism,
- citizens' voice and international cooperation,
- transition to a clean and circular economy,
- stopping climate change,
- counteracting the loss of biodiversity and reducing the level of emitted pollutants.

In turn, in the area of national documents that outline medium- and long-term goals and tasks in the field of energy transformation and the Just Transition Plan, there is the National Recovery and Resilience Plan (National Reconstruction Plan..., 2021), in which in the part devoted to green energy and reducing energy intensity the key goal is clean air. The indicated goal should be achieved, among others: thanks (<https://www.funduszeuropee.gov.pl>, 2022):

- faster replacement of old mining furnaces with more ecological ones,
- purchase of photovoltaic panels and solar track collectors,
- wind farms in the Baltic Sea,
- intelligent energy grid,
- hydrogen technology,
- green cities.

In the next document, the Strategy for Responsible Development, we read that the assumed transformation of the economy towards a low-emission economy will require a complete reevaluation and new market models allowing, among others, such features as power, availability, location of the generator, location of the recipient, demand characteristics, etc. However, due to the nature of energy services, changes must be evolutionary and it is necessary to reconcile a sufficiently strong base of conventional, large-scale production forces in the professional energy industry with distributed sources functioning as a complement to medium-sized agglomerations and clusters, energy cooperatives, etc. with a significant level of autonomy (Strategy for Responsible Development..., 2017).

Another important document in the area of transformation processes in the hard coal mining industry is the Polish Energy Policy. In this document, one of the primary goals is to ensure - for social, economic and environmental reasons - that a just energy transition will lead to economic strengthening, leaving no one behind and will serve future generations. This process will be supported by financial instruments under the EU Just Transition Mechanism, mobilizing support funds in the amount of PLN 60 billion. Detailed solutions in this area are included primarily in the national and territorial just transformation plans (Poland's Energy Policy..., 2021).

At the regional level, the key strategic document in the area of transformation processes in the hard coal mining industry is the Development Strategy of the Silesian Voivodeship "Śląskie 2030". This document clearly states that from the point of view of the Silesian Voivodeship, it will be important to implement the Program for Silesia, which aims to change the economic profile of the region, gradually replacing traditional economic sectors, such as mining and metallurgy, with new ventures in more productive, innovative and advanced sectors, technologically. The above-mentioned document assumes that after 2020 there will be full implementation of the Program for Silesia, correlated with government restructuring programs, expansion and modernization of transport infrastructure, implementation of a new, territorially sensitive, integrated urban and industrial policy, innovation and human resources development. It is planned to introduce additional instruments related to the adaptation of national operational programs to the objectives of the Program for Silesia, primarily in the area of investment promotion and innovation (Strategy for the Development of the Silesian Voivodeship..., 2020).

New directions and challenges are outlined in the Regional Innovation Strategy of the Silesian Voivodeship 2030. The strategy clearly indicates that in the coming years, entities from the Silesian Voivodeship will be the beneficiary of a special European Union instrument supporting the green transformation, which is the Just Transformation Fund. This support will enable: productive investments in SMEs, leading to economic diversification and economic restructuring; investments in the creation of new enterprises; investing in research and innovation activities and supporting the transfer of advanced technologies; investments in the implementation of technologies and infrastructures that provide affordable clean energy, in reducing greenhouse gas emissions, energy efficiency and renewable energy; investments in digitization and digital connectivity; investments in the regeneration, decontamination and renaturalization of areas and projects changing their purpose; investing in strengthening the circular economy; improving and changing employee qualifications. It should be noted that the allocation of funds will be carried out within the framework of a separate Territorial Just Transition Plan, which will be created for seven subregions of the voivodeship: Katowice, Bytom, Sosnowiec, Gliwice, Tychy, Rybnik and Bielsko (Regional Innovation Strategy..., 2021).

The key programs with an operational dimension in the area of transformation processes are the Regional Plan for the Just Transformation of the Silesian Voivodeship 2030 (Territorial Plan for Just Transformation..., 2021) and the Fund for Just Transformation. In the Regional Plan, expert attention was focused on the process of transformation of the hard coal mining industry. In this perspective, it is stated that the transformation of the voivodeship will require a change in the production structure and the development of the energy sector in the region. One of the actions being implemented will be the decommissioning of obsolete power units (built in the 1970s and 1980s) and replacing them with modern infrastructure that is friendly to the environment and the inhabitants of the region. (...) Renewable energy sources will play a key role in the region's energy system. The Territorial Just Transition Plan provides support

for this type of investment as an important element in the diversification of generation sources in the regional energy mix. The implementation of the indicated activities will contribute to achieving the national target of 21-23% share of Renewable Energy Sources in the final gross energy consumption.

The second of the documents mentioned, the Just Transition Fund in the Silesian Voivodeship, will serve to achieve the main goal, i.e., mitigating the social, economic and environmental effects of the transition to a climate-neutral economy. In combination with other sources of financing, in particular funds from the Cohesion Policy 2021-2027, funds from the remaining pillars of the Just Transition Mechanism and other public and private funds dedicated to complementary activities and projects, this fund will give a new impetus to the region's economy and open better development prospects for its inhabitants. , especially those most affected by the negative consequences of the inevitable process of transformation of the hard coal mining industry (Fund for the Just..., 2020).

In the described space, a very important document is the "Social Agreement on the transformation of the hard coal mining sector and selected transformation processes of the Silesian Voivodeship" regarding the transformation of the hard coal mining sector, which aims to ensure a gradual withdrawal from hard coal mining and transform it in an ecologically and sustainable manner. socially, taking into account the interests of employees, the economy and the environment. The Social Agreement defines the objectives of the transformation of the hard coal mining sector, including (<https://www.gov.pl/web/aktywa-panstwowe...>, 2023):

- reducing greenhouse gas emissions. The social contract assumes reducing greenhouse gas emissions by phasing out coal-fired energy production and improving energy efficiency, as well as introducing other renewable energy sources, such as solar, wind and geothermal energy,
- reducing energy dependence. The transformation of the hard coal mining sector aims to reduce the country's dependence on a single energy raw material by diversifying energy sources, increasing the use of renewable energy and introducing new technologies and innovative solutions,
- retraining of employees. As part of the social contract, plans are established to retrain employees in the hard coal mining sector to ensure that they can take up work in other sectors of the economy,
- ensuring employee safety. The social contract imposes on employers the obligation to ensure occupational health and safety and to protect the health and life of employees in the hard coal mining sector,
- development of regions. The transformation of the hard coal mining sector also aims to develop the regions affected by its effects, through investments in infrastructure, creation of new jobs and development of entrepreneurship.

The social contract regarding the transformation of the hard coal mining sector is an important step towards achieving sustainable development goals, including environmental protection and ensuring decent working conditions and a future for workers in the hard coal mining sector.

Documents, plans, strategies and theses corresponding to the goal of achieving a green economy in the EU, at the same time determining - especially at the level of mining communities - the need to recognize the social reception of the just transformation process, which may have an important impact on the condition and development prospects of the transformed mining areas and be an essential recommendation for the creation of programs aimed at strengthening the country's energy policy based on clean technologies. Bearing in mind the effects that have occurred over many years of transformation, e.g., of the hard coal mining industry in Poland, we should not ignore the fact that further reform of this important sector of the national economy may result in social acceptance or rejection of the directions of its further transformation. This is particularly important for the sector and its environment, which are systematically subjected to pressure resulting from its adaptation to changing economic, political and social conditions. The selected thematic areas presented in this article, which clearly fit into the transformation processes - especially the transformation of the hard coal mining industry - are key challenges for EU policies shaped by the European Green Deal plan, which is gaining particular importance both in the cognitive and utilitarian areas.

3. Summary

Taking into account all of the above content, it should be emphasized that the coal industry in Poland has an impact on the economy and development of regions. Moving away from hard coal may lead to job losses and changes in the country's economic structure. This poses a political challenge as politicians must deal with public resistance - including from numerous mining-related occupational groups - and seek sustainable plans for transitioning these communities to other economic sectors. To sum up, moving away from hard coal is both a necessity due to the protection of the environment and public health, and a political challenge due to the economic, infrastructural and social implications of this process. Putting in place effective transition policies and strategies can help manage this challenge to achieve the Sustainable Development Goals and ensure that no community or worker is left behind as the social and economic landscape of transformed mining areas changes. The transformation of mining is necessary due to the sustainable development goals, environmental protection and the fight against climate change. It is also a political challenge that requires well-thought-out investments, policies and regulations to minimize the negative socio-economic effects of the

transformation and to use the development potential of the transformed areas in all their dimensions (Skubida, 2023)

4. Acknowledgments

The article was financed as part of the project implemented by GIG PIB "Preservation and promotion of coal mining heritage as the cultural heritage of the European Union" financed by the Coal and Steel Research Fund, <https://coalheritageproject.eu>.

References

1. *A greener and more sustainable Europe*, https://europa.eu/european-union/topics/environment_pl, 24.11.2023.
2. *Analysis of the consequences of the liquidation of hard coal mining for Poland and enterprises in the mining-related sector* (2022). Katowice: Mining Chamber of Industry and Commerce.
3. Development Strategy of the Silesian Voivodeship "Śląskie 2030" (2020). Katowice: Zielone Śląskie, p. 90.
4. Egorow, D. (2020). Strategic planning in regional development - Poland in the perspective of 2020. *Entrepreneurship and Management, Vol. XVII. Iss. 4, part I*. Lublin: John Paul II Catholic University of Lublin; Wydawnictwo SAN, pp. 71-81.
5. Ruszel, M., Podmotywko, S., Łukasiewicz, I. (eds.) (2019). Energy security of Poland and Europe - conditions - challenges – innovations. Rzeszów: Energy Policy Institute.
6. *Environmental benefits resulting from the reduction of air pollution associated with CO₂ emissions. Analysis using an air quality model for Poland* (2019). Warsaw: IOŚ-PIB.
7. *Environmental Indicator Report 2012. Ecosystem Resilience and Resource Efficiency in a Green economy in Europe 2012*. Copenhagen: EEA.
8. Gawlikowska-Fyk, A. Forum Energii, Chapter I, Trends in global energy demand and supply. In: *Transformation of energy markets Economy. Climate. Technology. Regulations*. The project is co-financed by the "Social Responsibility of Science" program of the Minister of Education and Science. Project manager: G Wojtkowska-Łodej. Project implemented in the years 1.10.2020-31.09.2022, pp. 8-18.
9. *Greenhouse gas emissions. Selected issues regarding CO₂ emissions in Poland Thematic studies OT-683* (2020). Warsaw: Chancellery of the Senate of the Republic of Poland.

10. *Horizon Europe - new framework program for EU research and innovation*, <https://www.kpk.gov.pl/horyzont-europa-nowy-program-ramowy-badan-i-innowacji>, 25.08.2023.
11. w.funduszeuropee.gov.pl/strony/o-funduszach/fundusze-na-lata-2021-2027/krajowy-plan-odbudowy/zielona-energia-i-zdrowie-energochlonnosci/, 10.07.2023.
12. <https://www.gov.pl/web/aktywa-panstwowe/umowa-spoleczna>, 4.09.2023.
13. *Just Transition Fund* (April 2020). Policy Department for Budget, Directorate-General for Internal Policies of the European Union.
14. Marszowski, R. (2021). *Mining communes and districts in Poland in the perspective of just transformation*. Katowice: GIG.
15. *Measuring Progress Towards an Inclusive Green Economy 2012*. Nairobi: UNEP.
16. Mik, C., Borek, A. (eds.) (2021). *Climate change in the light of European Union law and Polish law in a comparative context*. Warsaw: IOŚ-PIB.
17. *National Recovery and Resilience Plan. Project* (2021). Warsaw: Ministry of Funds and Regional Policy.
18. *Optional Transformation Framework A guide to the principles of identifying and assessing concepts for the development of former mining and industrial areas* (2022). Katowice: Marshal's Office of the Silesian Voivodeship.
19. *Poland's energy policy until 2040 – Summary*. Warsaw: Ministry of Climate and Environment, p. 13.
20. *Polluter pays - inconsistent application of the principle in EU environmental policy and action* (2021). Luxembourg: European Court of Auditors.
21. Popławska, J. (2018). Diversification of energy sources as a method of making countries energy independent. *Annales Universitatis Paedagogicae Cracoviensis FOLIA, 257, Studia de Securitate, 8*.
22. *Regional Innovation Strategy of the Silesian Voivodeship 2030* (2021). Katowice: Inteligentne Śląskie, p. 44.
23. Selosse, S. (2019). *Bioenergy with Carbon Capture and Storage Using Natural Resources for Sustainable Development*, pp. 237-256.
24. Skubida, A. et al. (2023). *Drift or navigation? Coal regions facing transformation*. Warsaw: WiseEuropa – Warsaw Institute of Economic and European Studies Foundation.
25. Ślimko, E. et al. (2019). *Just transformation of Silesia. Challenges from a social perspective - analysis and recommendations*. Warsaw: Union of Associations Polish Green Network.
26. *State ecological policy 2030 - development strategy in the area of environment and water management* (2019). Warsaw: Ministry of the Environment.
27. *Strategy for Responsible Development until 2020 with a perspective until 2030* (2017). Warszawa, p. 323.

28. Territorial Plan for the Just Transformation of the Silesian Voivodeship 2030. Annex No. 1 to the Resolution of the Voivodeship Management Board No. 2326/383/VI/2022 of 21.12.2022.
29. Territorial plan for the just transformation of the Silesian Voivodeship (2022). Katowice: Marshal's Office of the Silesian Voivodeship.
30. Territorial Plan for the Just Transformation of the Silesian Voivodeship 2030 (2021). Katowice.
31. Wojtkowska-Łodej, G. (2022). *Transformation of energy markets. Economy. Climate. Technology. Regulations*. Warsaw: SGH.

PROTECTION OF POST-INDUSTRIAL CULTURAL HERITAGE. A TASK FOR SMART SOCIETIES

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Culture – this is what remains when you
forget everything you have learned.
S. Lagerlof

Purpose: In the cognitive space of the article, an important and significant social challenge arises, which is the preservation of cultural heritage in transformed post-industrial areas.

Methodology: the theses presented in the article were verified using the following methods: literature review, critical analysis of literature, analysis and comparison of documents and an example of good practices.

Result: the literature research confirms that the protection of cultural heritage is an important factor in socio-economic development. By preserving and using cultural heritage, the economic, cultural and social value of transformed post-industrial areas can be increased.

Originality: The literature research confirms that the protection of cultural heritage is an important factor in socio-economic development. By preserving and using cultural heritage, the economic, cultural and social value of transformed post-industrial areas can be increased.

Keywords: heritage, industry, society.

1. Introduction

Preserving post-industrial cultural heritage is one of the most important tasks for societies that want to remember and cherish their history and heritage¹. Post-industrial areas are not only monuments, but also important cultural and artistic sites that attract tourists and become an important element of regional development. The cultural heritage associated with mining is

¹ The article was financed as part of the project implemented by GIG PIB "Preservation and promotion of coal mining heritage as the cultural heritage of the European Union" financed by the Coal and Steel Research Fund (<https://coalheritageproject.eu>).

first and foremost an important part of our country's history and culture. However, due to continuous technological advances and changing trends in the economy, many mines are being decommissioned, which may result in the loss of cultural heritage. Therefore, the preservation of industrial monuments and intangible heritage related to mining is extremely important for preserving the cultural identity of regions and passing on knowledge of history and tradition to future generations.

A key determinant of heritage preservation is a wise society perceived as a group characterized by a high level of social awareness and responsibility toward each other and the environment in which they live. It is a society that prioritizes values such as honesty, solidarity, respect for diversity, dialogue, openness and tolerance. A wise society is able to effectively solve problems and conflicts, and act in a sustainable and responsible manner, taking into account the interests of present and future generations. A wise society cares about the development of its members, providing education, health, security and equal opportunities, while respecting individual privacy and freedom. In such a society, every person has the opportunity to express his or her views and participate in public life, which contributes to increasing civic engagement and strengthening democracy (Dudzik, 2017).

Through the preservation and use of cultural heritage, the economic, cultural and social value of transformed post-industrial areas can be increased and the sustainability and success of this process requires the involvement of society and local and regional authorities. The preservation of cultural heritage in transformed post-industrial areas is therefore an important aspect of socio-economic development (Ifko, Stokin, 2017). In this perspective - which we particularly emphasize - a wise society is a key factor in preserving cultural heritage. High social awareness and civic responsibility are qualities that allow a society to understand the importance of cultural heritage and to pass it on. A wise society realizes that cultural heritage is not only an element of culture and history, but also an asset for future generations - and therefore takes active measures to protect and preserve it (Kowalik, 2018).

2. Definitions describing the preservation of cultural heritage

The term "cultural heritage" has its origin in Latin. The Latin word "patrimonium" originally meant heritage received from a father or ancestors. Today, the word "patrimonium" is used in Italian and Spanish. In contrast, the English language has the term "heritage", which is used to describe cultural heritage and is derived from French and Old English – and means inheritance or legacy (Etymology..., 2011).

Expanding the space related to defining the term "cultural heritage", it is worth noting that it was first formulated in the early 20th century by French thinkers who began to draw attention to the need to protect national heritage from disappearing. French writer Prosper Mérimée was

one of the first to take action to protect France's monuments and cultural heritage. He was appointed inspector of monuments in 1837, which allowed him to inventory and protect many French monuments, including Notre-Dame Cathedral in Paris. Today, the term "cultural heritage" is widely used around the world and refers to various cultural elements, such as architectural monuments, works of art, handicrafts, music, literature, rituals and traditions. As has already been noted - the term in Latin emphasizes that cultural heritage is passed down through generations and forms the basis of national heritage, which should be protected and passed on to future generations (Chojacka, 2015).

In other terms, cultural heritage preservation is the process of protecting, conserving and managing monuments, works of art, traditions and other cultural elements that have historical, artistic, scientific or social value. Preservation of cultural heritage is aimed at protecting it from destruction, disappearance or oblivion. This activity includes not only monuments and works of art, but also local cultures, traditions, languages, rituals and beliefs. It is associated not only with issues of physical preservation, but also education, promotion and development of public awareness of cultural values. Preserving cultural heritage requires the cooperation of various institutions, organizations and local communities, which should work to protect it and preserve it for future generations (UNESCO, 2018).

3. Preservation of cultural heritage and its main objectives

Preserving cultural heritage is crucial for future generations, as it allows us to pass on the rich history, heritage and culture of our ancestors. These activities should be carried out at different levels depending on the tangible or intangible nature of the cultural value. Respect for cultural heritage determines the activities through which the tangible elements of culture will not be destroyed, lost or forgotten. There are various threats that can affect cultural heritage. These can include climate change, natural disasters, human activity, wars, inappropriate use of monuments, and lack of public interest and awareness in protecting cultural heritage. All of these factors can lead to the destruction of monuments and works of art, as well as the loss of knowledge and skills that were essential to their creation. In order to pass on cultural heritage to future generations, it is necessary not only to preserve it physically, but also to protect and develop public awareness of cultural values (Dąbrowski, 2012). Proper management of monuments, education and promotion of culture, as well as preservation of local traditions and languages are important elements of the process of preserving cultural heritage. In this way, mankind can benefit from cultural wealth and heritage, and understand the history and traditions of their country or region.

As indicated above, the preservation of cultural heritage is crucial to transmitting cultural wealth to future generations and protecting the historical, artistic and scientific values of monuments, works of art and local cultures (Murzyn, 2016). In addition, the preservation of cultural heritage also has a positive impact on social and economic development. Cultural tourism associated with visiting monuments, museums and other sites, contributes to income generation, job growth and improved tourism infrastructure. It is worth emphasizing that tourism should be carried out in a sustainable manner to avoid negative effects on cultural heritage and the environment.

Modern technology also plays an increasingly important role in the process of preserving cultural heritage (Cetera, 2022). Digitization and digital models of monuments make it possible to accurately represent their appearance and structure, and make it easier to access information about their history and significance to a region. Virtual tours of monuments and museums allow people to discover their rich history and art without having to travel long distances. Digitization and digital models are increasingly important tools in the process of preserving cultural heritage. One of the most important tools of digital technology in the process of preserving cultural heritage is laser scanning. This technique makes it possible to accurately represent monuments in a three-dimensional model that can be used for educational, scientific and reconstruction purposes. Laser scanning is particularly useful for monuments that are difficult to access or require special safeguards, such as sites of cultural significance or objects located in danger zones. Another tool of digital technology in the heritage preservation process are digital models, which allow the examination and analysis of monuments without touching them or exposing them to damage. Digital models can also be used to create virtual exhibitions or for educational purposes.

Another tool of modern digital technology used in the process of preserving cultural heritage is virtual tours, or interactive virtual tours of monuments or museums. Virtual tours allow people to remotely explore and understand cultural heritage and discover its history and art without having to leave home. This modern type of tour developed especially during the pandemic era, when it was not possible to physically visit monuments or museums.

It is also worth noting that modern digital technology also creates new opportunities in the field of reconstruction and conservation of monuments. Through the use of techniques such as 3D printing, it is possible to recreate damaged or destroyed elements of monuments, allowing them to be rebuilt as authentically as possible. Digital technology also makes it possible to accurately analyze and study monuments and their surroundings, allowing for a better understanding of their history and significance. When using digital technology, it is worth remembering that it cannot replace real monuments or museums. Digital models and virtual tours complement, but do not replace, real cultural sites. Therefore, preservation of cultural heritage requires proper planning and management, as well as broad public participation (Culture..., 2021). It is important that the process of cultural heritage preservation be conducted in a sustainable manner and tailored to the needs and capabilities of the community. Appropriate

planning and approaches by decision-makers, as well as broad public participation, are key to the success of the cultural heritage preservation process.

In conclusion, the preservation of cultural heritage is important for the transmission of historical, artistic and scientific values to future generations, and has a positive impact on social and economic development. Therefore, the preservation of cultural heritage should be treated as a priority issue both locally and globally (Szot-Radziszewska, 2009).

4. Cultural heritage and transformation of post-industrial areas

In the past, industry was a fundamental element of economic development, but its development did not always go hand in hand with the preservation of cultural heritage (Janikowski, Krzysztofek, 2009). The transformation of post-industrial areas, such as steel mills and mines, was associated with the disappearance of the cultural heritage of these places. Old buildings, traditions or customs associated with the industry were disappearing. Thus, the process of industrial modernization contributed to the destruction of cultural heritage, which is an integral part of the history of these places. In this light, it is important to remember that preserving cultural heritage in transformed post-industrial areas involves a number of challenges. The first is the complexity of cultural heritage due to the fact of the rich history of these regions not only in terms of industrial activity itself, but also in terms of culture, traditions and customs. Many of these sites also have symbolic and emotional value for local communities. In this context, the preservation of cultural heritage in post-industrial areas requires consideration of many cultural, social and economic aspects.

The second challenge is to change the function of post-industrial areas into places attractive to tourists, cultural centers, recreational spaces or offices. In such a context, it is important that while preserving the cultural heritage, the needs of the new users of these places are not forgotten, while at the same time their original character and value to the local community is not lost. Another challenge is the dangers of neglecting heritage sites. Post-industrial areas are being destroyed and devastated. Often, these are forgotten places that require a huge amount of money and work to preserve them for future generations. It is important to take appropriate steps to protect these places from destruction.

Preservation of cultural heritage in transformed post-industrial areas brings many benefits to society (Nilson, Thorell, 2018). First, the preservation of cultural heritage contributes to the economic value of these places. Such places attract tourists who are eager to visit places with rich history and culture. This translates into increased employment and income for local residents.

Preserving cultural heritage in transformed post-industrial areas contributes to the preservation of cultural identity. By preserving cultural heritage in transformed post-industrial areas, the unique identity of places and their residents can be preserved. Third, preserving cultural heritage in transformed post-industrial areas contributes to the development of local communities. Thanks to such places, people have the opportunity for joint activities and interactions. Many of these places become centers of culture and social development, attracting people with different interests and skills.

In order to preserve cultural heritage in transformed post-industrial areas, it is important to take appropriate steps (Konior, 2021). First, it is important to conduct a comprehensive analysis of the cultural heritage of these sites. Second, it is necessary to take into account both industrial and cultural aspects, traditions and customs.

It is important to use the cultural heritage in transformed post-industrial areas in an appropriate way. Appropriate ways should be found to use these sites so that they are user-friendly, and at the same time, retain their cultural and historical character, while being properly protected from damage and devastation. There are many ways to protect cultural heritage, such as designating protection zones, carrying out conservation and restoration work, and ensuring that heritage sites are properly supervised. Another important aspect is the education and promotion of cultural heritage through the organization of cultural events, exhibitions and other activities to raise awareness of its cultural and historical value.

In addition to the above-mentioned activities, the preservation of cultural heritage in transformed post-industrial areas requires cooperation between various representatives of public life.... It is important that local authorities, NGOs, local communities, as well as representatives of industry and business participate in the process of cooperation. Cooperation between these representatives could contribute to finding innovative solutions that will allow the use of cultural heritage in transformed post-industrial areas in a way that is beneficial to all concerned.

An excellent example of an action aimed at preserving cultural heritage in the space of a transformed post-industrial area is the project entitled CoalHeritage (Preservation and promotion of coal mining heritage as EU cultural heritage). Implementation of the project will last from 2023 to 2025. The project will be implemented in a consortium of the following partner institutions: Ethniko Kentro Erevnas Kai Technologikis Anaptyxis - Greece, Komag Institute of Mining Technology - Poland, Central Mining Institute - Poland, Premogovnik Velenje Doo - Slovenia, Bureau De Recherches Geologiques Et Minières - France and Dmt-Gesellschaft Fur Lehre Und Bildung MBH - Germany. CoalHeritage aims to develop an interregional network for the protection and promotion of coal mining heritage in post-mining areas. The project partnership, after identifying, inventorying and valorizing the assets of the selected mines, will develop a strategy for their preservation based on best practices - and identify the processes necessary to qualify a coal mine as a national heritage, and then develop a European Visual Map Journal for coal heritage as an intangible asset.

The key activities leading to the project's goal, the European Journal of Visual Maps for Coal Heritage as an Intangible Asset, are:

- to describe the current state of mining heritage in Europe,
- developing a clear and standardized method for inventorying the management processes of movable and immovable mine assets,
- implementation of a web-based geographic information system that will inform a wide audience about coal heritage.

Coal Heritage (Preservation and promotion of coal mining heritage as EU cultural heritage) is an activity aimed at developing an interregional network for the protection and promotion of coal mining heritage in post-mining regions. The project partnership, after identifying, inventorying and valorizing the assets of the selected mines, will develop a strategy for their preservation based on best practices and define the processes needed to recognize the mines as national heritage.

The project perspective described above corresponds perfectly with the local action entitled "Łaźna Moszczenica" implemented in the city of Jastrzębie-Zdrój. "Łaźna Moszczenica" is a multifunctional post-industrial space created in the building of a former mining bathhouse and the main brand of a public cultural institution called "Institute of Heritage and Dialogue - Łaźnia Moszczenica". The main building of the bathhouse is the carbonarium. It is a permanent exhibition about the history of coal - from the element, through its use in industry and the role coal played in the history of the city of Jastrzębie-Zdrój. The exhibition presents the uses of coal in the world of science, addresses the topic of mining transformation and ecological ways of using coal. The exhibition allows visitors not only to read and see the history of coal, but also to feel and discover for themselves the content that stays in the memory for longer. The reconstruction of the old bathhouse began in 2021, 20 years after the liquidation of the Moszczenica hard coal mine.



Figure 1. Łaźnia Moszczenica before reconstruction.

Source: Photograph by Aneta Czarnocka-Kanik, Radosław Kaźmierczak.

The project is implemented in cooperation with Dolní Vitkovice, which is located in the administrative territory of the city of Ostrava in the Czech Republic. In the future, in Łaźnia Moszczenica, the Jastrzębie Understanding Center and business and entertainment space will

be built (Neja, Kurpierz, 2013). The city of Jastrzębie-Zdrój has a secured own contribution for the implementation of the "Łaźnia Moszczenia" measure in the amount of PLN 14 million 47 thousand 710, which constitutes 36.63% of the implementation costs of the entire project.

5. Preservation of cultural heritage in social and economic space

Cultural heritage is our legacy, that which is left behind by our ancestors and which is the foundation of our culture and national identity. The preservation of cultural heritage is extremely important because it preserves our history, traditions and values, and passes them on to future generations. However, preserving cultural heritage is a task - as noted in the introduction to the article - for wise societies that realize its value and importance (Kobyliński, 2011).

One of the key ways to preserve cultural heritage is to protect and conserve it. Monuments, works of art and other elements of cultural heritage are exposed to many factors, such as aging, erosion, theft and vandalism. Proper conservation and protection of monuments is therefore crucial to preserving cultural heritage. Preservation of virginity can include its repair, restoration and maintenance to keep it in the best possible condition. Protection, on the other hand, involves ensuring that the heritage is properly supervised to prevent damage or theft. Another important aspect of preserving cultural heritage is, as mentioned earlier, its digitization. Through digital models and archives, cultural heritage items can be made available online and passed on to future generations, while being protected from destruction. Digitization allows monuments to be recreated virtually, and information about their history, significance and context can be made available.

Another important way to preserve cultural heritage is the education of the public, mentioned earlier. Knowledge of cultural heritage allows it to be better understood and appreciated. Education on cultural heritage can be carried out in schools, museums or cultural centers. Through education, the public is more aware of the importance of cultural heritage and more willing to protect it (Odoj, 2012).

All of these ways to preserve cultural heritage require the involvement of the public. It is the people who create cultural heritage, and it is they who should be vigilant about its preservation. The public should be active in heritage preservation, get involved in digitization and education projects, and support cultural institutions and museums. Another important aspect of preserving cultural heritage is its promotion. Societies should encourage people to learn about and respect their cultural heritage, and to share it with others. This will allow it to be further revived and developed, as well as passed on to future generations.

In conclusion, preservation of cultural heritage is not only a matter of protecting historical monuments and traditions, but also a key aspect of forming national and social identity. By respecting and cherishing cultural heritage, societies can build their identity, while also contributing to the preservation and promotion of culture and history for future generations (Hausner, 2013).

Preserving cultural heritage in economic space is an extremely important challenge for modern societies. Increasing economic development and growing social needs put the future of many cultural heritage sites in question. At the same time, cultural heritage represents not only historical and cultural wealth, but also economic wealth, so the proper preservation and use of it in economic space is not only an ethical issue, but also an economic one (Nocca, 2017). One of the most important aspects of preserving cultural heritage in economic space is its proper management. Cultural heritage management requires planning, coordination and implementation of activities aimed at protecting, preserving and making cultural heritage available for future generations. Proper management makes it possible to increase the potential of cultural heritage in the economic space, and thus its use for tourism, education or cultural purposes. An equally important aspect of preserving cultural heritage in the economic space is its sustainability. Sustainable development of cultural heritage means its development, which simultaneously takes into account economic, social and environmental aspects. The proper use of cultural heritage can benefit the local community, contribute to improving the quality of life and attract tourists, which can consequently increase tourism and culture-related revenues.

As has already been noted - in the era of digitization and technology development, digital tools are playing an increasingly important role in preserving cultural heritage in the economic space. Thanks to them, it is possible to digitize, share and promote cultural heritage on the Internet, which allows it to reach a wider audience. The introduction of digital tools makes it possible to increase the accessibility of cultural heritage and popularize its value, which contributes to increasing interest in it among a wide audience.

Despite the many challenges facing the task of preserving cultural heritage in the economic space, there are many positive examples of measures taken to preserve it. One example is the growing cultural tourism, which is becoming an important source of income in many regions of the world. At the same time, it should be noted that the development of tourism can lead to the destruction of cultural heritage, so it is necessary to introduce appropriate rules and regulations to protect monuments and other important elements of cultural heritage (Pacelt, 2014).

Another way to use cultural heritage for economic purposes is to adapt it for new purposes. A good example is factories and warehouses adopted as art galleries, museums, or commercial premises. Such adaptation of objects to new functions can contribute to the preservation of cultural heritage and at the same time use it for the needs of modern communities. Another example could be cultural heritage restored or preserved for educational purposes. For example,

the establishment of ethnographic parks and museums, open-air museums that show traditional ways of life and work of people from different regions of the world. Such museums are important because they allow the preservation and presentation of elements of cultural heritage that are in danger of extinction. At the same time, they are a valuable source of education for younger generations, who can learn about the history of their country and understand the culture of other nations.

In conclusion, one of the most important methods of preserving cultural heritage in the economic space is education and developing public awareness. People should realize the value of cultural heritage and its importance in forming national and cultural identity. By increasing social awareness and education, people will be more inclined to act to preserve cultural heritage (Poland's Cultural Wealth, 2020).

Another aspect worth emphasizing in the context of preserving cultural heritage in economic space is corporate social responsibility (Fordhem, 2018). Many companies operate in areas where there are important monuments or places of historical significance. In such situations, companies should act responsibly, respecting cultural heritage and taking care to protect it. It is worth noting that taking such actions not only positively affects the company's image, but also allows to create positive relations with the local community and increase employee involvement. Finally, a key element of preserving cultural heritage in the economic space is - repeatedly mentioned in the article - education. Knowledge of cultural heritage and its importance should be taught not only in schools, but also in companies, organizations and institutions involved in tourism or culture. In this way, the local community, tourists and employees will have a better understanding of the importance of cultural heritage and be more committed to its protection and preservation. Preserving cultural heritage in economic space is a task not only for cultural institutions and local authorities, but also for businesses and entire communities. A key element in this area is cooperation action in partnership, as well as corporate social responsibility. Only in this way, can cultural heritage be effectively protected and preserved for future generations.

6. Preservation of cultural heritage in the decommissioned mining space

Preserving cultural heritage in the decommissioned mining space is a significant challenge for local communities and municipal authorities. Mining over the centuries has played a key role in the development of many regions, and the remains of this activity are not only important industrial monuments, but also places of religious worship, tradition and intangible heritage. Mining has been one of the key industries for centuries, generating huge profits and attracting people from different regions and cultures. However, the end of mines has often meant the

closing of one chapter in history and the opening of a new one, in which this cultural heritage associated with mining becomes one of the most important elements.

Mining, as an industrial phenomenon, left behind a material heritage in the form of mines, shafts, machinery, installations and other equipment and buildings related to the extraction of natural resources. Along with tangible heritage, mining also had an impact on the creation of intangible heritage in the form of traditions, religious worship and cultural heritage. Mining is an important part of the history and identity of many communities, and the traditions and customs associated with it have often survived for centuries (Jelen, 2018). Mining not only influenced the development of industry, but also the creation of precisely cultural and religious heritage. Mines were often centers of social and cultural life, and their decommissioning is associated with the loss of many cultural and historical values. One of the most characteristic elements of cultural heritage associated with mining are the mines' chapels and churches. An example is the Marian Shrine in Górka Klasztorna near Lezajsk, which was built on the site of a former salt mine. There are also numerous chapels and churches in mining towns, many of which were built by miners as votive offerings for rescue from danger underground.

Another important element of intangible heritage related to mining is mining culture. Miners have their customs, traditions, costumes, songs and dances, which constitute a separate branch of culture. Equally important elements of intangible heritage are also the knowledge and skills that have been passed down from generation to generation among miners. These include traditions, beliefs, rituals, as well as a specific culture of language, especially the miners' dialect. In some regions, miners form their own unions and organize sports competitions. Today, many communities are trying to preserve these elements of intangible heritage by organizing festivals, workshops, exhibitions and other events (Fruzyński, 2012).

In Poland, there are many examples of mining-related sites that constitute important cultural and industrial heritage. One of them is the Wieliczka Salt Mine, which is one of the most important monuments of material culture in the world, listed as a UNESCO World Cultural and Natural Heritage Site in 1978. Other examples include the "Guido" Historic Coal Mine in Zabrze, the Gold Mine in Złoty Stok, and the Historic Silver Mine in Tarnowskie Góry. Not only the mines themselves, but also their surroundings and the memories associated with them are an important part of cultural heritage. An example is the traditions and customs associated with mining, such as the celebration of Barbórka, the holiday of the patron saint of miners, St. Barbara, which takes place in December in many mining towns in Poland.

The modern use of former mine sites also has an impact on the preservation of cultural heritage. Often, former mine sites are converted for tourist, cultural or educational purposes. Good examples include the Coal Mining Museum in Katowice and the Old Mine Science and Art Center in Walbrzych. In this area, an example of good practice in preserving cultural heritage related to mining is the Silesian Voivodeship's Technological Monuments Route, which consists of dozens of sites related to the history of mining in the Silesian Voivodeship.

This route not only attracts tourists, but also has an educational function, preserving the memory of the work and daily life of miners.

In the space of decommissioned mining in the preservation of cultural heritage - which once again should be noted with great importance - the key role is played by education and raising public awareness. In this area, educational campaigns and training should be conducted for employees in the tourism and cultural sectors so that they are able to provide adequate care for the cultural heritage associated with the related to mining. It is also important to involve the local community in the process of preserving mining-related cultural heritage. Local residents are an extremely valuable source of mining-related stories and histories and of passing on their knowledge and traditions to the next generation. It should also be ensured that local communities can enjoy the cultural heritage associated with mining so that they can enjoy its beauty and value.

Finally, it is important to make mining-related cultural heritage visible and accessible to all. This requires not only the preservation of the sites themselves, but also the provision of appropriate tourism infrastructure, such as hiking trails, tourist information centers, as well as accommodation and rest areas. In this perspective, the preservation of mining-related cultural heritage is not only important for historical and cultural reasons, but also has the potential to generate economic and social benefits. However, this requires cooperation among various stakeholders and investment in the protection, promotion and accessibility of mining-related cultural heritage (Jelinčić, Glivetić, 2020).

At the same time, the decommissioning of mines associated with socio-economic changes, introduces many difficulties in the process of heritage preservation. An important challenge is the preservation and documentation of the remnants of mining, such as mine buildings, machinery, equipment and tools, but also elements of the cultural landscape, such as pits, dumps, culverts, bridges, roads and canals. Many of these sites are historic and in need of preservation, and their preservation and protection are often a costly challenge for local governments and private investors. In addition, the process of decommissioning mines not infrequently involves environmental problems, such as soil and water contamination, which requires the implementation of appropriate reclamation procedures. In such a situation, the preservation of cultural heritage must be included in reclamation and mining waste handling plans.

In conclusion, the preservation of cultural heritage in the space of decommissioned mining is an important task for society, as it allows for the protection of cultural heritage and the formation of regional and local identity. However, this requires action at both the institutional and social levels, as well as consideration of ecological and sustainable development aspects (Burzyński, 2017).

7. Summary

Preserving cultural heritage in transformed post-industrial areas is an important challenge for modern society. These sites not only have historical and cultural value, but also potential for economic and social development. Therefore, the preservation of cultural heritage in transformed post-industrial areas is not only a matter of heritage preservation, but also of socio-economic development. In the process of preserving cultural heritage in transformed post-industrial areas, it is important to take into account the diversity of cultural heritage and the diverse needs of local communities. Preserving cultural heritage in transformed post-industrial areas is an important challenge, but at the same time it is an opportunity to revitalize these places and use them in a way that benefits society. Cultural heritage can contribute to the development of tourism and cultural activities, as well as inspire new social and business projects (Culture..., 2017).

It is worth noting that preserving cultural heritage in transformed post-industrial areas requires a long-term approach and the involvement of local communities. It is a process that requires time, work and resources, but at the same time brings many benefits to society. Cultural heritage is not only a reminder of the past, but also a forward-looking source of inspiration and development. Nowadays, when many post-industrial sites are undergoing transformation and change, preserving cultural heritage becomes even more important. These sites can be managed responsibly and sustainably, taking into account both their cultural value and their economic and social value. As the preservation of cultural heritage in transformed post-industrial areas is an important challenge, it must be approached with determination and an understanding of its importance for the future of society. Preservation of cultural heritage is an investment in the future that benefits all concerned (Kuzior, 2022).

References

1. Burzyński, T. (2007). *The heritage of industrial culture as an opportunity for the development of European tourism*. Katowice: Upper Silesian University of Commerce, City Hall in Zabrze.
2. Cetera N. et al. (2022). *Digital cultural heritage. How to prepare for digitization and sharing of collections online*. Warsaw: Ministry of Culture and National Heritage.
3. Chojecka, M. (2015). Cultural heritage protection policy in Poland. *Scientific Journals of the Poznań University of Technology. Organization and Management*, 69.
4. Culture and cultural heritage orientation paper. Urban Agenda for the EU 2019.

5. *Culture without borders: Cultural heritage management for local and regional development* Current Affairs Committee. Dourou E. Toce B. Report CG (2021).
6. Dąbrowski, A. (2012). Revitalization of post-industrial facilities on the example of "Manufaktura" - the former Izrael Poznański Plant in Łódź. *Scientific Journals of the WSB University in Poznań*, 42, *Space in New Economic Reality*.
7. Dudzik, I. (ed.) (2017). *The role of ethical values in the modern world. Ethical values of modern man*. Jarosław: Publishing House of the State Higher School of Technology and Economics, priest Bronisław Markiewicz.
8. Etymology of the word heritage (2011). *Sprawia wieki*, No. 5.
9. Fordhem, A.E. et al. (2018). Mapping meanings of corporate social responsibility – an Australian case study. *International Journal of Corporate Social Responsibility*, vol. 3, Article no. 14.
10. Fruzyński, A. (2012). *Outline of the history of hard coal mining in Poland*. Zabrze: Coal Mining Museum.
11. Hausner, J. et al. (2013). *Culture and development*. Warsaw: National Cultural Center.
12. Ifko, S. Stokin, M. (2017). *Protection and Reuse of Industrial Heritage: Dilemmas, Problems*. Monographic Publications of ICOMOS Slovenia I 02. Ljubljana.
13. Janikowski, R., Krzysztofek, K. (2009). *Culture sustainable development. Environment, spatial order, heritage in the light of UNESCO documents and other international organizations*. Warsaw: Polish Committee for UNESCO.
14. Jelen, J. (2018). Mining Heritage and Mining Tourism. *Czech Journal of Tourism*, 7(1), pp. 93-105.
15. Jelinčić, D.A., Glivetić, D. (2020). *Cultural heritage and sustainability. Practical guide: Effective policy for sustainable and self-sustaining projects in the cultural heritage sector, INTERREG Europe project, financed by the European Regional Development Fund*.
16. Kobylińsko, Z. (2011). *What is it, who needs it and who owns cultural heritage?* Mazowsze Regional Studies, pp. 21-47.
17. Konior, A. (2021). Cultural heritage management in the context of the revitalization process of post-industrial areas. *Cultural Management Library*, vol. XXI. Kraków.
18. Kowalik, W. (2018). Social and cultural capital, civil society and socio-economic development - analysis of connections. In: R. Boguszewski (ed.), *Civil society in theory and practice*. Warsaw: SGGW Publishing House.
19. Kuzior, A. et al. (2022). Revitalization of Post-Industrial Facilities in Economic and Socio-Cultural Perspectives—A Comparative Study between Poland and the USA. *Sustainability*, 14(17). pp. 1-15.
20. Murzyn, M. (2016). Cultural heritage management based on values. *Management in Culture*, vol. 17, iss. 3, pp. 195-213.
21. Neja, J., Kurpierz, T. (2013). A breath of freedom (August 1980). In: A. Haas, B. Linek, *Upper Silesia in People's Poland* (p. 35). Opole.

22. Nilson, T., Thorell, K. (2018). *Cultural Heritage Preservation. The Past, The Present And The Future*. Författarna och Halmstad University Press.
23. Nocca, F. (2017). The Role of Cultural Heritage in Sustainable Development: Multidimensional Indicators as Decision-Making Tool. *Sustainability*, 9(10), pp. 1-28.
24. Odoj, G. (2012). Cultural heritage as a key concept of regional education: terminological considerations. *Studia Etnologiczne i Antropologiczne*, 12, pp. 44-55.
25. Pacelt, J. et al. (2014). Józef Piłsudski University of Physical Education in Warsaw Development of cultural tourism while maintaining the principles of sustainable development on the example of the Alicante province in Spain. *Turystyka Kulturowa*, No. 11, pp. 24-37.
26. Poland's Cultural Wealth 2020.
27. Szot-Radziszewska, E. (2009). Post-industrial heritage of the Old Polish Industrial District in the cultural landscape of the Kielce region: threats and opportunities. *Ochrona Zabytków*, 62/4(247), pp. 69-82.
28. UNESCO (2018). *Convention Concerning the Protection of the World Cultural and Natural Heritage*. <https://whc.unesco.org/en/conventiontext>.

THE IMPACT OF THE CLOSURE OF MINING PLANTS ON THE LOCAL ENVIRONMENT IN THE PERSPECTIVE OF DEMOGRAPHIC CHANGE AND PUBLIC HEALTH

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Nothing stays the same.
The only thing you can be sure of in life is change.
Trudi Canavan

Purpose: in the cognitive space of the article, an important and significant challenge arises, which is - in the perspective of the megatrends indicated in the article, demographic change and public health - the need to prepare a package of socio-economic activities dedicated primarily to the inhabitants of the areas where the process of closing down mining plants will take place. In this context, the issues of demographic change and health should be given priority in these areas in activities promoting social and economic activity in the transformation process.

Methodology: the theses presented in the article were verified using the following methods: literature review, critical analysis of literature, analysis and comparison of documents and an example of good practices.

Resultat: in the perspective of the next decades, numerous social and economic challenges and effects related to the transformation of mining plants in the space of local communities (commune, district) can be pointed out. While maintaining the hierarchy of objectives described in the European Green Deal Plan and clearly related to the plan for the transformation of mining plants, lasting cooperation of the three key stakeholders in this process, i.e., local communities (representation of local and territorial self-government), employers and representation of state policies, should be expected in their environment.

Originality: the conclusions and recommendations from the article may be important for researchers and practitioners involved in the implementation of activities aimed at limiting the marginalization, differentiation and social and economic exclusion of residents of areas where the process of closing mining plants will take place.

Keywords: mining, demographic change, public health.

1. Introduction

Economic transformation shapes numerous spheres of social life and economic. Its course results in numerous challenges of macro, meso and micro dimensions, which are particularly visible in the evolving social policy. The indicated field of social sciences clearly reveals the connections between economic transformation - including the closure of mining plants – and dynamically progressing demographic changes. It draws attention to the utilitarian dimension of the changes taking place - with particular emphasis on public health.

As Ewa Frątczak notes, the political and social transformation in the countries of Central and Eastern Europe, including Poland, related to, among others, with the closure of hard coal mines, transformed this region into a kind of "demographic laboratory" in which population processes are subject to significant, perhaps irreversible changes of a new quality and new dimension (Frątczak, 2008, Perspectives..., 2017). In this light, it is justified to claim that further transformation processes - including those related to the domestic hard coal mining sector - will include, among others: in the Silesian Voivodeship determine significant transformations of labor markets and the related quality of life - significantly emphasized in the transformation process. As noted in the transformation process, special attention will be paid to the availability of health care, participation in culture, public transport, schools and universities with an attractive educational offer, apartments for rent, senior services, sports facilities and recreational areas (What is..., 2020). It should therefore be recognized that anticipating the transformation process and its effects in the local surroundings of the closed mines without taking into account demographic changes will incompletely reveal the social and economic effects caused in the transformed areas. All the more so because Poland has entered the period of another demographic crisis (GUS..., 2020). Its result will be a process of systematic decline in labor supply and, above all, an increase in the demographic dependency ratio. According to forecasts, by 2060 the demographic burden will increase significantly - in relation to the base year, i.e., 2020, it may even more than double. In turn, as forecasts indicate, the dependency ratio for older people may increase more than three times (Demographic..., 2014).

In this area of projected changes, a special role in transformation processes is assigned to health, which is perceived not only as disability and disease, but also as a state of physical, mental and social well-being, defined as quality of life. In this perspective, Territorial Just Transition Plans should indicate how they influence the main areas of the quality of life, i.e., an individual's physical health, mental state, level of independence and social relationships, promoting high quality of health and life, and not only eliminating exposure to factors degrading health. Equally important is the elimination of all types of social inequalities, which should also remain the focus of attention of those responsible for carrying out the transformation process. There is ample evidence that social factors - including education, employment status, income level, gender and ethnicity - have a significant impact on a person's health. These factors

have even been shown to influence a number of specific health outcomes, such as the incidence of prematurity and low birth weight in children, heart disease, stroke and some cancers in adults.

Given the above conditions, we cannot give up on perceiving the process of economic change - the key determinant of which is transformation - in the area of public health. As the authors of the study note: Just Transition for the protection of public health, an important aspect of the ongoing transformation is that it takes place in a thoughtful and fair way for everyone. We should think about people working in the coal sectors, the health well-being of residents exposed to breathing polluted air and/or the effects of climate change, the development of cities that will be friendly to residents and meet their needs in a sustainable way, and representatives of local communities and companies. In their opinion, a just transition is the process of changing the type of economy from high-emission to zero-emission, with particular emphasis on the well-being of local people in terms of continuity of employment and the environment in which they live. It involves creating alternative branches of the economy and providing jobs to people who will lose them as a result of the gradual closure of enterprises such as mines or power plants. It must take place in accordance with a previously planned schedule and with the participation of the community concerned (Territorial..., 2022).

2. Discussion

Today, the dynamically changing world is determined by new, previously unknown phenomena, such as globalization, demographic, technological and climate change. The world of the early 21st century is looking for new ways of development. The progress of civilization is omnipresent and determines the behavior of humans and human communities and the institutions they create. However, the modern world is very diverse, not everyone benefits from development equally, societies differ in cultural heritage, wealth and vision of the future. The above-mentioned phenomena pose numerous new challenges to modern civilization aimed at maintaining its safe life. One of them - certainly - is the need to build a new perspective in the sphere of public health at each of its spatial levels - in the phase of demographic changes and the transformation processes accompanying these changes.

As stated by the authors of the above-mentioned document entitled Just Transition to protect public health A just transition must take into account the health perspective in achieving climate neutrality. This is necessary to maintain good quality public health of residents of the transformation area and beyond. In this process, people from the region's most dependent on coal should be supported and they should be helped to combat the inequalities that may arise in this process, including: energy poverty, food poverty, lifestyle diseases, stress and mental health problems (Michalak, Karaczun, 2021).

In the light of the above-mentioned conditions - especially taking into account the transformation processes in the EU countries - it should be emphasized that good health is a serious challenge for the European Union. The Union shall pursue better health protection in all policies and actions in accordance with Article 168 of the Treaty on the Functioning of the European Union. EU action on health aims to improve public health, prevent disease and health risks (including lifestyle-related), and promote research. The EU does not determine health policies or the organization and delivery of health services and medical care. Instead, its activities serve to complement national policies and support cooperation between Member States in the field of public health (<https://eur-lex.europa...>, 2022).

In turn, at the national level, the Strategy for Responsible Development states that one of the most important challenges for the country's development are unfavorable demographic trends, which are manifested by negative natural growth, a decline in the share of people of working age and a rapid increase in the share of older people in the entire population. This means a significant increase in the demographic burden, which threatens to increase the fiscal burden borne by working people and limits the country's investment and development opportunities, (...) A smaller number of young people may also affect the level of creativity of society, and therefore the innovativeness of the economy. Today, in some areas, there is a shortage of qualified staff, which increases the importance of migration processes and the need to prepare an effective strategy for managing human capital flows (Strategy..., 2017).

Another important document in the area of transformation processes is the Polish Energy Policy. In this document, one of the primary goals is to eliminate the so-called low emission of pollutants. For the sake of the health and quality of life of society, the use of solid fuels in individual heating will be gradually reduced. The above will involve moving away from coal burning in households in cities by 2030, and in rural areas by 2040. However, until 2040 - also in cities - the possibility of using smokeless fuel will be maintained, unless this is contrary to from the so-called anti-smog resolutions (Poland's Energy Policy, 2021).

At the regional level, it is a key strategic document in the area of transformation processes - taking into account demographic changes and public health is the Development Strategy of the Silesian Voivodeship "Śląskie 2030". This document clearly states that demographic trends and the aging of society are important factors that will significantly influence the development of the region in the future. An increase in the demographic burden of people of working age with older people; will either result in a significant increase in taxes and contributions financing pension and health care expenses, or in a significant reduction in the scope of security provided to older people (lower pensions, worse access to benefits, faster increase in prices of goods they prefer); changes in the ratio of pensions to wages (the so-called replacement rate) will be much lower in the future than currently, especially in the case of women (Development..., 2020).

New directions and challenges are outlined in the Regional Innovation Strategy of the Silesian Voivodeship 2030. The strategy clearly indicates that the demographic situation of the region, and specifically the progressive aging of the population, favors the adoption of

technology-related topics to support seniors. Historically, the region was the first in Poland to successfully attempt to digitally manage patient data in publicly financed health care. Although in subsequent years other national solutions diminished the importance of this system, its implementation at that time had a strong impact on the understanding of digitalization throughout society. In the longer term, 2021-2030, due to the aging of society, lifestyle diseases and other crisis events (pandemics, effects of climate change, economic transformation) affecting the health of the population, the demand for new solutions in the field of medical biotechnology and medical engineering technologies will be the basis smart specialization of the region, which is medicine (Regional Innovation Strategy..., 2021).

The key programs with an operational dimension in the area of transformation processes are the Regional Plan for the Just Transformation of the Silesian Voivodeship 2030 (Territorial..., 2021) and the Fund for Just Transformation. In the Regional Plan, expert attention in the area of demographic changes and public health was focused on investments. In this perspective, it is stated that investments will contribute to improving the quality of life of the region's inhabitants, including improving access to health and social services, the right to clean and healthy air and the need to raise awareness and make decisions in this regard. The above will contribute to the reversal of negative demographic phenomena, such as population depopulation, and will allow the creation of a system of incentives covering the entirety of people's actual living conditions in terms of the degree to which their health, social, cultural, etc. needs are met within the stream of services, including in order to maintain cultural identity (Territorial..., 2021). The plan further emphasizes that an essential element of the just transformation process is also the improvement of the quality of life of the inhabitants of the transformation areas, which will mitigate negative effects, including in the social and health areas. In connection with the above, support will be provided for health protection, including mental health, addressed to residents of communes undergoing mining transformation, in particular to employees employed in mining and mining-related enterprises. The scope of support will include activities related to medical rehabilitation, including post-traumatic rehabilitation facilitating return to work and maintaining employment, in cooperation with employers, increasing access to diagnostics and health prevention (in the field of, among others, occupational, cancer, lifestyle and mental diseases that are a significant problem region) and health education (Territorial..., 2021).

The second of the documents mentioned, the Just Transition Fund in the Silesian Voivodeship, will serve to achieve the main goal, i.e., mitigating the social, economic and environmental effects of the transition to a climate-neutral economy. In conjunction with other sources of financing, in particular funds from the Cohesion Policy 2021-2027, funds from the remaining pillars of the Just Transition Mechanism and other public and private funds dedicated to complementary activities and projects, this Fund will give a new impetus to the region's economy and open better development prospects for its inhabitants, especially those most affected by the negative consequences of the inevitable transformation process (Fund..., 2020).

To conclude, the demographic development in the Silesian Voivodeship has undergone significant transformations compared to previous years (Skibiński, 2012). From the perspective of transformation processes - following Anna Runge - it should be stated that a retrospective study of population changes as well as their broader socio-economic background allows for appropriate generalizations. Thus, in the trend of demographic work, especially in recent years, the thesis about a qualitative change in population trends draws attention. It begins in 1982, when for the last time other voivodeships significantly contributed to the regional labor market of the Katowice Voivodeship. The closing of this market has nationwide caused, i.e., the crisis of the 1980s. In addition to growing economic problems, the dynamics of population transformation has decreased (Runge, 2010). Silesia is therefore an example of a dramatic demographic situation and weakening human and social capital with profound social consequences until 2035. These consequences concern the depopulation of numerous cities and communes, mass foreign emigration, disturbances in natural movement, lack of generation replacement and the aging process of the population. Demographic changes in Silesia reflect economic conditions. They occur with different dynamics in spatial systems (Rauziński, Zagórowska, 2014). It seems that the transformation processes in the demographic space and the related sphere of public health will not only confirm the theses expressed above, but will be important determinants of their further dynamic development.

In the perspective described and the megatrend recognized many times in the literature, demographic change is important to be analyzed in a narrower scope, focusing on public health. The indicated demographic trend will have a strong impact on changes in health care in Poland. Public health - i.e., activities aimed at preventing diseases, extending life and increasing its quality by influencing lifestyle (e.g., diet, exercise, fitness, addictions) along with introducing pro-efficiency changes to health care systems using IT and mobile techniques - these will certainly be the most frequently appearing slogans in health care system reforms in the area of transformation processes (Institute of Public Health, 2022).

Given the above regularities - in the context of transformation processes - the human right to health protection grows from the root of social rights. From a social perspective, a person's ability to have the right to health is manifested on the bodily level, consisting in maintaining and protecting good health using all available material resources, including reproductive health, adequate nutrition and shelter. A comprehensive approach to health and its connection with economic and even cultural rights is becoming more and more common. The deepest connections link the right to health with the right to obtain and enjoy a decent standard of life. According to some theories, health is an essential attribute of "life in dignity" and quality of life. The material determinants of this level are, in particular, access to safe drinking water, adequate food and employment. They determine individual health and, in the long run, affect the health of the entire society. The right to health is also linked to the rights enabling the individual's needs to be met in terms of access to housing and clothing. Guaranteeing the right to health care is possible by creating a mechanism of basic health services provided under the

so-called social security system. Another group of rights related to health concerns property and the ability to access basic resources enabling survival. The right to own and obtain property includes the human right to water, food, medicines and vaccinations. The sum of the material components ensuring a healthy life, including satisfaction at the physical, mental and spiritual levels, constitutes the right to happiness. Therefore, the right to health has profound implications in the field of social security. In particular, this concerns the introduction of hygienic and healthy working conditions, as well as the right to leave, sleep and rest. In turn, the circumstances triggering the use of social security instruments include: unemployment, disability, age, helplessness in life, the need to personally care for a loved one, as well as motherhood and widowhood. The last group of social rights with which the right to health care is closely related is the so-called human development rights, enabling the satisfaction of individual aspirations. In this approach, the right to health is associated with ensuring the right to education, i.e., the ability to implement the current state of medical knowledge in relation to maintaining the health status quo of the individual and his or her unrestricted (without excessive effects and costs) access to such resources, including the use and use of modern technologies. Along with economic development and the progress of civilization, medicine is developing and natural and technical sciences are developing, constituting the basis for preventive activities (Relationships..., 2016).

In the above perspective - which should be particularly emphasized - the aging of societies will continue dynamically in parallel with the transformation process. This process will certainly determine numerous changes in public health that should be prepared for. In the indicated perspective, it is worth developing issues related to public health through the topic of aging. As noted in the report on the situation of older people in Poland, the concepts of old age and aging can be considered in two ways, in the individual aspect and as phenomena relating to the collective of these individuals, i.e., the society of a given region, country, part of the world (Report..., 2012). In the individual aspect, old age is a biological phenomenon that constitutes the human life cycle (Colloca et al., 2020). According to another approach, aging is perceived as a process of progressive impairment of the body's vital functions and loss of the ability to adapt to environmental changes along with the increasing probability of death (Kirkwood, 1996).

A generally inevitable stage of the aging process is a condition known as old age. In turn, aging, as defined in the psychogerontological literature, means a certain process and is dynamic, while old age as a state is static (Porzych, Kędziora-Kornatowska, Porzych, 2004). According to D.J. Levinson's life cycle theory (Levinson, 1986), old age is one of the phases, which, however, is not homogeneous and can be divided into subsequent periods. The life cycle theory describes changes in the psyche and behavior that occur at subsequent stages of an individual's life - progressing with age. The first phase of life is the phase of learning and gaining experience (covers childhood and youth). The next phase covers adulthood and is the period of implementing the acquired knowledge. The last phase - old age - is the phase of regression.

Individual phases may occur in different individuals at different times, and there are no rigid limits on the age at which individual phases of the life cycle end or begin. However, the psychological concept of the life cycle - created by E. Erikson - divides an individual's life into eight stages (Erikson, 2002). The final stage is late adulthood and begins at the age of 60-65. It should be noted that the division of the last stage of human life changes as life lengthens and its quality improves in the elderly population. Currently, the English literature divides old age into three phases: – young old – people aged 60/65-74, – old old – people aged 75-84, – the oldest old (the oldest old) – people aged 85 and over. Young and old people are most often still fully functional, both physically and mentally. People included in the elderly category are people who require help in performing some everyday activities, such as shopping, cleaning, and washing underwear. The oldest old need constant assistance in performing most activities, people of this age are potential clients of institutional forms of assistance. In turn, Simone de Beauvoir did not perceive old age as a uniform period and distinguished two stages of the last phase of life, taking as one of the criteria functional age, i.e., the psychophysical capabilities of an older person: in the first phase, older people are functionally independent and economically dependent (the so-called third age), in the second phase, older people are dependent, both functionally, as well as economically (the so-called fourth century) (Beauvoir, 1996).

Based on the above theses, the following conclusions and recommendations were formulated, focusing on the indicated area, i.e., demographic change in the perspective of the impact of the closure of mining plants on the local environment.

In the area of demographic changes, a clearly unfavorable process - unfriendly to social and economic development - is the age structure of the population. As a result of the processes taking place in the age structure, further dynamic stratification of labor demand and labor supply streams should be expected. The stratification will be primarily implied by a clear increase in the population in age groups approaching retirement age (professional inactivity) with a simultaneous decline in the population in age groups characterized by demographic youth and the highest professional activity and mobility. The key source of these unfavorable trends for the labor market is the lack of simple replacement of labor resources at the age of peak professional activity by a significantly smaller population of the youngest people. As a result of the indicated processes on labor markets, a significant increase in the economically inactive population should be expected. This is confirmed by the forecasts of the Central Statistical Office, which clearly indicates that in the perspective of 2050, the burden of the working-age population with economically inactive people, e.g., in the commune of Siemianowice Śląskie, may increase from 48 in 2018 to an extremely high number of 103 people in 2050. The source shaping the indicated forecasts will primarily be the dynamic growth of the population of non-working age, i.e., people aged 60/65 and over. This process, in turn, will result in a very high rate of increase in the aging of the population in the so-called old-old group, i.e., in the oldest categories, aged 75 and over (Population Forecast..., 2014).

All the outlined changes, processes and forecasts indicate that in order to limit stratifications in labor markets, which are the main source of structural mismatches, actions should be taken to build a future-oriented policy that minimizes the effects of aging societies. Failure to take this type of action may delay preparation for the seemingly inevitable changes in the age structure of the population in the perspective of transformation processes. As already noted, these are changes in many aspects, starting from changes in the structure of consumption, through changes in "production" (labor force, GDP), and ending with the consequences for public finance systems. The mentioned need to prepare for the effects of an aging population will also be determined by further - as has already been signaled - expected effects, such as: mismatches in the labor market in terms of sectors or occupations (for example, due to the increased demand for health care and social care workers, related to the increase in the population aged 65+ and, above all, 80+) and the need to fill gaps in labor supply related to the possible inflow of immigrants (Janicka, Kaczmarczyk, Anacka, 2015).

As E. Trafiałek notes, modern civilization guarantees an increasingly longer average life expectancy. This is accompanied by the phenomenon of an increase in the number of the elderly population and a simultaneous decline in birth rate. As a result, this results in the strengthening of the so-called model on a global scale. the inverted demographic pyramid (Phenomenon..., 2010), which is characterized by, among others, in the social sphere, the lack of generational replacement on the labor market and raises the problem of securing decent conditions for those leaving the labor market. In turn, in the sphere of economic effects, it causes the so-called devastating labor markets (Trafiałek, 2006). Hence, despite the passage of several years since its formulation, L. Frąckiewicz's postulate is still valid, which states that the economic, social, social, medical and cultural effects of the phenomenon of demographic old age cover various spheres of behavior, needs and tendencies, creating an extensive catalog of tasks, the implementation of which requires the activation of appropriate entities and instruments of social policy (Frąckiewicz, 2003).

Noting this challenge from the perspective of conditions related to transformation processes, attention should be paid to numerous further consequences that may emerge in connection with demographic changes, including:

- clearly imbalanced feminization rate,
- serious shortages of women aged 20-29 (the age of highest matrimonial activity),
- unnatural numerical predominance of women in the oldest age groups,
- a significant decline in the number of marriages,
- significant decline in the number of births,
- negative birth rate,
- extremely low fertility rate,
- extremely low gross reproduction rate,
- low demographic dynamics,
- dynamically growing demographic dependency ratio.

In this context, the need to undertake the following activities in the perspective of social and economic transformation can be recommended:

- development of guidelines for programs preparing municipal and district policies for the phenomenon of old age,
- giving public employment services a primary role in the work on preparing a thematic proposal for social and professional activation of the increasing number of seniors,
- developing proposals for activities strengthening the participation of seniors in making local decisions shaping their present and future (Senior Council at the commune head, mayor, president, etc.),
- preparation of guidelines for an intergenerational integration program, in particular based on the diversity management method and limiting the intergenerational information gap,
- attempting to develop an educational program presenting the economic and social effects resulting from demographic change,
- preparation of a package of activities dedicated primarily to women in senior age,
- giving the issues of education and health a priority in activities promoting the social and professional activity of seniors.

Based on the above conclusions and recommendations, it seems that the greatest contemporary challenges for the communities, institutions and people creating the future - apart from preparing for the just transformation process - may be the need to secure decent living conditions for people transitioning from economic activity to professional inactivity as a result of the demographic change referred to as. Secondly, maintaining the professional activity of the aging population by building a modern, active social and labor market policy - corresponding to the economic structure of the transformed areas, in particular based on their social and economic advantages.

In the space described above - as has already been noted - the context related to public health is equally important. It is emphasized very clearly in the work entitled Territorial just transformation plan and health care. In the above-mentioned expert opinion, its authors clearly indicate that health care experts, doctors, nurses, scientists and patient groups can bring to the debate on the Just Transition in Europe the perspective of public health protection, which has long been neglected in the discussion. Just transition activities should be based on the involvement of local communities, and this must also include the health community. In the discussion about transformation, it is necessary to include and amplify voices related to health. Professionals from many areas of public health can make an important contribution to the transformation. They can achieve this by sharing knowledge about the links between various forms of energy production and public health or highlighting the health risks arising from the climate change process. Additionally, they can participate in consulting assessments of the impact of the transformation on health, as well as conduct educational activities aimed at the

general public. In the light of the directions of changes and forecasts outlined above, public health becomes a universal goal. This is noted by Zsuzsanna Jakab and Agis D. Tsouros - representing the World Health Organization Regional Office for Europe - who emphasize that good health and well-being are two universal goals of humanity that are currently recognized as fundamental human rights and important components of the equitable development of human potential, economic and social, and for the resources used in everyday life. Both goals are increasingly considered to be the main premises of human development and security. Health is no longer treated as an item on the list of expenses that must be financed, but as an important good that must be taken care of and improved in a fair manner. Health is a positive concept that emphasizes the importance of social and individual resources and physical potential (...) There is a need for a new health management system tailored to the needs of the 21st century, which will take into account the social factors determining health, act in a fair and sustainable manner and implement global and social goals, using new, interconnected forms of formal and informal management and new strategic relationships developed taking into account people's opinions and involvement. This is both an opportunity and a challenge for us (Jakab, Tsouros, 2020).

In the light of the indicated challenges, changes caused by transformation are taking place in the civilizational, cultural and socio-economic dimensions. Therefore, it is becoming quite certain that areas undergoing transformation must be equipped with strategic solutions that respond to very extensive, diversified, unstable and comprehensive socio-economic changes in their area and surroundings.

3. Summary

The regularities, phenomena and changes mentioned in the above article cause transformations in the labor markets, in the education system, within economic organizations and other institutions in the vicinity of the closed mining plants. Many of them are directly or indirectly related to the areas of employment, education, health, social security, etc. As noted in numerous works, three key global changes, which are the already mentioned climate, technological and demographic changes, result in the process of adapting the environment of closed mining plants in the areas of operating principles, information methods and organizational models in order to build sensitive activities based on innovations. that shape modern (intelligent) solutions of the future. It seems that in view of the directions of change outlined in this way, the greatest challenge for intelligent and innovative environments and entities representative of the environment of the closed mining plants is the need to predict the future, improve and build solutions that respond to possible challenges and increase their competitiveness. It is worth noting here that the liquidation of mines is a serious challenge due

to the comprehensive nature of social relations centered around the mine (Mrzygłocka-Chojnacka, 2012) and the economic identity of communities built around mining (Bell, York, 2010). A particular challenge is therefore to fill the institutional void created after the liquidation of the mine, around which the life of the community was centered so far, and to counteract the identity crisis of the entire community. Alienation of mine workers after their liquidation may lead to the disintegration of the social fabric in mining communities (Nawrocki, 2006; Wódz, 2013). The complexity of these spheres indicates primarily the qualitative nature of changes that may occur in the hard coal mining environment, and also determines the need to build multidisciplinary programs, which should be used as part of the intervention for the duration of the closure of mining plants. The key goal of the programs would be to strengthen cooperation in the indicated areas of liquidated mining plants with the local environment. It seems that in the transformed areas, this may be a fundamental determinant shaping the effectiveness of closing mining plants from a demographic and public health perspective.

Acknowledgments

This article - and its thematic scope - result from the application for co-financing the implementation of the Regional Observatory of the Transformation Process (hereinafter referred to as ROPT) project under the Regional Operational Program of the Silesian Voivodeship for 2014-2020. See Application for co-financing for the implementation of the project under the Regional Operational Program of the Silesian Voivodeship for 2014-2020, WND-RPSL.01.04.03-24-0004/22-002

References

1. Beauvoir de, S. (1996). *The Coming of Age*, 7. New York: WW Norton & Company.
2. Bell, S.E., York, R. (2010). Community economic identity: the coal industry and ideology construction in West Virginia. *Rural Sociology*, vol. 75.
3. *Central Statistical Office on Poland's demographic situation: It will be even worse*, <https://www.mp.pl/pacjent/ciaza/aktualnosci/214436,gus-o-sytuacji-demografi-j-polski-bedzie-jeszcze-gorzej>, 15.09.2023.
4. CODED%3D29& locale=pl, 17.04.2022.
5. Colloca, G., Capua, B., Bellieni, A., Fusco, D., Ciciarello, F., Tagliaferri, L., Valentini, V., Balducci, L. (2020). *Biological and Functional Biomarkers of Aging: Definition*,

- Characteristics, and How They Can Impact Everyday Cancer Treatment*. Current Oncology Reports 2020.
6. *Development Strategy of the Silesian Voivodeship "Śląskie 2030"* (2020). Katowice: Zielone Śląskie, p. 113.
 7. Erikson, E.H. (ed.) (2002). *The Completed Life Cycle*. Warsaw: Rebis.
 8. Frąckiewicz, L. (2003). Poland's demographic problems. *Problemy Polityki Społecznej. Studies and Discussions, No. 5*, p. 11, passim.
 9. Frątczak, E. (2008). Demographic situation in Poland during the transformation period. In: B. Chyrowicz (ed.), *Life extension as a moral problem* (pp. 77-150). Lublin: Towarzystwo Naukowe KUL.
 10. https://eur-lex.europa.eu/summary/chapter/public_health.html?root_default =SUM_1_
 11. Institute of Public Health of the Jagiellonian University, <https://izp.wnz.cm.uj.edu.pl/pl/blog/czem-jest-zdrowie-publiczne/>
 12. Jakab, Z., Tsouros, A.D. (2015). Health 2020 – achieving health and development in today's Europe. In: *Przegląd Epidemiologiczny*. Warszawa.
 13. Janicka, A., Kaczmarczyk, P., Anacka, M. (2015). *Changes in labor resources and their economic consequences and other economic consequences of population aging*. Warsaw: University of Warsaw.
 14. Just Transition Fund. Policy Department for Budget Directorate-General for Internal Policies of the European Union PE 651.444 – April 2020.
 15. Kirkwood, T.B. (1996). Human Senescence. *BioEssay, No. 18*.
 16. Levinson, D.J. (1986). A Conception of Adult Development. *American Psychologist, vol. 41(1)*.
 17. Michalak, W., Karaczun, J. (2021). Just Transition for the protection of public health and Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO.
 18. Mrzygłocka-Chojnacka, J. (2012). Transformations of local mining communities. Theoretical foundations of analyses. *Oppuscula Sociologica, No. 2*.
 19. *National Spatial Development Concept 2030*. Ministry of Development Poland.
 20. Nawrocki, T. (2006). *Persistence and change of the local mining community in Upper Silesia*. Katowice: Publishing House of the University of Silesia.
 21. *Perspectives on transitions to sustainability* (2018). Luxembourg: Publications Office of the European Union.
 22. Poland's energy policy until 2040 – Summary (2021). Warsaw: Ministry of Climate and Environment, p. 74.
 23. Population forecast for 2014-2050 (2014). Warsaw: Central Statistical Office.
 24. Porzych, K., Kędziora-Kornatowska, K., Porzych, M. (2004). Psychological aspects of aging and old age. *Gerontologia Polska, No. 12*.
 25. Rauziński, R., Zagórska, A. (2014). Socio-demographic changes in Silesia in 2002-2011 and their prognostic implications. *Studia Ekonomiczne, No. 197. Education in the light of*

- changes in the modern labor market: selected problems*. University of Economics in Katowice, 21-33.
26. *Regional Innovation Strategy of the Silesian Voivodeship 2030* (2021). Katowice: Intelligent Śląskie, pp. 48, 76.
 27. Relationships of the right to health with economic, social and cultural rights (2016). In: R. Tobaszewski, *The right to health in human rights protection systems* (p. 51). Lublin: John Paul II Catholic University of Lublin, Faculty of Law, Canon Law and Administration.
 28. *Report on the situation of older people in Poland* (2012). Warsaw: IPiSS, pp. 15-18.
 29. Runge, A. (2010). Population processes and structures in the Silesian Voivodeship. In: *Demographic and social processes and structures in the Silesian Voivodeship in the years 1988-2008*. Katowice: Statistical Office in Katowice, p. 35.
 30. Skibiński, A. (2012). Development of the population of the Silesian Voivodeship in the period of systemic transformation, in: *Demographic conditions of economic development. Faculty Scientific Journals of the University of Economics in Katowice*. Katowice, pp. 144-55.
 31. *Strategy for Responsible Development until 2020 with a perspective until 2030* (2017). Warsaw, p. 12.
 32. Sztando, A. (2011). The essence and functions of local government strategic planning in the region. *Scientific Works of the Wrocław University of Economics, No. 180*, pp. 45-55.
 33. *Territorial Just Transition Plan and Health Care. HEAL guide*. http://healpolka.pl/wp-content/uploads/2021/11/HEAL-Just-transition_scorecard_PL-2021-11-25.pdf.
 34. *Territorial plan for the just transformation of the Silesian Voivodeship 2030* (2021). Katowice.
 35. *The demographic situation of older people and the consequences of the aging of the Polish population in the light of the forecast for 2014-2050* (2014). Warsaw: Central Statistical Office.
 36. Strzelecki, Y. (2010). The phenomenon of demographic change was discussed at length. In: J. Osiński (ed.), *Contemporary and future demographic situation of Western civilization. Contemporary Western Civilization. Strengths and weaknesses*. Warszawa: SGH, pasimm.
 37. Trafiałek, E. (2006). *Aging and old age*. Wydawnictwo Uczelniane Wszechnica Świętokrzyska, p. 246.
 38. *What is a just transformation and why do we need it in Poland?* <http://sprawedliwa-transformacja.pl/o-sprawedliwyj-transformacji/>, 27.09.2023.
 39. Wiatrak, A.P. (ed.) (2011). Development strategies of rural communes. Theoretical foundations, assessment of usefulness and importance in structural changes in rural areas. Warszawa: IRWiR PAN, pp. 25-76.
 40. Wódz K. (ed.) (2013). *Forgotten places, forgotten people. Economic restructuring and cultural change*. Wydawnictwo Śląsk.

EATING BEHAVIOURS OF GDYNIA MARITIME UNIVERSITY STUDENTS REGARDING THE CONSUMPTION OF BEVERAGES AS A SOURCE OF WATER

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Purpose: This study aimed to characterise the nutritional behaviour of Gdynia Maritime University students in terms of consuming various types of drinks as a water source. Moreover, the aim was to analyse the determinants of these behaviours in the context of selected socioeconomic parameters that differentiate the studied group of respondents.

Design/methodology/approach: The tool used to conduct the study was a survey questionnaire. The questions concerned the nutritional behaviour of students regarding the consumption of beverages as a source of water and the conditions for their diversity.

Findings: The main source of water for students was mineral water. Unfortunately, it is associated with environmental pollution related to the packaging of this water (PET bottle). The second important source of water was tap water. This should be considered a manifestation of a developing trend in health-promoting, ecological and economic behaviours among the students. None of the socioeconomic factors differentiated students' behaviours when choosing bottled water.

Research limitations/implications: Students constitute a specific group of respondents. It should be expected that their current behaviours will reflect the behaviour of a wider society group, but only in the future. Therefore, the results obtained in this study can be considered limited, especially in the short term. Thus, this study should be conducted in a group of older respondents. Then, the following study should be repeated on older respondents in the distant future. On this basis, it is possible to verify how the change behaviours of respondents over time. The obtained results should allow us to verify the assumption that students' behaviours can be treated as indicators of the behaviours of the future society.

Practical implications: Consumers' eating behaviour regarding water consumption has health and environmental consequences. This approach to analysing water consumption is strategic because it concerns the direct and indirect impact on human health and quality of life.

Originality/value: The study results were used to formulate conclusions regarding behaviours that determine human health, the state of the environment and, consequently, quality of life.

Keywords: eating behaviour, bottled water, tap water, determinants of water choice, impact on the environment, freshwater deficit.

Category of the paper: Research paper.

1. Introduction

Water is a specific and dominant element of the Earth's natural environment. It determines and sustains the creation of life as we know it (Kardaś, 2019). Water is the main component of every living organism. This applies to the most primitive single-celled organisms up to humans. Therefore, every living organism must have constant access to water of appropriate quality because it determines well-being and, above all, life. Rising living standards during the Industrial Revolution, as well as the increase in global population, created the demand for energy and water. This has led to the intensification of the global water cycle, including its variability, global monsoon rainfall, and the intensification of wet water and dry phenomena (Popkiewicz, 2022). These phenomena are a derivative of climate change and will determine living conditions and their consequences for every living organism. What we see today was written over 20 years ago (Jackson et al., 2001).

Available freshwater resources are dwindling and are already declining in many parts of the world. In Poland, they are insufficient. These resources are decreasing not so much due to reduced rainfall intensity because rainfall in Poland remains at an even level but due to increased evaporation (Bănăduc et al., 2022; Popkiewicz, 2022; Wiech, 2023).

FAO data shows Poland has some of Europe's lowest water reserves (only the Czech Republic, Cyprus, and Malta have less). The condition is serious because it corresponds to the risk of water deficit below the "water stress" limit of $1.700\text{m}^3/\text{person}$. In Poland, water resources amount to $1.600\text{m}^3/\text{person}$. By comparison, there is approximately 4.500m^3 of water per European (GUS, 2022). Data indicates that by 2050, there may be a critical shortage of drinking water in the world if the necessary global changes are not implemented and water use habits are not changed (<https://www.national-geographic.pl>). WHO and UNICEF reports show that in 2020, 25% of the world's population did not have access to drinking water. By 2025, this problem may affect half of the population (<https://www.afro.who.int>).

Simultaneously, we should be aware that water is needed not only for drinking but also for production and the provision of services (Bănăduc et al., 2022). The Rankomat website aims to educate and spread knowledge about saving water resources. It states that the average Pole uses 92 litres of water daily. It is easy to determine this value because consumption is monitored. However, due to the consumption of goods, daily water consumption increases to thousands of litres. Actual water consumption, including its direct consumption and use in producing all types of goods (virtual water), determines the water footprint. Virtual water also comes from exhaustible freshwater sources. One Polish resident's average daily water footprint is estimated at 3.900 litres. This means that water consumption is consuming goods per kilogram or piece,

and clothing production is up to tens of thousands of litres per kilogram or piece, respectively. In the case of packaging, of which approximately 400 million tons are produced worldwide each year, water required for production is estimated at 650 to 800 billion m³ per year. Therefore, virtual water consumption is very high, although Poland does not lead in this regard (<https://rankomat.pl>).

The issue discussed in this work covers two essential aspects, both from the perspective of human health and the state of the environment, which determines its social nature. This study aimed to characterise the nutritional behaviour of Gdynia Maritime University (UMG) students in terms of consuming various types of drinks as a water source. The qualitative and quantitative dimensions of the water sources selected by students were considered. It was also important to determine the form of beverage packaging in the context of the potential environmental impact and convenience of use. Moreover, the aim was to analyse the determinants of these behaviours in the context of selected socioeconomic parameters that differentiate the studied group of respondents. The results of this study were the basis for formulating conclusions relating directly to behaviours that determine human health as well as the state of the environment that determines the quality of life.

The article is organised as follows. Part 2 characterises the object and tool of the research and the statistical methods of interpreting the results. Section 3 presents and discusses the empirical results and provides a discussion with relevant literature data. Finally, conclusions and health and environmental implications are presented in Section 4.

2. Experimental Methods

The research subject was UMG students of 2023, who represented all faculties of the University. The studied group of students consisted of 240 people. The socioeconomic profile of the study group is presented in Table 1.

Table 1.
Socioeconomic profile of the study group

Total	Gender		Cycles of study*		Faculty**				Financial situation			Place of residence		
	Woman	Men	I	II	E	M	N	MQ	< average	average	> average	Rural	City	
n	240	79	161	226	14	60	60	60	60	22	156	62	50	190
%	100	32.9	67.1	94.2	5.8	25.0	25.0	25.0	25.0	9.2	65.0	25.8	20.8	79.2

* I – Bachelor studies; II – Master's studies;

**E – Electrical Engineering; M – Marine Engineering; N – Navigation; MQ – Management and Quality Science.

Source: own calculations.

The tool used to conduct the study was a survey questionnaire. It included nine closed questions, six single-choice, and three multiple-choice questions. The questions concerned the nutritional behaviour of UMG students regarding the consumption of beverages as a source of water and the conditions for their diversity. Validation was carried out before using the questionnaire in the study, which included two main stages. The first one consisted of substantive verification of its content based on an interview with four experts in the management and quality sciences and food and nutrition technology. It was assessed as to how important individual elements of the tool (questions) were for the set goal and how they serve to achieve it. After verification, no question was removed from the scale. However, some questions have been reformulated according to experts' suggestions.

The second step was validating the response process (face validity). It assessed whether individual words or sentences in the questions were readily understandable to respondents. Respondents were asked to indicate words/sequences/entire questions whose meaning they did not fully understand. Thus, the connection between the proposed tool, consisting of questions, and the thought processes of people participating in the study was assessed. This validation stage was carried out on ten respondents representing UMG students. The questionnaire did not contain any elements that were incomprehensible to the respondents. Consequently, this validation step did not result in any changes to the questionnaire. The research instrument validated this way contained nine questions ready for use in the main study.

The paper presents the results of the analytical and synthetic exploration of primary data obtained from the survey. The analytical approach was used for questions 1, 3, and 9 and included (1) identifying the beverages chosen by the greatest percentage of respondents as a source of water, (3) indicating the types of water chosen by the greatest percentage of respondents, and (9) indication of factors determining the consumption of bottled water by the greatest percentage of respondents. The synthetic approach was used for the remaining questions. It included an assessment of the differences in the distribution of answers to questions regarding the amount of water consumed in pure form, preferences for bottled water, method of preparing tap water for consumption, preferences for water conditioned by the presence of CO₂, and the preferred type and capacity of water packaging. The results obtained were analysed taking into account gender, level of studies, faculty, place of residence, and subjective assessment of the respondent's financial situation. For this purpose, the χ^2 test was used. The assumed significance level was $p \leq 0.05$ (Łomnicki, 2014).

3. Results and discussion

The first analysed area of the study included determining the frequency of consumption of various types of drinks as a water source. This area is essential due to the critical role of water in human nutrition (Jarosz et al., 2020; Benelamand, Wyness, 2010). Considering that various types of drinks provide the body with not only water but also substances with a positive impact (antioxidants, electrolytes) and adverse effects on the human body, such as refined sugars. The source of the latter is mainly sweetened drinks. They contribute to a significant proportion of simple sugars in the diet (Park et al., 2022; Ah Han, 2021; Khan et al., 2020; Pepin et al., 2019; Jones et al., 2019). It was, therefore, necessary to determine which drinks were consumed most often and which were consumed least often. It was shown that 52% indicated still mineral water as the most frequently consumed drink. In second place was tap water, chosen by 51% of students. The third place was taken by milk/milk drinks, which was indicated by 38% of students. The least commonly consumed drink was bread acid (kvass), as shown by only 4.17% of respondents.

The described eating behaviours of students can be considered health-promoting and rational. Water consumption is a fundamental element of sound nutrition. Water is an essential substance that every living organism needs, which determines the physiological state of body homeostasis. The body's water balance consists of water supplied with drinks and food and metabolic water produced in cells through systemic metabolic processes (Szczepańska-Sadowska, 2018; Benelamand, Wyness, 2010). However, the primary source should be drinking water. Water needs vary depending on lean body mass (gender, body weight), age, level of physical activity, diet composition, physiological condition, air humidity, and altitude above sea level. In Poland, the daily water demand for adults in average climatic conditions, depending on gender, is from 2.0 to 2.5 litres (Yamada et al., 2022; Jarosz et al., 2020). The human body cannot store water, and its daily turnover reaches 1/30 of the body weight of adults and as much as 1/10 of the body weight of infants (Yamada et al., 2022; Shimamoto, Komiya, 2000). During exercise, water exchange increases proportionately to intensity and duration (Frączek et al., 2019). Therefore, systematically providing it appropriately is the starting point for maintaining physiological balance and good health (Kłos, 2016; Jarosz et al., 2020; Swanson, Pontzer, 2020).

The results obtained should also be viewed through the prism of the packaging of these drinks. They pose a potential burden to the environment (Zapata, 2021). The use of any packaging impacts the environment but also determines the properties of the packaged product (<https://rankomat.pl>). A comprehensive approach to the results showed that the drinks consumed by UMG students were most often packaged in PET (polyethene terephthalate) bottles. The beverages were consumed much less frequently in glass bottles. However, Tetra-Pak cardboard appeared sporadically. The mass production of PET bottles far exceeds the

possibilities of selective waste collection. Therefore, it can be assumed that the behaviours of beverage consumers and their attitudes toward the environment are critical factors determining the state of the environment (Borusiak et al., 2021). Publications indicate that the behaviours of Polish consumers in this respect differ far from those of highly developed countries. Therefore, their monitoring is justified and is a starting point for searching for methods for pro-ecological modification of these behaviours (Kopania, 2016; Walden-Kozłowska et al., 2003). It is important to remember that glass water bottles are used more often as packaging for water than cardboard. Imposing a deposit on glass bottles used as water packaging in Poland is not as popular as in other countries. This may result in their limited turnover and, consequently, in wasted opportunities to apply pro-ecological solutions. It should be emphasised that even glass waste, such as cullet, can be recycled, eliminating the problem of its recovery. Using glass scrap reduces energy consumption for producing and transporting raw materials and fuels (Vellini et al., 2009). The use of Tetra Pak cardboard packaging for water is the least common. Considering ecological conditions, it is a better solution than PET bottles because it is less environmentally harmful. The production of this packaging involves lower energy demand. This contributes to six times less fossil fuel consumption. Tetra Pak packaging comprises 75% paper, an advantage compared to commonly used PET bottles (Stramarkou et al., 2021). It should be emphasised that a significant percentage of respondents (51%) indicated that they most often drink tap water, and its use does not require packaging. This trend can be described as rational from the point of view of human nutrition but also as an ecological and economic activity (Borusiak et al., 2021; De Marchi et al., 2020; Mishra, Mohanty, 2018).

Water is the dietary component that must be provided in the highest quantity daily. Therefore, the next element of the study was to determine the amount of water consumed in pure form by the greatest percentage of students. It was also identified which of the socioeconomic characteristics of the study group significantly differentiated their behaviour in terms of the level of daily water consumption in this form. The most significant percentage of respondents (59%) said they consumed more than 1 litre of clean water daily. The results of the statistical analysis of the distribution of primary data showed that both the gender of UMG students ($\chi^2_{\text{calc.}} = 12.44$; $\chi^2_{\text{crit.}} = 7.81$), the level of studies ($\chi^2_{\text{calc.}} = 34.42$; $\chi^2_{\text{crit.}} = 7.81$), the faculty, where they study ($\chi^2_{\text{calc.}} = 21.04$; $\chi^2_{\text{crit.}} = 16.92$), place of residence ($\chi^2_{\text{calc.}} = 20.25$; $\chi^2_{\text{crit.}} = 16.92$) and financial situation ($\chi^2_{\text{calc.}} = 12.70$; $\chi^2_{\text{crit.}} = 12.59$) showed variation in the amount of water consumed.

Men declared a higher level of water consumption than women. This could probably be due to the greater demand for water in the group of men. A greater water demand is associated with greater body weight and a lower percentage of fat tissue determined by gender or a higher level of physical activity (Yamada et al., 2022; Borusiak et al., 2021). It was also found that second-cycle students (Master's studies) consumed less water than first-cycle students (bachelor studies). This statement should be considered disturbing, especially since most second-cycle students (64%) drank up to one glass of clean water daily (220-250 ml). This amount is

insufficient to ensure the proper functioning of the human body. At the same time, almost 61% of first-cycle students reported consuming more than one litre of water daily. Only this level of consumption can be considered appropriate from the point of view of human nutrition recommendations (Jarosz et al., 2020).

Moreover, it was found that students living in rural areas had lower water consumption than students living in metropolitan areas. One possible reason for this could be that those from rural areas are more likely to consume drinks other than water because of their relative novelty value. In the context of the results obtained, it seems justified to take action to promote the consumption of water. Additionally, the financial situation varied the amount of water consumed. People declaring their financial situation below average consumed the least water, but the amount consumed increased as their economic status improved. At first glance, this may seem to be paradoxical in terms of cost, but it may reflect more affluent students' access to improved education.

Because UMG students declared a relatively high level of water consumption, it was purposeful to determine the type of water they most frequently consumed. Respondents could indicate the three kinds of water they most often chose. The most significant percentage of respondents (55%) consumed still mineral water. Second in order was tap water (49%), and third was still spring water (30% of responses). The fewest respondents (0.4%) consumed flavoured water. The results indicate that although the eating behaviour of UMG students in this respect was rational (Jarosz et al., 2020), unfortunately, it did not fit into the concept of sustainable consumption because spring water was ranked third among the indications. This water has a composition similar to tap water. Its taste resembles tap water (Salomon, Regulska-Ilow, 2013). However, the packaging of spring water in a PET bottle seriously burdens the environment (Borusiak et al., 2021; Kłos, 2016). At the same time, the costs of consuming bottled spring water are much higher compared to tap water. The level of consumption of bottled water among UMG students was relatively high because the most significant percentage (49%) of respondents chose bottled mineral water overall. Therefore, an attempt was made to identify the socioeconomic parameters that differentiated the study group and which differentiated the type of bottled water chosen. However, the results of the statistical analysis showed that none of the factors differentiated the group of respondents (gender of students ($\chi^2_{\text{calc.}} = 2.00$; $\chi^2_{\text{crit.}} = 7.81$); faculty where they study ($\chi^2_{\text{calc.}} = 4.99$; $\chi^2_{\text{crit.}} = 16.92$); degree of studies ($\chi^2_{\text{calc.}} = 0.86$; $\chi^2_{\text{crit.}} = 7.81$); place of residence ($\chi^2_{\text{calc.}} = 6.63$; $\chi^2_{\text{crit.}} = 16.92$) and financial situation ($\chi^2_{\text{calc.}} = 6.74$; $\chi^2_{\text{crit.}} = 12.59$)) did not differentiate their behaviours regarding the consumption of bottled water.

The way UMG students prepared tap water for consumption was also examined because tap water is increasingly chosen as an everyday beverage. Although tap water is suitable for consumption by a healthy person without additional preparation, its quality may vary, and there may be indications of the need to improve its safety and quality (Abkar et al., 2024; Qian, 2018). For this purpose, various practices can be used, which involve filtering it using multiple types

of solutions (stationary, e.g., under-tap filters, or mobile, e.g., bottle filters) and boiling. Each of these solutions involves a modification of its chemical composition, sensory properties, and hygienic quality of water, but is also associated with certain costs and environmental burdens. Drinking tap water without treatment does not change its composition and sensory properties. They are determined by the quality of water present at the point of intake, the treatment plant's efficiency, and the water supply system (GUS, 2022). The results allowed us to conclude that most respondents (59%) filtered tap water before drinking it. Therefore, it can be assumed that there are reservations among UMG students regarding the quality of tap water. It could also be due to the popularity and fashion of drinking filtered water. Statistical exploration of the distribution of obtained results showed that students' behaviours in this area were very similar. None of the factors differentiating the studied population significantly differentiated these behaviours.

An important element of dietary behaviour is choosing the consumption of sparkling or still water. The results showed that the most significant % of students (75%) chose still water. It is a universal means of satisfying thirst, and there is a well-established belief in its health-promoting nature (Duda, 2012). The nutritional behaviours of the surveyed students in terms of preferring the choice of still water can be assessed as correct. This type of water quenches thirst very quickly. However, some sources indicate that sparkling water consumption increases significantly during summer (Duda, 2012). In addition to the amount of fluids consumed, the type of fluids also significantly impacts the ability to quench thirst. Generally, hypotonic fluids (200-250 mOsm/L), such as water, are perfectly absorbed from the gastrointestinal tract, dilute the plasma, and reduce the osmotic pressure of the blood, thus quickly quenching thirst (Frączek, 2014). However, when consuming sparkling water with a modified taste and exceptionally refreshing properties (Duda, 2012), the released carbon dioxide presses on the stomach walls and leads to a reflex inhibition of the feeling of thirst. Therefore, such water does not support adequate body hydration (Frączek, 2014). It should be taken into account that the results obtained could be strongly related to the season (early spring - April) in which the study was conducted. Another important feature of sparkling water is that it is safer from a bacteriological point of view. Its low pH significantly hinders the development of microorganisms (Korzeniewska et al., 2005; Wojtaszek 2006). A statistical assessment of the differences in the distribution of the collected results allowed us to conclude that only the student's place of residence was a factor differentiating their behaviours regarding the type of water they chose ($\chi^2_{\text{calc.}} = 60.87$; $\chi^2_{\text{crit.}} = 7.81$). Students from cities chose still water significantly more than sparkling water. It can be assumed that this tendency may result from the sensory attractiveness of sparkling water to village residents.

The study also examined the diversity of students' behaviours when choosing water in terms of its packaging type. The results showed that most students chose water packaged in a PET bottle (91%), while the smallest percentage (2%) chose water in cartons. The main reason for such diversity is the rare use of cardboard packaging and its common occurrence in PET

packaging. Kopania (2016) showed that PET packaging is the most frequently used packaging in the bottling industry. This type of bottle takes 100 to 1000 years to decompose in the natural environment. Hence, the conclusion is that PET packaging is very harmful from an environmental point of view. In addition, approximately 1.9 kg of crude oil and much energy are used to produce 1 kg of this type of packaging. Unfortunately, these facts do not limit their production, which is still vast. At the same time, attention should be paid to the advantages of PET packaging compared to glass packaging: low weight, high plasticity and resistance to mechanical damage. The statistical analysis of data distribution indicated that gender, faculty, and place of residence did not differentiate students' behaviours in this area. However, the degree of studies ($\chi^2_{\text{calc.}} = 16.67$; $\chi^2_{\text{crit.}} = 5.99$) and the financial situation ($\chi^2_{\text{calc.}} = 11.74$; $\chi^2_{\text{crit.}} = 9.49$) turned out to be factors that statistically significantly differentiated behaviour regarding the choice of water, taking into account the type of its packaging. Older students chose water in PET packaging. This may be related to the need to be comfortable while using it. Students declaring a better financial situation also chose water in PET bottles. However, it could be assumed that people with a higher economic status would more often consume more expensive mineral water, usually in glass bottles. In this case, convenience of use and the cost of purchase were probably the deciding factors in the choice of water. The type of water consumed was, therefore, not an important element of the lifestyle of UMG students. It was not intended to promote oneself as a person of high status, high sensory requirements for the water consumed, or to distinguish oneself from the group otherwise.

In the modern world, even drinking bottled water can be a vital element in building an image by following current trends or temporary fashions (Ballantine et al., 2019). For a long time, bottled water has been available in the Polish market and elsewhere, allowing you to stand out. For example, Borjomi mineral water comes from the depths of a volcanic spring, with a unique taste, microbiological purity, and properties resulting from its unique chemical composition. It is classified as one of the best waters in the world. This water was promoted in 1890 by Grand Duke Michael Romanow. This water is relatively expensive compared to others available on the Polish market. Another example may be Bling H₂O water, classified as a luxury, for which one must pay more than alcohol. One 0.75 litre bottle of Bling H₂O water, mined in Dandridge, costs around \$40-50. This brand's water packaging is also important - the bottle is decorated with Swarovski crystals, significantly affecting the final price. Another example of an opportunity to stand out is to buy mineral water from the Arctic, which used Cindy Crawford's image. The point is for consumers to associate it with a healthy lifestyle and fitness philosophy. Therefore, these waters are not very expensive and cannot be used to emphasise the consumer's economic status. They undoubtedly indicate a particular lifestyle and adherence to values such as health (Nowakowska-Kutra, 2014).

Another analysed area concerned the packaging capacity in which UMG students most often bought water. The results showed that almost half of the students (45%) bought water in a 1.5-liter package. Statistical analysis of the data using the χ^2 test allowed for the conclusion

that both the gender of the students ($\chi^2_{\text{calc.}} = 15.27$; $\chi^2_{\text{crit.}} = 11.07$) and the faculty at which they study ($\chi^2_{\text{calc.}} = 35.39$; $\chi^2_{\text{crit.}} = 25.00$) and the degree of studies ($\chi^2_{\text{calc.}} = 25.00$; $\chi^2_{\text{crit.}} = 11.07$) differentiated their behaviours in terms of the capacity of the unit package of purchased water. Only place of residence and financial situation were factors that did not determine the choice of packaging capacity. It was found that more female students than male students purchased water in 0.7-litre packages. This could be due to their lower weight and convenience, which may be more important for women. It was also found that a more significant percentage of first-cycle students chose water in 1.5-litre packages. The highest availability on the market characterises water sold in packages of this capacity and is relatively cheaper than water in packages of smaller capacity. Therefore, this is a rational and economically justified action for people who consume large amounts of water and buy it in more oversized packaging (Ballantine et al., 2019). Additionally, it was found that a more significant percentage of students studying at the Faculties of Electrical and Mechanical Engineering purchased bottled water in 1.5-litre packages compared to students of the other two faculties. This finding is quite surprising. It could be expected that students studying at the Faculty of Management and Quality Sciences should be more aware of the values of individual types of water consumed, the impact of water packaging on the environment and the economic consequences of their choices.

The last aspect of eating behaviours and their determinants examined was to identify the factors determining the choice and consumption of a specific type of water. As a result of the research, it was found that the most significant percentage of students (60%) declared that the most important factor for them when choosing water was their habit of drinking a specific type of water. A slightly smaller percentage of students (59%) indicated that the capacity of the packaging determines the choices they make. The least important factor was the taste of water. About 55% of respondents indicated it as a significant factor when choosing and consuming water. However, the least important factor when choosing and consuming a specific type of water was trend/fashion. Only 7% of respondents indicated that fashion is very important to them.

An in-depth analysis of the factors determining the choice and consumption of a specific type of water showed that many respondents indicated habituation to the type of water consumed. However, it was more important for women, city students, students of the Faculty of Management and Quality Science, first-cycle students and students with a lower-than-average financial situation (Fig. 1). The second most important factor was the packaging capacity. It was more important for women, students from the village, students of the Faculty of Management and Quality Science, first-cycle students and students with a lower-than-average financial situation. In third place, taste characteristics were indicated to be more important for women, especially for city students, Faculty of Management and Quality Science students, and second-cycle students. The taste characteristics of water were equally important to students regardless of their declared financial situation. However, it is important to note that students who declared their financial situation to be lower than average paid more attention to

price than taste. Fashion was the least important factor in choosing water in the following groups: men, first-cycle students living in the village, studying at the Faculty of Electrical and Marine Engineering, describing their financial situation as average or below average. This analysis allows us to conclude that habit is second nature to a rational consumer who considers the convenience of packaging size. However, the taste of water is important to him only when its price is adequate to his financial situation. At the same time, water is not a product whose consumption serves to promote oneself and is not an element of fashion trends. However, considering its health and environmental importance, it can be assumed that it will become an element of the so-called quiet luxury. Ballantine et al. (2019) carried out similar research on consumers' choice of bottled water and reached similar conclusions.

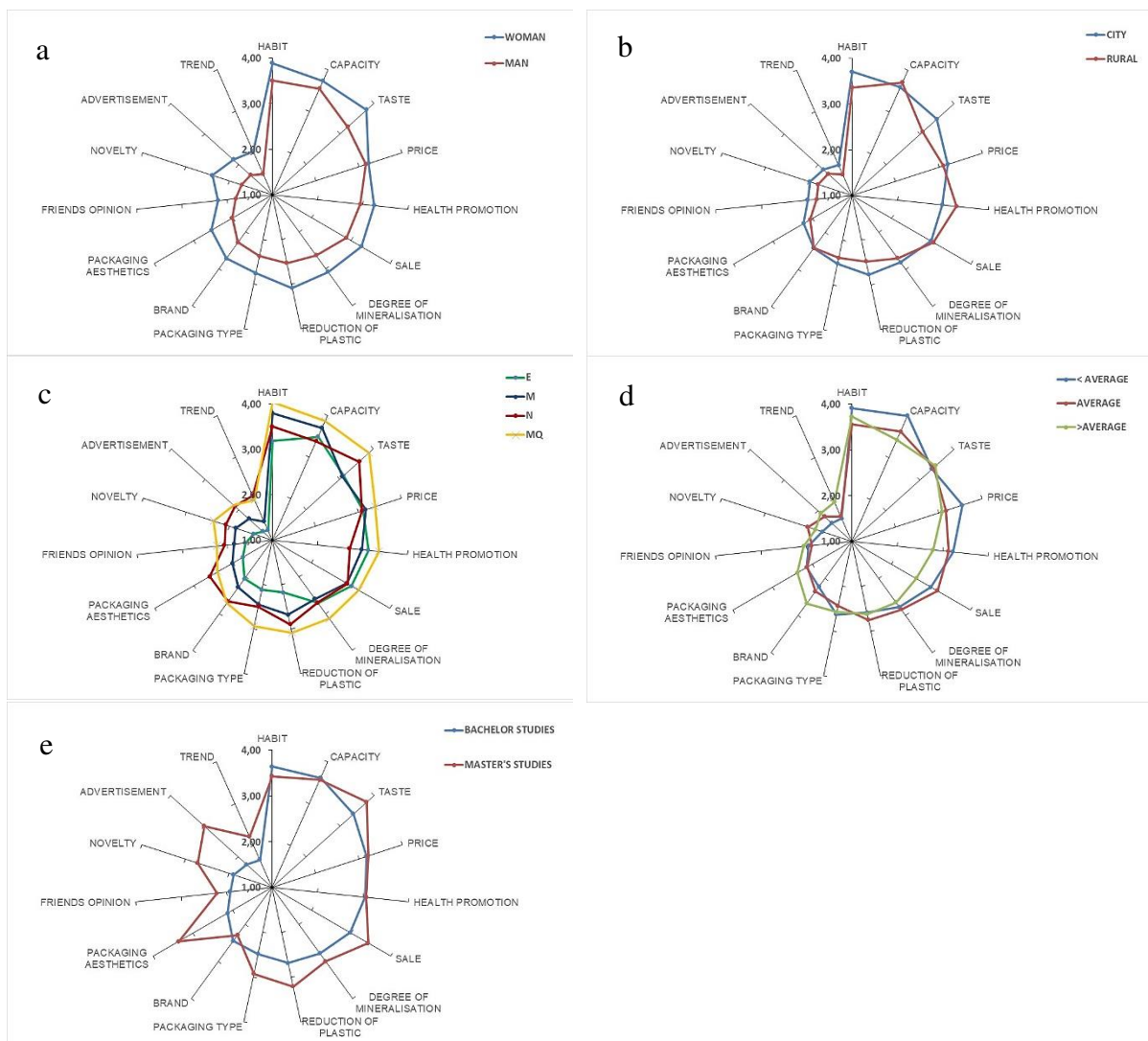


Figure 1. Factors determining the choice and consumption of a specific type of water chosen by: a) gender; b) place of residence; c) the faculty at which they study; d) financial situation; e) cycle of study.

Source: own elaboration.

4. Summary

The main source of water for UMG students was still mineral water. This choice is part of the trend of proper human eating behaviours. Unfortunately, it is associated with environmental pollution related to the packaging of this water (PET bottle). The second important source of water in the diet of UMG students was tap water. This should be considered a manifestation of a developing trend in health-promoting, ecological and economic behaviours among the UMG students. None of the socioeconomic factors differentiated students' behaviours when choosing bottled water. This may prove the universal nature of this water source. Students constitute a specific group of respondents. They are young and already relatively well-educated. It should be expected that their current behaviours will reflect the behaviour of a wider society group, but only in the future. Therefore, the results obtained in this study can be considered limited, especially in the short term. Thus, the study using the same research tool should be conducted in a group of older respondents (over 50 years of age). The results obtained should be compared with the results of this work in order to verify the assumption that the behaviours of these two groups of respondents will be significantly different. Then, the following study should be repeated on respondents over 50 years of age in the distant future (e.g. in 10 years). Later, it would be necessary to compare the results of this work and those planned for the near future. On this basis, it is possible to verify how the behaviours of respondents over 50 are changing. The obtained results should allow us to verify the assumption that students' behaviours can be treated as indicators of the behaviours of the future society.

References

1. Abkar, L., Moghaddam, H.S., Fowler, S.J. (2024). Microbial ecology of drinking water from source to tap. *Science of The Total Environment*, 908, 168077; <https://doi.org/10.1016/j.scitotenv.2023.168077>.
2. Ah Han, M. (2021). Water Drinking and its Correlation with Beverage Consumption in Korean Adolescents. *American Journal of Health Behavior*, 45(1), 152-160.
3. Ballantine, P.W., Ozanne, L.K., Bayfield, R. (2019). Why buy free? exploring perceptions of bottled water consumption and its environmental consequences. *Sustainability*, 11(3), 757; <https://doi.org/10.3390/su11030757>.
4. Bănăduc, D., Simić, V., Cianfaglione, K., Barinova, S., Afanasyev, S., Öktener, A., McCall, G., Simić, S., Curtean-Bănăduc, A. (2022). Freshwater as a Sustainable Resource and Generator of Secondary Resources in the 21st Century: Stressors, Threats, Risks, Management and Protection Strategies, and Conservation Approaches. *International*

- Journal of Environmental Research and Public Health*, 19(24), 16570. <https://doi.org/10.3390/ijerph192416570>.
5. Benelamand, B., Wyness, L. (2010). Hydration and health: a review. *Nutrition Bulletin*, 35, pp. 3-25.
 6. Borusiak, B., Szymkowiak, A., Pierański, B., Szalonka, K. (2021). The Impact of Environmental Concern on Intention to Reduce Consumption of Single-Use Bottled Water. *Energies*, 14(7), 1985, <https://doi.org/10.3390/en14071985>.
 7. De Marchi, E., Pigliafreddo, S., Banterle, A., Parolini, M., Cavaliere, A. (2020). Plastic packaging goes sustainable: An analysis of consumer preferences for plastic water bottles. *Environmental Science & Policy*, 114, pp. 305-311, doi.org/10.1016/j.envsci.2020.08.014.
 8. Duda, M. (2012). Wyglądanie wahań sezonowych. *Zeszyty Naukowe Wyższej Szkoły Bankowej we Wrocławiu*, 28, pp. 245-255.
 9. Frączek, B., Krzywański, J., Krzysztofiak, H. (2019). *Dietetyka sportowa*. Warszawa: PZWL.
 10. GUS *Analizy statystyczne. Ochrona środowiska*. Retrieved from: <https://stat.gov.pl/obszary-tematyczne/srodowisko-energia/srodowisko/ochrona-srodowiska-2022,1,23.html>, 15.12.2023.
 11. Jackson, R.B., Carpenter, S.R., Dahm, C.N., McKnight, D.M., Naiman, R.J., Postel, S.L., Running, S.W. (2001). Water in a changing world. *Ecological Applications*, 11(4), pp. 1027-1045.
 12. Jarosz, M., Rychlik, E., Stoś, K., Charzewska, J. (2020). *Normy żywienia dla populacji polskiej i ich zastosowanie*. Warszawa: NCEŻ IŻŻ.
 13. Jones, A.C., Kirkpatrick, S.I., Hammond, D. (2019). Beverage consumption and energy intake among Canadians: analyses of 2004 and 2015 national dietary intake data. *Nutrition Journal*, 18, 60; <https://doi.org/10.1186/s12937-019-0488-5>.
 14. Kardaś, A. (2019). *Książka o wodzie*. Kraków: Wydawnictwo MG.
 15. Khan, S., Waliullah, S., Godfrey, V., Khan, M.A.W., Ramachandran, R.A., Cantarel, B.L., Behrendt, C., Peng, L., Hooper, L.V., Zaki, H. (2020). Dietary simple sugars alter microbial ecology in the gut and promote colitis in mice. *Science Translational Medicine*, 12, 567; DOI: 10.1126/scitranslmed.aay6218.
 16. Kłós, L. (2016). Spożycie wody butelkowanej w Polsce i jej wpływ na środowisko przyrodnicze. *Barometr Regionalny. Analizy i Prognozy*, 14(1), pp. 111-117. <https://doi.org/10.56583/br.681>.
 17. Kopania, J. (2016). Oddziaływanie na środowisko branży rozlewniczej. In: A. Walaszczyk, I. Jałmużna, J. Lewandowski (Eds.), *Zarządzanie i bezpieczeństwo w łańcuchu żywnościowym. Monografie Politechniki Łódzkiej* (pp. 134-151). Łódź.
 18. Korzeniewska, E., Filipkowska, Z., Domeradzka, S., Włodkowski, K. (2005). Microbiological quality of carbonated and non-carbonated mineral water stored at different temperatures. *Polish journal of microbiology*, 54, pp. 27-33.

19. Łomnicki, A. (2014). *Wprowadzenie do statystyki dla przyrodników*. Warszawa: PWN.
20. Mishra, B.B., Mohanty, S. (2018). Consumer preference towards packaged drinking water: a literature review. *International Journal of Information Research and Review*, (5)11, 5845-5853.
21. *National Geographic*. Retrieved from: <https://www.national-geographic.pl/artukul/do-2050-roku-nawet-5-mld-ludzi-bez-domu-wody-i-jedzenia-prognoza-naukowcow-ze-universytetu-stanforda>, 10.12.2023.
22. Nowakowska-Kutra, A. (2014). Woda w butelce-analiza socjologiczna. *Kultura i Społeczeństwo*, 2, pp. 199-218.
23. Park, S., Onufrak, S.J., Cradock, A.L., Hecht, C., Patel, A., Chevinsky, J.R., Blanck, H.M. (2022). Factors Related to Water Filter Use for Drinking Tap Water at Home and Its Association With Consuming Plain Water and Sugar-Sweetened Beverages Among US Adults. *American Journal of Health Promotion*, 36(5), pp. 813-822; <https://doi.org/10.1177/08901171211073304>.
24. Pepin, A., Stanhope, K.L., Imbeault, P. (2019). Are Fruit Juices Healthier Than Sugar-Sweetened Beverages? A Review. *Nutrients*, 11(5), 1006; doi.org/10.3390/nu11051006.
25. Popkiewicz, M. (2022). *Zrozumieć transformację energetyczną*. Katowice: Sonia Draga Post factum.
26. Qian, N. (2018). Bottled water or tap water? A comparative study of drinking water choices on university campuses. *Water*, 10(1), 59; [doi:10.3390/w10010059](https://doi.org/10.3390/w10010059).
27. *Rankomat*. Retrieved from: <https://rankomat.pl/woda/wirtualnie-zuzywamy-40-razy-wiecej-wody-niz-bezposrednio.html>, 10.12.2023.
28. Salomon, A., Regulska-Ilow, B. (2013). Polskie butelkowane wody mineralne i lecznicze—charakterystyka i zastosowanie. *Bromat Chem Toksykol*, XLVI, pp. 53-65.
29. Shimamoto, H., Komiya, S. (2000). The turnover of body water as an indicator of health. *J. Physiol. Anthropol. Appl. Human Sci.*, 19, 5, pp. 207-212; doi.org/10.2114/jpa.19.207.
30. Stramarkou, M., Boukouvalas, C., Eleni, P., Karalekas, D., Krokida, M. (2021). Comparative life cycle assessment of polyethylene terephthalate (PET) and multilayer Tetra Pak juice packaging systems. *Chemical Engineering Transactions*, 87, pp. 103-108.
31. Swanson, Z.S., Pontzer, H. (2020). Water turnover among human populations: Effects of environment and lifestyle. *American Journal of Human Biology*, 32(1), e23365; doi.org/10.1002/ajhb.23365.
32. Szczepańska-Sadowska, E. (2018). Regulacja gospodarki wodno-elektrolitowej organizmu. In: W.Z. Traczyk, A. Trzebski (Eds.), *Fizjologia człowieka z elementami fizjologii stosowanej i klinicznej* (pp. 816-839). Warszawa: PZWL.
33. Vellini, M., Savioli, M. (2009). Energy and environmental analysis of glass container production and recycling. *Energy*, 34, 12, pp. 2137-2143.

34. Walden-Kozłowska, A., Moskal, M. (2003). Preferencje konsumenckie w zakresie opakowań napojów bezalkoholowych. *Zeszyty Naukowe*, 625. Akademia Ekonomiczna w Krakowie, pp. 41-58.
35. Wiech, J. (2023). *Energetyka po prostu*. Kraków: Znak.
36. Wojtszek, T. (2006). Woda mineralna jako czynnik ekologicznej profilaktyki zdrowotnej. *J. Elementol.*, 11(3), pp. 399-409.
37. *World Health Organization*. Retrieved from: <https://www.afro.who.int/health-topics/water>, 17.12.2023.
38. Yamada Y. et al. (2022). Variation in human water turnover associated with environmental and lifestyle factors. *Science*, 378, 909-915; DOI:10.1126/science.abm8668.
39. Zapata, O. (2021). The relationship between climate conditions and consumption of bottled water: A potential link between climate change and plastic pollution. *Ecological Economics*, 187, 107090; <https://doi.org/10.1016/j.ecolecon.2021.107090>.

PRO-ENVIRONMENTAL IMPROVING PRODUCTS QUALITY IN SMES FROM THE VISEGRAD GROUP COUNTRIES (V4)

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Purpose: The aim of the article was to analyse the pro-environmental approach to products improvement by SMEs from the Visegrad Group (V4) countries.

Design/methodology/approach: The research was survey. The survey research was carried out in traditional (paper) and electronic form (MS FORMS). The survey was directed at electronic industries (machinery processing) belonging to small and medium enterprises (SMEs) from V4 countries. The results presented in the article refer to sample size of 379 SMEs, obtained between March and September 2023. Results were analysed in statistical way, i.e.: ANOVA test and Mann Whitney U test by significance level equal to $\alpha = 0.05$.

Findings: SMEs in V4 countries have a similar approach to pro-environmental improving of products. It was shown that pro-environmental activities of SMEs from the V4 countries, the lowest consistency of assessments occurs in the following countries: Poland and Slovakia, Poland and Hungary, Slovakia and Hungary.

Practical implications: The research results may contribute to more effective and coherent development activities of SMEs in the V4 countries as part of their sustainable development, and also to take appropriate actions that will be supporting qualitative and environmental products.

Social implications: The results can help SME entrepreneurs improve their products to protect the natural environment. In addition, they can be the basis for the development of SMEs from the V4 countries and their unidirectional development, which includes not only improving the quality of products, but also caring for the environment.

Originality/value: The originality of the research is the determination of the current pro-environmental approach to product improvement in SMEs in the V4 countries. The novelty is the provision of current data on the importance of improving pro-environmental products in SMEs from the V4 countries and their comparison between companies in the electrical machinery industry.

Keywords: Visegrad Group (V4), SMEs, environment, quality, product improvement, production engineering.

Category of the paper: Research paper.

1. Introduction

Small and medium-sized enterprises (SMEs) play an important role in most world economies, and their number is the largest, e.g. in the European Union, SMEs constitute up to 99% of all enterprises (Masocha, 2018). Therefore, SMEs determine many jobs and generate the economic level of business activity (Lu et al., 2022). At the same time, the importance of SMEs translates into their significant impact on the natural environment (Hoogendoorn et al., 2015). The environmental impact refers to the positive or negative impact of a company's (and other interested parties') activities on the natural environment (Civelek et al., 2021; Gajdzik et al., 2023; Ingaldi, Ulewicz, 2019; Pacana, Siwiec, 2022a).

As mentioned, the activities of companies have a very important impact on the state of the environment (Gajdzik, Wolniak, 2022; Pacana, Siwiec, 2022b, 2021). Inappropriate use of resources makes it necessary to increase the level of environmental responsibility (Golovko, Valentini, 2011; Ostasz et al., 2022; Siwiec, Pacana, 2021). This is a condition for SMEs (Hatmanu et al., 2019), which in particular must take care of competitiveness on the market (Pacheco Blanco et al., 2014). The mentioned environmental responsibility is caused by the increase in environmental problems that also affect society. This is also due to increased customer awareness and stricter environmental protection regulations. For this reason, enterprises are motivated to take into account the impact of their activities and products on the environment (Talbot, 2005) by searching for strategies and measures to reduce this negative impact. The increased concern and availability of natural resources becomes crucial for future generations. For this reason, decisions made in the industrial sector are focused on sustainable development and eco-efficiency. They concern, for example, waste reduction and increasingly greater economic benefits (Gajdzik et al., 2018; Siwiec et al., 2019; Siwiec, Pacana, 2022; Vásquez et al., 2018). In this area, a literature review was conducted.

As part of pro-environmental improvement in SMES, the authors of the article (Laforet, 2011) studied innovations in SMEs and developed a theoretical framework for them. For this purpose, they conducted interviews with entrepreneurs from various industries. However, the authors of the article (Lu et al., 2022) studied the quality management of SMEs and their impact on the management of supply chain financing. The analyses were based on determining the relationship between quality management and the supply chain, but also determining the role of environmental dynamics. However, the authors (Vásquez et al., 2018), presented a conceptual framework to assess the efficiency of SMEs from an environmental perspective (the so-called ecoefficiency). They concerned sustainable development strategies as part of reducing the negative impact and increasing the profitability of SMEs. Another example is the article (Hatmanu et al., 2019), in which the importance of factors influencing environmental responsibility in SMEs was estimated, where the analyses were carried out for enterprises at different levels of socioeconomic development. In turn, in the article (Hasan,

Rahman, 2023), the authors examined the key factors that support eco-innovation initiatives in SMEs. They analysed the criteria of sustainable development, i.e., economic, environmental, and social. However, the authors of the study (Afum et al., 2021) conducted research in SMEs using a questionnaire. The results of the analysis were concerned with the interactions between lean production, internal ecological practices, innovations, and sustainable production indicators. Another example is an article by (Mittal et al., 2023), which determines the impact of green business on the perception of SMEs' wealth. The results of these analyses showed that elements such as process, measurement, communication, and capacity building have an impact on the assessment of the wealth of SMEs and their ecological approach. The authors of the study (Agusdin et al., 2023) carried out a similar type of research, in which the impact of improving ecological products on the marketing results of SMEs was verified.

It has been shown that pro-environmental activities undertaken by SMEs have been studied. They concerned not only the public awareness, but also products. However, no research has been found that analyses pro-quality product improvement in all Visegrad Group (V4) countries, and additional in small and medium enterprises (SMEs) belonging to the electromechanical industry. This was considered a research gap. Hence, the purpose of the article was to analyse the environmental approach to products improvement by SMEs from the countries of the Visegrad Group. The research carried out during the project co-financed by the Governments of the Czech Republic, Hungary, Poland and Slovakia through Visegrad Grants from the International Visegrad Fund. The fund's mission is to promote ideas for sustainable regional cooperation in Central Europe.

2. Method of research

The research involved qualitative-environmental approaches to the improvement of products and was carried out as part of an international project „Qualitative-environmental aspects of products improvement” (IVF 22230264). The research was carried out in small and medium enterprises (SMEs). These enterprises belonging to the electromechanical industry from Visegrad Group countries (V4), that is, Czech Republic, Hungary, Slovakia and Poland. The research consisted of survey research. In this article has shown only selected results of research, which included period from March to November 2023. In this period, we obtained surveys from 379 SMEs (Figure 1).

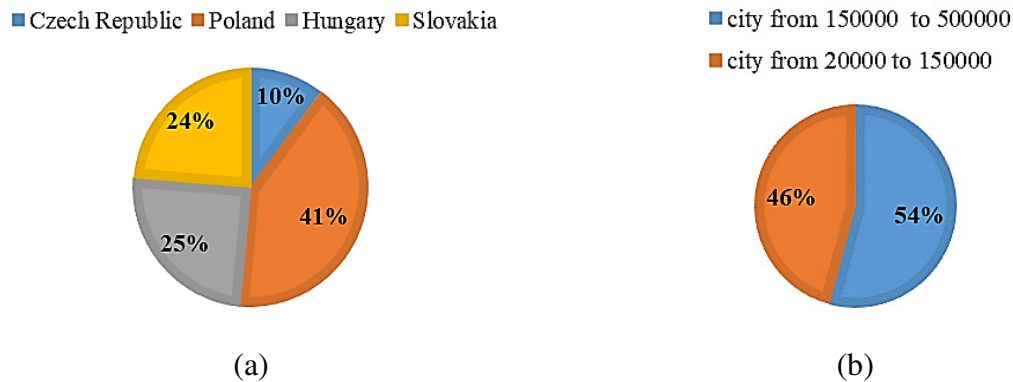


Figure 1. Survey details: (a) sample size of SMEs, (b) number of residents.

Source: Own study.

In addition, many SMEs were international companies (46%). The research survey was conducted in paper and electronic form using MS FORMS. The survey was created based on preliminary research which is presented for example in (Hajduk-Stelmachowicz et al., 2022; Siwiec et al., 2022; Siwiec et al., 2023). Also, the questions included in survey resulted from literature review, i.e.: (Benito-Hernández et al., 2023; Bryła, 2020; Hudakova et al., 2021; Saqib et al., 2023; Wysocki, 2018).

In this article was concentrated on results of research refers to pro-environmental approaches of SMES from V4 countries in products improvement. Therefore, following hypothesis was assumed:

H₁: *Do SME entrepreneurs from the V4 countries have a similar approach to pro-environmental product improvement?*

Research results for these topics were obtained through the following question:

Question: What is your opinion about every statement refers to pro-environmental improving of products? Mark one answer for each statement in scale: 1 – I totally don't agree, 2 – less than once every three years, 3 – once every two to three years, 4 – I mostly agree, 5 – I totally agree.

Statements:

1. Customers attach great importance to the pro-environmental actions of analyzed enterprise.
2. Customers will pay more if the product is pro-ecological.
3. A pro-ecological product is the product that meets the current requirements of customers.
4. Currently, pro-ecological products have also a high level of quality.
5. Wealthy customers usually choose pro-ecological products.
6. Choosing a pro-ecological product can improve a customer's self-esteem.
7. Customers pay attention to the pro-ecological packaging of product.
8. Pro-ecological products are sufficiently promoted.
9. We as a company strives to produce pro-ecological products.

10. The higher price of pro-ecological products significantly discourages customers from buying them.
11. Customers are more likely to buy a pro-ecological product if it has been previously recommended/tested.
12. Customers have a lot of knowledge about the attributes of products that affect their pro-ecological features.
13. Pro-ecological products have higher prices.
14. Customers will pay more for products from enterprises that take real pro-ecological actions.

The results were analyzed by using STATISTICA 13.3. program. It were ANOVA test (repeated measure designs) and Mann Whitney U test. These analysis were at the significance level of $\alpha = 0.05$. The results has shown in the next part of the article.

3. Results

The environmental activities undertaken in SMEs of the V4 countries were analysed. Similarly as before, the ANOVA test (repeated measurement designs) was used. The analyses were performed at the significance level of $\alpha = 0.05$ (Figure 2).

To standardise the analysis, the mean values obtained from the responses were grouped into two groups, that is, statements with high scores for mean values $<2.72;3.50$) and statements with low scores for mean values $<3.50;4.29>$. According to the assumptions adopted, it was concluded that SME entrepreneurs from all V4 countries unanimously rated one statement highly: (13) pro-ecological products have higher prices. However, the vast majority of the statements were rated low, that is, 1, 2, 3, 7, 12, 14, according to method of research. The vast majority of positively evaluated statements were made by Hungary's small businesses, that is, 4, 5, 6, 8, 10, 11, 13, according to the research method.

Then it was verified whether there are statistically significant differences in responses on pro-environmental activities among SME entrepreneurs from V4 countries.

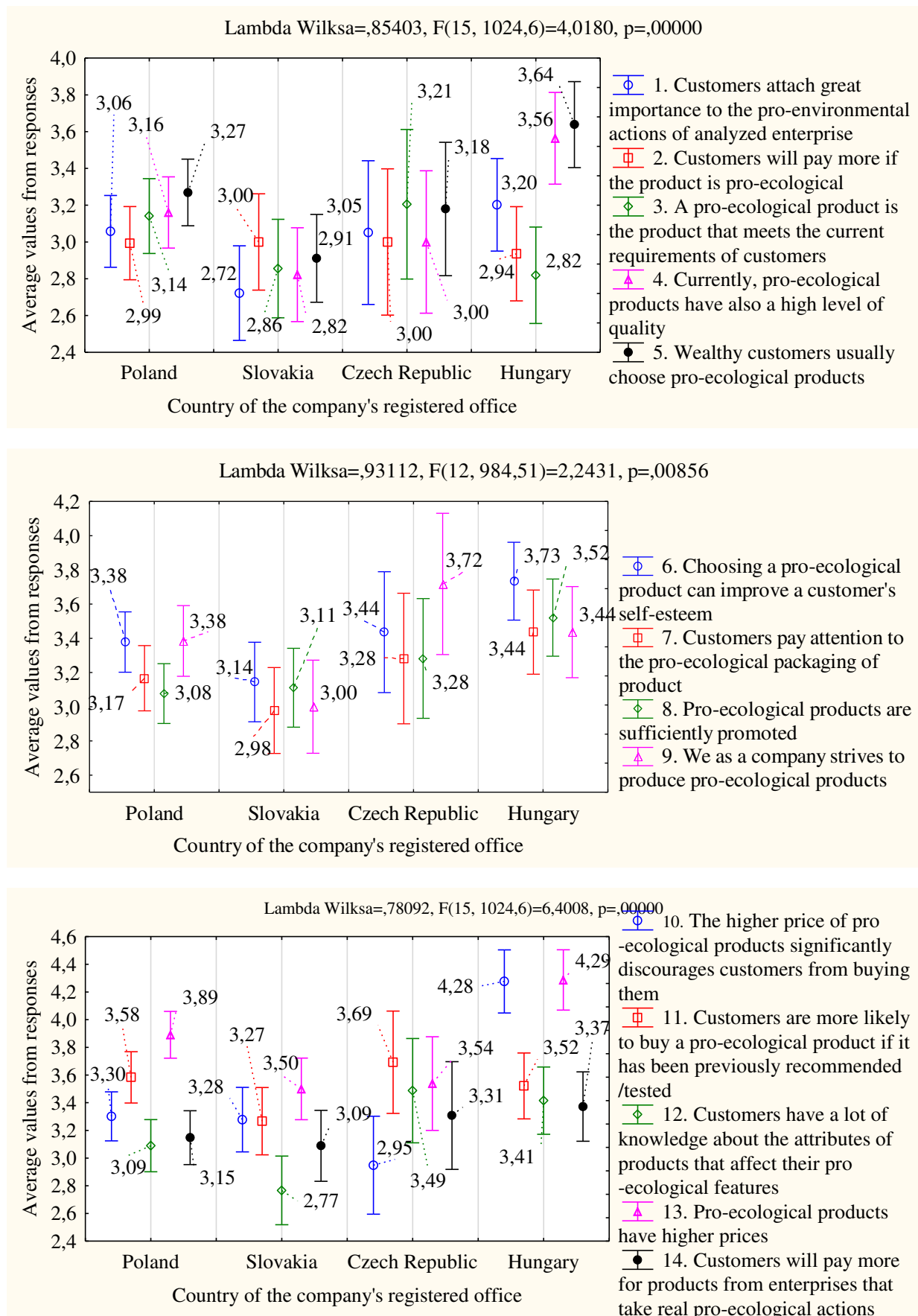


Figure 2. Average values of assessments of SME entrepreneurs by V4 country for pro-environmental activities.

The Mann Whitney U test was carried out to verify whether there are statistically significant differences in responses on pro-environmental activities among SME entrepreneurs from V4 countries. Analyses were performed at the significance level of $\alpha = 0.05$. The result is shown in Table 1.

Table 1

Results of the Mann-Whitney U test for pro-environmental activities of SMEs from the V4 countries

Number of actions	Poland-Slovakia	Poland - Hungary	Poland - Czech Republic	Slovakia - Hungary	Slovakia - Czech Republic	Hungary - Czech Republic
1	0.042	0.376	0.935	0.019	0.106	0.554
2	0.998	0.760	0.935	0.756	0.873	0.877
3	0.095	0.083	0.757	0.916	0.128	0.247
4	0.039	0.013	0.469	0.000	0.327	0.007
5	0.025	0.020	0.572	0.000	0.241	0.026
6	0.196	0.038	0.972	0.003	0.311	0.100
7	0.260	0.117	0.621	0.012	0.175	0.585
8	0.840	0.005	0.304	0.016	0.370	0.449
9	0.018	0.542	0.188	0.018	0.002	0.625
10	0.915	0.000	0.088	0.000	0.122	0.000
11	0.044	0.545	0.838	0.163	0.081	0.513
12	0.042	0.030	0.070	0.000	0.001	0.896
13	0.013	0.005	0.056	0.000	0.962	0.000
14	0.781	0.163	0.590	0.145	0.474	0.575

where: 1-14 statements as in method research for pro-environmental actions.

The research shows that the relatively largest statistically significant differences in the answers given occur in the case of Slovakia and Hungary. SME entrepreneurs from these countries have different views on the issues, i.e.: (1) customers attach great importance to the pro-environmental actions of the analysed enterprise ($p < \alpha$, $p = 0.019$), (4) currently, pro-ecological products also have a high level of quality ($p < \alpha$, $p = 0.000$), (5) wealthy customers usually choose pro-ecological products can improve the self-esteem of a customer's self-esteem ($p < \alpha$, $p = 0.000$), and 6, 7, 8, 9, 10, 12, 13, according to method of research.

Slightly less statistically significant differences occurred in the responses of SME entrepreneurs from Poland and Slovakia, as well as Poland and Hungary. In the case of Poland and Slovakia, they were: 1, 4, 5, 9, 11, 12, 13, according to the research method. For Poland and Hungary, statistically significant differences occurred for the following statements: 4, 5, 6, 8, 10, 12, 13, according to method of research. The least statistically significant differences were observed in SMEs from Hungary and the Czech Republic, respectively, that is, 4, 5, 10, 13 and Slovakia and the Czech Republic, that is, 9, 12, according to the research method. An important observation is the lack of statistically significant differences in the claims evaluations of the analysed claims of SME entrepreneurs from Poland and the Czech Republic. Hypothesis (H_1) concluded that SME entrepreneurs in the V4 countries have a similar approach to improving products in an environmentally friendly way.

4. Discussion and conclusion

Enterprises strive to consistently implement activities that will support their effective development. These activities should correspond to the concept of sustainable development. However, this remains a challenge for SMEs from the V4 countries. Therefore, research was carried out in the area of the environmental approach of SMEs from countries in the Visegrad Group to product improvement (Civelek et al., 2021; Domaracká et al., 2018; Siwiec et al., 2023a).

According to the results of the analysis of pro-environmental activities of SMEs from the V4 countries, it was shown that:

- the complete consistency of the assessments of SME entrepreneurs occurs in Poland and Slovakia,
- the greatest consistency in the assessments of SME entrepreneurs occurs in the countries of Slovakia and the Czech Republic, as well as Hungary and the Czech Republic,
- the lowest consistency of assessments of SME entrepreneurs occurs in the countries: Poland and Slovakia, Poland and Hungary, Slovakia and Hungary,
- SME entrepreneurs from Poland, Slovakia, and Hungary jointly agree most with the statements that choosing a pro-ecological product can improve a customer's self-esteem, and pro-ecological products have higher prices,
- SME entrepreneurs from the Czech Republic most agree with statements such as: a pro-ecological product is the product that meets the current requirements of customers; or we as a company strive to produce pro-ecological products,
- SME entrepreneurs from the V4 countries indicated in different ways the statements with which they agreed the least.

The pro-environmental approach to improving products in SMEs in the V4 countries is similar in most aspects. It has been shown that the lowest consistency of assessments occurs in the following countries. Poland and Slovakia, Poland and Hungary, Slovakia and Hungary.

The originality of the research is the determination of the current pro-environmental approach to product improvement in SMEs in the V4 countries. The novelty is the provision of current data on the importance of improving pro-environmental products in SMEs from the V4 countries and their comparison between companies in the electrical machinery industry.

Future research will focus on comparing pro-quality and pro-environmental approaches to product improvement in SMEs from the Visegrad Group countries with enterprises in western Europe or other regions of the world.

Acknowledgements

The article was created as part of research conducted in the project Visegrád Fund, project ID: 22230264, Title: Qualitative-environmental aspects of products improvement, carried out from February 1, 2023 to March 31, 2024: Applicant: Politechnika Rzeszowska im. Ignacy Łukasiewicz. Rzeszow University of Technology, Rzeszów, PL.

References

1. Afum, E., Zhang, R., Agyabeng-Mensah, Y., Sun, Z. (2021). Sustainability excellence: the interactions of lean production, internal green practices and green product innovation. *International Journal of Lean Six Sigma*, 12, 1089–1114. <https://doi.org/10.1108/IJLSS-07-2020-0109>
2. Agusdin, A., Herman, L., Athar, H., Furkan, L. (2023). Does Green Entrepreneurship Orientation Affect to Marketing Performance? *Quality - Access to Success*, 24. <https://doi.org/10.47750/QAS/24.195.34>
3. Benito-Hernández, S., López-Cózar-Navarro, C., Priede-Bergamini, T. (2023). The influence of government support over environmental protection investment on SMEs: R&D collaboration and financial aspects. *Business Ethics, the Environment & Responsibility*, 32, 836–846. <https://doi.org/10.1111/beer.12496>
4. Bryła, P. (2020). Znaczenie marki na rynku ekologicznych produktów żywnościowych, in: Strategie Budowania Marki i Rozwoju Handlu. *Nowe Trendy i Wyzwania Dla Marketingu*. Wydawnictwo Uniwersytetu Łódzkiego. <https://doi.org/10.18778/8142-903-0.03>
5. Civelek, M., Ključnikov, A., Kloudová, J., Vozňáková, I. (2021). Digital local currencies as an alternative digital payment method for businesses to overcome problems of covid-19 pandemic. *Polish Journal of Management Studies*, 23, 57–71. <https://doi.org/10.17512/pjms.2021.23.2.04>
6. Domaracká, L., Tausová, M., Muchova, M., Janocková, I., Bednárová, L. (2018). Limestone in V4 countries. *Acta Montanistica Slovaca*, 23, 390–401.
7. Gajdzik, B., Gawlik, R., Skoczypiec, S. (2018). Forecasting-Scenario-Heuristic method proposal for assessment of feasibility of steel production scenarios in Poland – Managerial implications for production engineering. *Archives of Civil and Mechanical Engineering*, 18, 1651–1660. <https://doi.org/10.1016/j.acme.2018.06.008>

8. Gajdzik, B., Wolniak, R. (2022). Smart Production Workers in Terms of Creativity and Innovation: The Implication for Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 8, 68. <https://doi.org/10.3390/joitmc8020068>
9. Gajdzik, B., Wolniak, R., Grebski, W. (2023). Process of Transformation to Net Zero Steelmaking: Decarbonisation Scenarios Based on the Analysis of the Polish Steel Industry. *Energies (Basel)*, 16, 3384. <https://doi.org/10.3390/en16083384>
10. Golovko, E., Valentini, G. (2011). Exploring the complementarity between innovation and export for SMEs' growth. *J. Int. Bus. Stud.*, 42, 362–380. <https://doi.org/10.1057/jibs.2011.2>
11. Hajduk-Stelmachowicz, M., Bełch, P., Siwiec, D., Bednárová, L., Pacana, A. (2022). Instruments used to improve the betterment of products quality. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 157, 157–171. <https://doi.org/10.29119/1641-3466.2022.157.10>
12. Hasan, M.J., Rahman, M.S. (2023). Determinants of eco-innovation initiatives toward sustainability in manufacturing SMEs: Evidence from Bangladesh. *Heliyon*, 9, e18102. <https://doi.org/10.1016/j.heliyon.2023.e18102>
13. Hatmanu, M., Sandu, C.B., Jaba, E. (2019). A Comparative Study on Drivers for Corporate Environmental Responsibility, EU15 vs. EU-NMS13. *Sustainability*, 11, 6397. <https://doi.org/10.3390/su11226397>
14. Hoogendoorn, B., Guerra, D., van der Zwan, P. (2015). What drives environmental practices of SMEs? *Small Business Economics*, 44, 759–781. <https://doi.org/10.1007/s11187-014-9618-9>
15. Hudakova, M., Gabrysova, M., Petrakova, Z., Buganova, K., Krajcik, V. (2021). The Perception of Market and Economic Risks by Owners and Managers of Enterprises in the V4 Countries. *Journal of Competitiveness*, 13, 60–77. <https://doi.org/10.7441/joc.2021.04.04>
16. Ingaldi, M., Ulewicz, R. (2019). Problems with the Implementation of Industry 4.0 in Enterprises from the SME Sector. *Sustainability*, 12, 217. <https://doi.org/10.3390/su12010217>
17. Laforet, S. (2011). A framework of organisational innovation and outcomes in SMEs. *International Journal of Entrepreneurial Behavior & Research*, 17, 380–408. <https://doi.org/10.1108/13552551111139638>
18. Lu, Q., Yang, Y., Yu, M. (2022). Can SMEs' quality management promote supply chain financing performance? An explanation based on signalling theory. *International Journal of Emerging Markets*. <https://doi.org/10.1108/IJOEM-03-2022-0456>
19. Masocha, R. (2018). Does Environmental Sustainability Impact Innovation, Ecological and Social Measures of Firm Performance of SMEs? Evidence from South Africa. *Sustainability*, 10, 3855. <https://doi.org/10.3390/su10113855>

20. Mittal, A., Raheja, K., Raut, R., Deshpande, A. (2023). Fostering perceived wealth among SMEs through green business: unveiling the mediating influence of consumers' green attitude. *Management of Environmental Quality: An International Journal*. <https://doi.org/10.1108/MEQ-06-2023-0167>
21. Ostasz, G., Siwiec, D., Pacana, A. (2022). Model to Determine the Best Modifications of Products with Consideration Customers' Expectations. *Energies (Basel)*, 15, 8102. <https://doi.org/10.3390/en15218102>
22. Pacana, A., Siwiec, D. (2022a). Model to Predict Quality of Photovoltaic Panels Considering Customers' Expectations. *Energies (Basel)*, 15, 1101. <https://doi.org/10.3390/en15031101>
23. Pacana, A., Siwiec, D. (2022b). Method of Determining Sequence Actions of Products Improvement. *Materials*, 15, 6321. <https://doi.org/10.3390/ma15186321>
24. Pacana, A., Siwiec, D. (2021). Universal Model to Support the Quality Improvement of Industrial Products. *Materials*, 14, 7872. <https://doi.org/10.3390/ma14247872>
25. Pacheco Blanco, B., Collado-Ruiz, D., Viñoles-Cebolla, R. (2014). Percepciones de una pyme del sector de la construcción hacia la implementación de mejoras basadas en el análisis del ciclo de vida. *Dyna Ingenieria E Industria*, 89, 518–525. <https://doi.org/10.6036/7092>
26. Saqib, Z.A., Qin, L., Menhas, R., Lei, G. (2023). Strategic Sustainability and Operational Initiatives in Small- and Medium-Sized Manufacturers: An Empirical Analysis. *Sustainability*, 15, 6330. <https://doi.org/10.3390/su15076330>
27. Siwiec, D., Bednárová, L., Pacana, A., Zawada, M., Rusko, M. (2019). Decision support in the selection of fluorescent penetrants for industrial non-destructive testing. *Przemysł Chemiczny*, 1, 92–94. <https://doi.org/10.15199/62.2019.10.12>
28. Siwiec, D., Bełch, P., Hajduk-Stelmachowicz, M., Pacana, A., Bednárová, L. (2022). Determinants Of Making Decisions In Improving The Quality Of Products. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 157, 497–507. <https://doi.org/10.29119/1641-3466.2022.157.31>
29. Siwiec, D., Gawlik, R., Pacana, A. (2023a). Fuzzy Multi-criteria Decision Model to Support Product Quality Improvement. *Management and Production Engineering Review*, 14(2), 134-149. <https://doi.org/10.24425/mper.2023.146030>
30. Siwiec, D., Pacana, A. (2022). A New Model Supporting Stability Quality of Materials and Industrial Products. *Materials*, 15, 4440. <https://doi.org/10.3390/ma15134440>
31. Siwiec, D., Pacana, A. (2021). Model of Choice Photovoltaic Panels Considering Customers' Expectations. *Energies (Basel)*, 14, 5977. <https://doi.org/10.3390/en14185977>
32. Siwiec, D., Pacana, A., Simková, Z., Metszösy, G., Vozňáková, I. (2023b). Current activities for quality and natural environment taken by selected enterprises belonging to SMEs from the electromechanical industry. *Scientific Papers of Silesian University of*

- Technology Organization and Management Series*, 172, pp. 537-553.
<https://doi.org/10.29119/1641-3466.2023.172.33>
33. Talbot, S. (2005) *Ecodesign practices in industry: an appraisal of product life cycle design initiatives in SMEs*. Proceedings. IEEE International Engineering Management Conference, pp. 475–479. <https://doi.org/10.1109/IEMC.2005.1559193>
 34. Vásquez, J., Bruno, G., Settineri, L., Aguirre, S. (2018). Conceptual Framework for Evaluating the Environmental Awareness and Eco-efficiency of SMEs. *Procedia CIRP*, 78, 347–352. <https://doi.org/10.1016/j.procir.2018.09.062>
 35. Wysocki, J. (2018). Działalność proekologiczna dużych przedsiębiorstw produkcyjnych w Polsce - wyniki badań ankietowych. In: *Nowe Formy Innowacji*, pp. 82–109.

THE ASSOCIATION BETWEEN PAKISTAN AND THE EUROPEAN UNION, WITH A PARTICULAR FOCUS ON TRADE

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Purpose: This paper aims to investigate the bilateral relations between Pakistan and the European Union, with a specific emphasis on trade dynamics. The primary purpose is to explore the factors influencing trade between these two entities, delving into historical perspectives, contemporary developments, and future milestones set by the European Union and Commission.

Design/methodology/approach: The objectives are achieved through a comprehensive analysis of trade data, policy documents, and relevant literature. The research employs a multi-faceted approach, encompassing both theoretical and empirical considerations. The theoretical scope extends from the historical Silk Road to the contemporary geopolitical landscape, while the empirical analysis involves a PEST analysis and examination of internal and external factors influencing trade.

Findings: The research reveals significant insights into the factors shaping trade relations between Pakistan and the European Union. These findings are presented through a thorough analysis, discussion, and interpretation of results, providing a comprehensive understanding of the bilateral trade dynamics.

Research limitations/implications: While offering valuable insights, this study recognizes potential limitations, such as data constraints and geopolitical factors. Suggestions for future research are provided, focusing on areas that could further enhance the understanding of the relationship and trade dynamics.

Practical implications: The paper identifies outcomes and practical implications for businesses and enterprises engaged in trade between Pakistan and the European Union. Recommendations for changes in business practices are discussed, considering the potential commercial and economic impact of the findings.

Social implications: The study assesses the social impact of the Pakistan-European Union trade relationship, exploring how it influences public attitudes, corporate social responsibility, and environmental considerations. The research may inform public and industry policies, potentially affecting the overall quality of life.

Originality/value: This paper contributes novelty by offering new insights into the dynamics of the Pakistan-European Union relationship, specifically in the context of trade. Its value lies in its relevance to policymakers, businesses, and researchers interested in understanding and enhancing this bilateral association

Keywords: Trade dynamics, Bilateral relations, Pakistan, European Union, Geopolitical landscape.

Category of the paper: Review Article.

1. Introduction

The focus of this study henceforth shall be to throw light on the bi-lateral relationship between Pakistan and the European Union and in particular the trade and commerce related aspect of it. The bilateral trade relations between Pakistan and the European Union are governed by the 2004 Cooperation Agreement. The EU-Pakistan 5-year engagement plan also focuses on enhancing trade and investment between the two parties. The EU Generalized Scheme of Preferences (GSP) also benefits multiple trading opportunities to Pakistan. Since 1st January 2014, Pakistan has been enjoying liberal tariff preference (mostly zero percent duties on more than half al product categories) because of the GSP deal aimed at promoting sustainable growth and progress and aid superior governance. With the intention of maintaining its current status in the EU Generalized Scheme of Preferences Pakistan has to keep its end of the bargain and implement upwards of twenty-five global conventions on human rights, labor rights, environmental protection steps and acceptable and good governance.

- The European Union is one of the most significant trading partners of Pakistan, amounting to upwards of 12% of Pakistan's entire trade in 2015 and captivating 23.7% of Pakistan's total exports (An official website of the European Union, 2019).
- Pakistan proved to be the EU's 41st biggest trade collaborator in merchandise amounting to 0.3% of European trade in 2016.
- Pakistan's exports to Europe are mainly comprised of textiles and clothing, amounting to almost 80% of Pakistan's entire exports to the EU in the year 2016.
- Pakistan's imports from the EU are dominated by machines and transportation gear (40.2% in 2016) in addition to chemicals (19.5% in 2016).
- During the period 2006 to 2016, EU28 imports from Pakistan have roughly doubled from almost €3 million to €6,273 million. The increase in imports from Pakistan has been predominantly quick ever since the award of GSP+ (€5,515 million in 2014) (An official website of the European Union, 2019).
- A Sub-Group on Trade has been set by the European Union and Pakistan to enhance the growth of bilateral traffic. The Sub-Group on Trade has been arranged under the sponsorship of the European Union-Pakistan Joint Commission. The purpose of this

medium remains to discuss trade strategy developments in a holistic manner and deal with individual market access issues which impede trade between the two regions.

- Pakistan's economy promises significant potential but certain factors including lofty costs of doing business, unnecessarily difficult regulations and infrastructure shortcomings all are deciding factors of a country's trade and growth. Unfortunately, Pakistan's trade management and regulatory atmosphere are still relatively restraining.
- More than 80% of Pakistani exports to the EU is based upon textiles and garment items. Granted, the textile and clothing industry to this day remains the backbone of Pakistan's exports, none the less, relying a great deal on one manufactured goods group carries risks for any nation. Trade diversification is thus utmost important for Pakistan. The conceding of GSP+ preferences in 2014 ought to fuel Pakistan's hard work towards economic diversification.
- Almost 80% of Pakistani exports to the EU enter at preferential rates thanks to the GSP+ status it enjoys (An official website of the European Union, 2019).

2. Research Questions

A number of factors ranging from political to irredentism may affect the trade relations between any two nations. A host of these factors shall be considered and discussed here in an effort to appreciate the efforts made by both sides and pinpoint any problem causing areas.

2.1. Political relations

Pakistan and the EU enjoy cordial bilateral political relations. The European Delegation to Pakistan represents the EU on a wide variety of subjects including: development collaboration, humanitarian aid, trade, security and counter terrorism, energy, environmental factors, health, transportation services, migration and climate change. Thanks to the EU-Pakistan 5-year Plan, political and security relations between the two regions are also getting stronger. To review the plan's progress, a Pakistan-EU Joint Commission meets annually (EU-Pakistan 5-year Engagement Plan, 2019).

2.2. Economic relations

The EU is a firm proponent of Pakistan's integration into the global economy. In order to achieve the goal of integrating Pakistan into the Global economy the EU and Pakistan are collectively working on:

1. Increasing bilateral trade.
2. Encouraging direct investment.
3. Sustaining institution building, and
4. Protecting basic human rights and ensuring the execution of global labor laws.

The Pakistani Government's current economic reforms program in accord with global financial institutions is also supported by the EU. Moreover, the EU is preparing to enlarge its exchange of ideas and collaboration with Pakistan relating to energy issues.

2.3. Trade relations

The European Union remains to be one of the largest trade Partners of Pakistan and the main marketplace for exports from Pakistan. The overall Pakistan-EU trade stood to be €10.49 billion for the year 2015 which is 20.1% higher than trade in 2013. 76% of all Pakistani exports to the European Union consist of textile and clothing products. Pakistan's main imports from the European Union consist of Machines and Appliances (comprising 25.5%), transportation gear which amounts to 16.5% and chemicals and pharmaceuticals amounting to 15.5%.

A Sub-Group focused on trade was arranged by EU and Pakistan under the EU-Pakistan Joint Commission in May 2007. (Trade with the European Union the Pakistan Business Council, 19). The EU Generalized System of Preferences (GSP) which was setup in January 2014 has been benefitting Pakistan by boosting its exports to the EU.

2.4. Development cooperation

Constituent countries of the EU provide Pakistan with almost €700 million per year as humanitarian aid and also as a source of development assistance. Along with further issues, the EU also supports Pakistan in its hard work to deal with the menace of poverty, amplify the literacy rates, lessen child mortality rates, advance maternal health status, fight major diseases including emerging threats as the corona virus, and also to ensure environmental sustainability (EU-Pakistan 5-year Engagement Plan, 2019).

2.5. Science and technology

Pakistan and the EU are dedicated to cooperating in the contemporary fields of science and technology. With virtually €80 billion of financial support accessible over a period of seven years (2014 to 2020), Horizon 2020 is the largest EU research and improvement program. The Delegation from the European Union has accomplished a joint venture with Pakistan Science Foundation (PSF) in an effort to advance the Horizon 2020 initiative within Pakistan. (European Issues, 2019)

2.6. Support for specific issues

A Multi Annual Indicative Program (MIP) contains particulars and instructions about the EU collaboration priorities concerning Pakistan for the period from 2014 to 2020. The program aims at providing long-term aid and assistance to Pakistan for various issues specific to Pakistan such as rural development, increasing the level of Education, Ensure good governance and other such issues.

2.7. Rural development

In the course of the MIP, EU has contributed in excess of €340 million to the rural improvement projects of Pakistan. The endowment program puts special focus on enhancing economic development and livelihoods in several of the most poverty-stricken areas of Pakistan. Efforts are therefore being made to:

1. Ensure easy access to basic public services.
2. Lessen the margin of Social and Economic disparity.
3. Enhance positive, revenue generating measures, and
4. Contributing to assembling and maintaining peace and security throughout the country.

2.8. Education and training

The MIP has provided an estimated €210 million to help in improving Pakistan's teaching and schooling initiatives.

Explicit goals consist of:

1. Improving admittance to and ensure achievement of fundamental and derived education for children, while dropping bias caused as a result of gender and region. Civilizing the value of education by introducing improved coaching materials, evaluation systems and school administration practices may as well be upgraded.
2. Refining the efficiency and employability of workforce by introducing applicable technological and occupational instruction programs (Pakistan, EU agree to strategic partnership, 2019).

2.9. Governance and human rights

Moving forward with Pakistan, governance and human rights concerns have always been a major issue for the European Union. Various issues regarding human trafficking, illegal immigration, and denial of labor rights within the country have all been sore spots for the EU regarding Pakistan.

Almost €97 million is to be paid in the course of the MIP for the purpose of bolstering the current democratic system of Pakistan. Definite objectives include:

- To reinforce the domestic elected institutions and the electoral processes – combating the menace of corruption, enhancing the legislative system and better accountability for the administration (The Commonwealth authentic website, 2018).
- To support the decentralization process of public administration offices as a means to civilizing the supervision of civic funds and service deliverance.
- To better the safety situation by ensuring Rule of law – defending basic human rights of people, making law enforcement easy and official and legal systems further liable.

2.10. Humanitarian aid

European Union being a huge proponent of human rights has never backed down from providing aid and assistance for humanitarian causes. Since 2009, the EU has been providing Pakistan with the amount of €537 million as humanitarian assistance, as well as an allotment of €21.5 million for the year 2016. Assistance has also been given to the victims of flood. EU has continued to sustain people affected by conflict as well as those afflicted from undernourishment and lack of food security. The EU has also been generous enough to aid the Afghan refugees residing in Pakistan.



Figure 1. EU-Pakistan Friendship Flag. Source: EU - Pakistan Relations.

Source: The London Post.

It offers: support in the form of food, access to clean potable water, sanitation services, sanctuary, health care, and protection to people displaced due to conflict, i.e. internally displaced people (IDP's).

3. Methodology

The methodology applied in this paper ranges from extensive literature review to precise arithmetical analysis such as the PEST analysis. Comparing various characteristics of both economies in an effort to assess the positive and the negative factors influencing the relation between the two regions and how it affects the trade and economic relation between them.

Cooperation between the two parties involved, especially through the Joint Commission, a sub- group setup by the Commission and the exchange of ideas dedicated solely to trade, will deliberate on:

- Contemplation of Pakistan's eligibility to profit from the EU's GSP+, henceforth being able to access the European market place at much profitable terms.
- Working towards an all-inclusive agenda to improve trade, as well as EU-Pakistan all-inclusive Free Trade Agreement, casing everything from goods to services and venture (Delegation of the European Union to Pakistan, 2018).
- Improved trade facilitation as well as simplification and up gradation of customs control, execution of WTO codes incorporating those related to quality standards.
- Promoting an environment conducive for investment.
- Encouraging practices such as public-private partnerships, business-to-business discourse and commercial sector Mutual Ventures.
- Taking into consideration potential for transfer of technology, particularly associated to manufacturing and farming applications.

4. Literature Review

Before acquiring independence from the Empire on 1947, Pakistan used to be a component of Royal British Kingdom in the South Asian region. British direct power over the area initiated by taking over Sindh in 1843, Punjab and the North-West Frontier were next annexed in 1949, with Baluchistan being last to fall in 1876. The expansion era stretched European existence and power in the South Asian region. Scores of settlers from Europe reached the Asian subcontinent, each contributing to different tasks such as bureaucrats, military, government officers, civilian population, followers and merchants. Throughout 1940s, there existed minorities of Jews of European descent spread along international metropolitans for example Lahore and Karachi. They came as a component of the mass exodus of Jews to Indian territories occupied by Britain subsequent to World War II. Nevertheless, by the end of 1960, the majority of the aforementioned Jews performed a derivative resettlement and went to Israel and other Western nations.

4.1. Pakistan -Historical perspective

The area where Pakistan is located was among the original cradles of civilization. Hunting-gathering societies as far back as the stone-age (some 300,000 years back) lived in the Potohar highland, in and around the valley now known as the Soan Valley located in northern Punjab. Excavations from the plateau of Baluchistan illustrate that a much-sophisticated civilization flourished in that region from 4000-2000 BCE. A premature Bronze Age society emerged during this period at Kot Diji in the Khairpur district. The Indus Valley civilization is the pinnacle of these Civilizations. Cities such as Moenjodaro and Harrapa still stand as a tribute to these once great civilizations. The aforementioned civilizations had learned advanced forms of town planning and pictorial writing techniques, which is writing with the help of symbols and diagrams. During 327 BC, Alexander the Great conquered the region with the Macedonian military under his command. Afterward, Mauryans, a group originating in the Indian region conquered the northern Punjab area, they were then succeeded by the Greco-Bactrian. Diverse religions were practiced as a consequence of this constant regime change: Buddhism prevailed under the rule of the Mauryans, and when the Arabs arrived in the eighth century, Islam became the dominant religion of the sub-continent.

There were two main principalities during the reign of the Arabs, one al-Munsurah and the other Multan. Ghaznavid sultans dominated Punjab during the 11th century. The following superiority of the Mughols, which came from Central Asia, reigned the period 1536-1707; their reign lasted on the surface till 1857. They created an urbane royal government and have left a pompous heritage of cities surrounded by walls, gateways, gardens, tombs and mosques, all testaments to their architectural prowess. In the early 17th century European traders travelling thousands of miles through the Ocean reached the Indian Continent. The British graduated to be the governing force in the region using the East Indian Company. The British took direct control after an unsuccessful revolt by the locals in 1857. Overtime a nationwide Muslim individuality emerged; led by leaders the like of Sir Syed Ahmed Khan (Groupe Société Générale, 2019).

As the people of the sub-continent became ever desperate for self-government, it was ever more apparent that the interests of Muslims and Hindus could in no way be settled. The movement to found a sovereign Muslim state came to the forefront throughout 1920s and 1930s. The movement was led by the brilliant poet philosopher Allama Mohammad Iqbal and the esteemed Lawyer and later politician Jinnah. Pakistan was formed, as an Islamic country, out of the division of the British Indian Empire, on the now historical date of 14th August, 1947. Pakistan initially had two separate territories with 1000 miles of Indian territory, a western territory which is now Pakistan and an eastern territory now Bangladesh. Soon after partition, war ensued between Pakistan and India over Kashmir; this led to the mass migration of Hindus, Sikhs and Muslims to relocate inside the new-fangled borders, a turmoil which led to hostility, economic failure and casualties on a huge level. With the influx of Muslims from India

and exodus of Hindus and Sikhs from Pakistan, Pakistan became a nearly exclusively Muslim people. Jinnah, honored as the Quaid-E-Azam translating to great leader, passed away in 1948 (Groupe Société Générale, 2019).

4.2. Silk Route

The Silk Route used to be a system of trade routes that connected the world to the Global West in the east, and it conducts financial, educational, religious and political relations among these areas commencing the 2nd century BC. The 18th century highway silk mainly consists of ground routes linking regions of East Asia and Southeast Asia to Persia, the Arab continent, south Asia, Southern Europe and East Africa. The name 'Silk Road' carries historical significance as it originates from the profitable trade of silk that was conducted across it, commencing from the Chinese Han empire in (207 CE–220 CE). The Han Empire extended the sector of the trade routes in Central Asia now known as the Silk Road in the region of 114 CE during the assignments and journeys of the Chinese royal representative Jhang Xian, in addition to numerous armed occupations. The Chinese were greatly interested about the safety measures of their trade products, and expanded the great wall to protect their trade route. The business made possible by the Silk Road has put in a momentous role in the progress of multiple civilizations including that of Japan, Korea, China, Europe, the Indian subcontinent, Iran, the Horn of Africa and Arabia, creating opportunities for long-distance trade and industry dealings among the civilizations. Although silk used to be the chief trade article sold abroad from China, numerous additional commodities and thoughts were swapped, as well as beliefs (particularly Buddhism), syncretism viewpoints, sciences, and expertise similar to paper production plus gunpowder. Consequently, as well as financial trade, the Silk Road also served as a means for intellectual trade amongst the civilizations along its system. Negative effects such as the spread of disease are also aided by trade routes it is thus mentioned that ailments, most remarkably plague, also spread down the Silk Road (Whitfield, Susan, 2004).

4.3. History behind the Name

The name Silk Road is derived from the profitable trade of silk. Silk was initially produced in China and was a main cause for the development of business routes into a widespread transcontinental association. The German phrase Seidenstraße ('The Silk Road') was invented in 1877 by Ferdinand von Richthofen; he completed multiple visits to China as of 1868-1872. Even though the term originated in 19th century, it does not get extensive recognition in the academic world nor gain recognition amongst the community till the 20th century. The original manuscript written about the route entitled 'The Silk Road' is by a Swedish geologist Sven Hedin in 1938. Utilization of the expression 'Silk Road' is not devoid of its critics. For example, Warwick Ball maintained that the nautical spice business between India, Europe and Arabia used to be extremely more significant used for the financial system of the Roman kingdom as compared to the silk business with China, the marine part of it was conducted typically through

India and the land part was controlled by copious mediators for example the Sogdians (Whitfield, Susan, 2004).

The Southern extensions of Silk highway, starting from Khutan (now Xinjang) to Eastern China, be initially intended for emerald, not silk, until 5000 BCE, and are still in operation for this very function. The expression "Jade Road" would be much more appropriate than 'Silk Road' if not for the much superior and physically broader character of silk traffic; the expression is still operational in China.



Figure 2. Map of the Silk Road including the land route and the maritime route.

Source: silkepc.com.

4.4. Central Asian and Chinese links (2nd CE)

Central Eurasia has enjoyed popularity since very old era for its equestrian community activities, and the land Plain Route from corner to corner the northern plains of Central Eurasia were engaged way earlier than that of the Silk Road. Archeological locations for instance the barrel graveyard in Kazakhstan, established that wandering Arimaspians tribes were not merely breeding livestock for the purposes of business but were furthermore grand craftsmen capable of propagating wonderful pieces of art all along the Silk Road. As far back as the 2nd century BCE, nephrite emerald was mined from the regions of Yarkand and Khotan and traded with China.

Considerably, these excavations were not far away from the lapis lazuli and spinel mines in Bedakhshan, moreover, even though divided by the formidable Pamir Mountains, routes crossways were used long ago. A number of leftovers of most likely Chinese silk timed on or after 1070 BCE have originated in prehistoric Egypt. The vast haven cities of Central Asia contributed a vital part in the successful implementation of the Silk Road traffic. The instigating cause appears satisfactorily dependable, but silk demeans swiftly, so it is difficult to confirm if it was refined silk or a type of natural silk, which is suspected to have originated from Middle Eastern or the Mediterranean regions (Whitfield, Susan, 2004).

Subsequent acquaintances among urban China and itinerant western boundary lands in the 8th century, the precious metal gold was pioneered from Central Asia, and Chinese emerald carvers began to build replica drawings of the prairielands, implementing the Scythian-style creature painting of the steppes. This method is predominantly replicated in the rectangular shaped strap tablets completed with bronze and gold, with further variations in emerald and steatite. An influential entombment close to Stuttgart, Germany, constructed during the 6th century, was dug up and it was discovered containing not just Greek bronze artifacts but as well as Chinese silks. Resembling animal-shaped bits of art and combatant ornamentations on straps have been discovered in Scythian burial locations originating from the area of the Black Sea the entire way to militaristic regions period archaeological locations in Shaanxi in China and Inner Mongolia. The development of Scythian civilizations, starting from the Hungarian plain and extending to the Carpathian peaks to the Chinese Kansu passageway, and connecting the Middle East with India and the Punjab, unquestionably contributed an imperative part toward improvement for the Silk Road. Scythians escorted the Assyrian leader during his incursion of the Egyptian regions, and the characteristic triangular arrowheads they used were excavated from the region of Aswan. The wandering nations were reliant upon bordering established peoples for a multitude of essential equipment's, as well as marauding susceptible arrangements for these merchandises; in addition, they promoted long-distance traders as a basis of proceeds during the obligatory reimbursement of tariffs and taxes. Sogdians played a chief part in assisting business in the form of trade among China and Central Asia down the Silk Roads by the 10th century.

4.5. Royal Persian Road (500 - 330 CE)

Near the point in time of Herodotus which was in 475 CE the imperial highway of the Persian kingdom was an awesome 3000 km distant metropolis of Susa in Karin which is east 250 km from the River Tigris to docks of Snyrma, the present İzmir in Turkey near the Aegean Sea. It was preserved and defended by the Achaemenid kingdom and maintained postal positions and dispatches at standard intermissions. By comprising fast horseback riders prepared at every dispatch point, imperial dispatch riders may possibly bring letters and go across entire span of the highway in just nine days, at the same time as typical voyagers required almost three months (Whitfield, Susan, 2004).

4.6. Empire Expansion (329-10 CE)

The subsequent chief task in route to expansion of the Silk highway proved to be the extension of the Greek kingdom of Alexander the Great into Central Asian regions. In pursuit of the aforementioned goals in August 329 CE, at the jaws of the Fergana basin in Tajikistan, Alexander established the town of Alexandria Ecshate translated as "Alexandria the Farthest". The Greeks stayed in Central Asia for three following centuries, initially during the management of the Selucid kingdom, and next through the organization of the Bactrian-Greek

Empire which lasted from 250 BCE to 125 BCE in the Bactrian region which is the contemporary Pakistan, Tajikistan and Afghanistan and afterward Indo-Greek Empire from 180 CE to 10 CE in contemporary Northern Afghanistan and Pakistan. They sustained their expansion eastward, particularly through the period of influence of Euthydemus from 230 BCE to 200 BCE, who furthered his power further than Alexandria Eschate to Sogdiana. It is evident from the archeological remnants that they might have piloted missions in so far as Kashgar in Chinese Turkestan, leading to the initial recognized links amid China and the West about 200 BCE. The Greek historian Strabo inscribes, “They completed their kingdom as far as the Sieres and the Phryni” (Whitfield, Susan, 2004).

4.7. Modern Silk Route (20th – 21st century)

Following an earthquake Tashkent in Central Asia during the year 1966, the town was forced to reconstruct itself. And even though it acquired a gigantic charge on the condition of their marketplace, this bold step aided in the commencement of a renewal of contemporary Silk highway municipalities (Whitfield, Susan, 2004).

4.8. Railway

The Eurasian ground connection which is a network of railway lines throughout Kazakhstan, China, Russia and Mongolia, is every so often passed on to as the “New Silk Road”. The final connection of one particular railway route project concluded during 1990, on this day the railway tracks of Kazakhstan and China linked at Alutaw Pass (Alushan Kuo). During 2008 this track inured to unite the municipalities of Ürümqi in Ximjiang Province, China with the metropolitans of Alamaty and Noor-Sultana in Kazakhstan. In October of 2008 the foremost Trans-Eurasia cargo train arrived at Hamburg, Germany from Xiamgtan, China. Since 2011 the track erstwhile employed by a cargo service that linked Xhongqing, China to Duisburg, Germany, effectively reducing time needed for cargo to travel from about thirty-six days when transported using container ship to a mere thirteen days by means of cargo train. During 2013, HP started shifting hefty cargo trains containing laptops and computer screens across this rail road. In January 2017, the first train dispatched to London. The set of connections also attaches to the Spanish cities of Milan and Madrid.

4.9. The Belt and Road Initiative (BRI)

In September 2013 at a conference in Kazakhstan, The President of China Ji Jinping initiated a proposal for a modern Silk Road which will connect Europe to China. The most recent versions of this proposal, which is named as the ‘Belt and Road Initiative’, consists of a terrestrial Silk Route Economic band as well as a contemporary nautical Silk Route, with principal positions in Ürümqi, Dostyck, Noor-Sultan, Gommal, the Belarusian town named Berst, and Polish cities Małaszawicze and Łudź—they later served as centers for the purposes

of storage and trans-shipment to further European countries. On 15th of February, 2016 there was route alteration; subsequently the foremost train sent off in the proposal reached from eastern Xhejiang region to the Iranian Capital. Despite the fact that this segment in no way concludes the Silk Road–styled terrestrial link amid Europe and China, but a fresh railway track linking Europe to China through the Turkish Capital has recently be set up. The real course went through Bishkek, Alamty, Samurkand, and Dishanbe (Whitfield, Susan, 2004).

4.10. Roads

The Silk highway historically comprised of multiple roads. As it expanded westwards from the early economic centers of China, the terrestrial, transnational Silk Road was separated into two routes namely the northern and southern routes circumventing the Takhlamakan Desert and Lup Nor. Traders all along the route were occupied in ‘relay trade’ which is a form of trade in which commodities altered ‘hands multiple times prior to getting their ultimate destinations’.

4.11. North route

The North route originated at Changan contemporarily known as Xian, an early center of China which was later shifted east in the duration of the Han Dynasty to Louyang. The path was distinct about the 1st century when Han Wadi, the emperor ended persecution by itinerant clans. The northern path passed through the Chinese province of Gaansu from Shanxi Province and further divide into three paths, two tagging along the mountain range to the south and north of the Takhlamakan Desert to retort at Kasghar, and third departing north of the Tain Shin mountains through Talghar, Tarpan and Alamty in what is at present the southeastern part of Kazakhstan. The paths split once more west of Kasghar, and a southern division routing down the Alae Valley towards Tirmez which is located in contemporary Uzbekhistan and Balakh now known as Afghanistan, whilst the supplementary travelled all the way through Kukand in the Fergana Valley in contemporary eastern Uzbekhistan and then west crossing the Karukam Desert. Together, the roads connected the major southern road prior to terminating at early Merv in Turkmenistan. An additional division of the north route curved northwest crossing Aral Sea, going north from the Caspian Sea, and then to the Black Sea. The north Silk highway was a path for convoys and thus transported to China numerous commodities for instance ‘dates, saffron powder and pistachio nuts from faraway places such as Persia; frankincense, aloes and myrrh from the African regions of Somalia; sandalwood from the highly fertile India; glass bottles from the technologically advanced Egypt, and a plethora of other luxurious and sought-after commodities from other fractions of the planet. In return, the caravans carried back with them back locks of silk brocade, lacquer-ware, and porcelain (Whitfield, Susan, 2004).

4.12. South route

The Southern or Karakoram path used to be for the most part a singular course beginning China all the way through the Karakoram Mountains, and it still continues to this day as the present-day Karakoram freeway, a cemented highway that serves as a means of connecting Pakistan to China through land. Then it sets off towards the west, but amid south going branches in an effort to allow travelers to be able to conclude the expedition by ocean from a variety of positions. Voyaging through the lofty mountains, it crossed the northern regions of Pakistan, above the Hindu Kush Mountain range, and entering Afghanistan, retorting to the north course at a place near Merv. in Turkmenistan. From there it pursued an almost straight past west across hilly regions of Mesopotamia, northern Iran, and the north edge of the Syrian Desert to the Levant, where Mediterranean merchant ships practiced customary paths to Italy, at the same time as land paths departed either south to North Africa or north across Anatolia. An additional bough highway travelled from Haret through Susa to Charaz Sipasnu at the top of the Persian Gulf and transversely to Petra and then Alexandria plus additional eastern Mediterranean docks where crafts accepted the freight to Rome.

4.13. Southwestern route

The Southwestern path is comprised of the Ganges Delta; it remains to be an area under discussion of worldwide attention for more than two centuries. Starbo, the 1st century writer of Roman descent, talks about of the deltaic terrain: ‘concerning traders that now navigate beginning from Egypt...to the extent of Ganges, they are merely general public...’ His observations remain fascinating because Roman globules and additional equipment are still being discovered at Wuri-Betashwar remains, the primordial metropolitan with ancestry since a lot before, prior to the Bronze era, currently being gradually exhumed next to the aged Brahmaputra in Bangladesh. Ptolemy’s drawing depicting Ganges Delta region, a surprisingly precise endeavor, demonstrated his informers recognized the entire route of the Brahmaputra River, passing all the way through the Himalayas, later meandering west to its starting place in Tibet. Without question this delta used to be a chief global trading hub, more or less without doubt commencing a lot before the Common epoch. Precious stones and additional commodities from Thailand and the Javanese region were bought and sold through it. Chinese archaeological writer Bing Jang and a few previous authors and archaeologists, for example Janice Sturgardt, sturdily recommend the route of global trade as Sichaun-Yunnan-Bangladesh-Burma route. According to Bing Jang, particularly from the 12th century the path was employed to transport gold bars from Yunnan (precious metals; gold and silver remain amongst the raw materials in which Yunnan is affluent), throughout north Burma, entering contemporary Bangladesh, employing the early path, identified as the ‘Ledo’ route. The up-and-coming substantiation of the prehistoric municipalities of Bangladesh, especially Wuri-Betashwar remains, Mahashtanghar, Bithagarh, Bakrampur, Egarshindur, and Sonragaon, are believed to be the global trade hubs of this path.

4.14. Nautical route

Marine Silk Route Road is used to categorize the nautical sector of the imperative Silk highway that linked China to the Indonesian Islands, India, Southeast Asia, Arabia, until Egypt finally reaching Europe. The trade path included multiple water bodies; counting Strait of Malacca, Indian Ocean, South China Sea, Arabian Sea, Gulf of Bengal, Persian Gulf and the Red Sea. The marine road is not separate from notable Southeast Asian naval business, India Ocean business, and Spice trade after 8th century – the Arab maritime trade arrangement. The system furthermore extends east towards East China Sea and Yellow Sea to join the Chinese mainland to the Korean Peninsula and the Japanese Islands (Whitfield, Susan, 2004).

4.15. Silk Road heritage

By far the utmost contribution of the famous Silk Road proved to be the exchange of technology, science, architecture, religion, culture, language, philosophy, art, and all additional ingredients of culture were traded all across these roads, accompanied with profitable merchandise the traders operated from nation to nation. On a negative note disease also traveled across this tradenetwork, as is evident by the transmission of the bubonic plague in 542 CE which is believed to appear in Constantinople thanks to the Silk Route and that destroyed the entire Byzantine kingdom. The concluding of the Silk highway enforced traders to discover nautical routes and discover naval passage ways to practice their business, therefore beginning the Age of Discovery which showed the way to universal communication and the early stages of an international society. For the era, the Silk Road provided to expand human beings perceptive of the planet they resided upon; its conclusion propelled the Europeans to cross the oceanic boundary and discover, and ultimately triumph over, the self-styled New World of the Americas. Thus, the Silk highway can be understood to have launched the foundation for the advancement of the contemporary world (Whitfield, Susan, 2004).

5. Economic sectors of trade

5.1. Types of Economic Sectors

The modern economic system as we know it is divided into sectors with each sector representing the amount of expertise and labor needed to reach from raw material to finished product. We study the **five economic sectors types**:

- Primary,
- Secondary,
- Tertiary,
- Quaternary and
- Quandary.

The first is the primary segment, it is that component of the economy that utilizes harvest grown on the soil, and this sector includes essential foodstuffs plus the manufacture of raw materials alongside their wrapping and dispensation. Primary sector activities include farming, agriculture, quarrying, mining, fishing, forestry, and hunting (Trade with the European Union the Pakistan Business Council, 2018).

The secondary sector is concerned with manufacturing completed products. Manufacturing, construction, and processing are all included in the secondary sector. Actions in this sector include textile production, construction, metal working and smelting, automobile production, aerospace manufacturing, the chemical and engineering industries, shipbuilding, energy utilities, and breweries.

The economy's Tertiary sector is the services trade, giving services to the populace and to commerce. Behaviors consist of all discussed until now as services, as well as trade deals, transport and delivery, amusement, eatery, tourism, indemnity, health care, collection, lawful, and secretarial as an only some cases. In every urbanized country and a few rising countries, the major percentage of personnel are at the present in the tertiary sector.

The quaternary and quinary sectors are also explained by several economists. The quaternary is mainly established in jobs that consist of scholarly activities. These comprise of employment dealing with teaching, technical research, administration, customs, libraries, and IT.

The quinary sector is occasionally judged as a division of the quaternary segment. This sector deals with the uppermost echelon of decision making in a civilization. It comprises of the highest-level administrators in, for instance, science, administration, customs, health care, the media, and colleges.

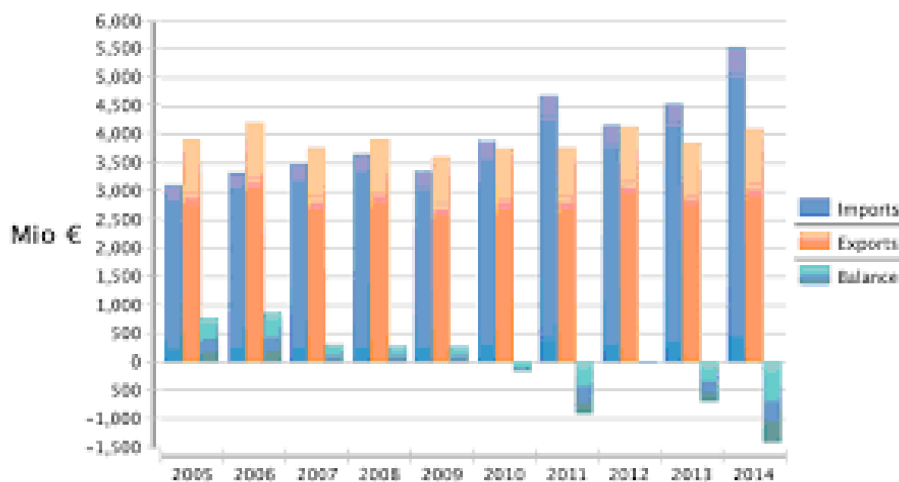


Figure 3. Graph relating Pakistan's imports and exports over a ten-year period (2005-2014).

Source: European Union, Trade in goods with Pakistan.

5.2. Pakistan's imports

Pakistan's imports from the European Union mostly consist of the secondary sector. Pakistani trade in from Europe are primarily consisting of secondary sector goods including products such as machinery and transport equipment which comprised 40.2% of total imports in 2016 as well as chemicals which were 19.5% of total import in 2016. In 2018, Pakistan traded in 60.3 US \$ billion value of commodities globally.

Known Pakistani populace of 207.9 million citizens, its whole 60.3 \$ billion in 2018 trade in interprets to an anticipated \$290 in annual manufactured goods requirement from each individual in the Pakistan. Through a continental point of view, traders in Asia supply nearly three-quarters of overall Pakistani importation produce. Lesser proportions initiate from the European continent (11.9%), North American region (6%), African continent (5.3%), Latin American region (1.2%) not including Mexico but counting the Caribbean, then Oceania (0.7%) led by Australia (Trade with the European Union the Pakistan Business Council, 2018).

5.3. Pakistani exports

Pakistan's exports to the European Union mainly comprise of the Primary Sector. Pakistani sales abroad to Europe are conquered by garments and yard goods, amounting to 82% of Pakistani complete sale to other countries to Europe in 2016. In 2018, Pakistan's mainly precious exported goods were linens, un-knitted and un-crocheted men's outfits and trousers, cotton fiber, rice, natural fiber yarn cloth, rawhide garments or garnishes, interweaved or crocheted men's set of clothes and trousers, woven or crocheted men's shirts, various pieces as well as clothing blueprints followed by ethyl alcohol.

With common terrestrial borders with trade and industry powerhouses like India and China, Pakistan transported supplies about the earth valued at 23.6 billion USD in 2018. The aforementioned dollar sum reveals a -4.4% decline ever since 2014 but an 8% increase beginning 2017 to 2018. Additionally, Pakistan provided services during 2018 an anticipated valued at international 5.3 billion USD encompassing about \$4 billion from business services. Given Pakistan's populace of 207.9 million citizens, its entire \$23.6 billion in 2018 sale abroad interprets to a projected \$120 for each inhabitant in the South Asian nation (Trade with the European Union the Pakistan Business Council, 2018).

5.4. Chances and potentials of future trade

Pakistan and the European Union are constantly looking for new opportunities and initiatives in an effort to enhance bilateral trade and cooperation. In an effort to increase trade opportunities in the future and unlock new potentials the European Union strives in helping Pakistan achieve internal peace and security, as such the European Union supports Pakistan in its fight to battle terrorism and extremism. It is an established fact that Pakistan has put up with extremism further than any other nation and that has adversely impacted its economic capabilities. This was affirmed by Andres Peibalgs, EU Development Commissioner during a lecture on 'The prospect of Pakistan- EU Relations' at The School of Politics and global associations, Quaid-i-Azam University, Islamabad. "We must work mutually in order to fight the danger of radicalism".

Andres Peibalgs believed that even though among the general public of Pakistan collaboration with the 'West' has turned into a contentious subject matter the atmosphere in the European Union is quite different and Pakistan's function in South Asia and in the globe is at the peak of the political program. "EU supervised and maintained the 2008 elections, and presented our complete opinionated support to the latest administration. 'Currently we are prepared to keep on supporting Pakistan in all the sectors which are essential for its autonomous growth. That comprises efforts from our side with the learning institutions, with law enforcement and judicial services, and with the nominated government' he added. Such unwavered support from the EU for Pakistan is of utmost importance and is expected to bring unprecedented growth in bilateral trade between the two regions (The future of EU-Pakistan Relations, 2017).

European Union Commissioner alleged EU to be one of Pakistan's mostly significant overseas markets. And during the course of the past five years the European citizens had financed, by means of their administration and via the Commission, ventures in Pakistan valued at, an estimated, upwards of 300 million € annually. Also there exists the humanitarian assistance provided by the Union after the natural disasters of 2005 and 2010. In 2010 EU responded to the flood without delay, with 430 million € in humanitarian aid packages through various sources. Additionally, millions of Euros were collected by non-governmental organizations (NGOs) and the general European people. He believed that the European people as a whole had concerns regarding that region of the globe. He further added that the Union was focused primarily on two things; understanding between India and Pakistan and harmony in Afghanistan. Europe and Pakistan share a number of principles in common; they have lots of mutual interests and common concerns. He added that the EU pledged Pakistan with their long-term backing and support. The EU is interested in building a strong and dependable affiliation found upon shared benefits. The EU and Pakistan have since come a long way in progressing bilateral relationships ever since the Pakistan-EU Cooperation Agreement implementation in 2004. The EU has toughened their political discourse and their Joint

Commission now convenes regularly. The EU also cooperates in the 'Acquaintances of Democratic Pakistan' faction that is serving to center worldwide awareness on challenges faced by Pakistan (The future of EU-Pakistan Relations, 2017).

VC. Professor Dr. Muhammad Masum Yasenzai in his reception speech held that the EU is not just the financial power house of the globe it in addition does extremely well in the fields of international power and human rights. The associations amid the European Union and Pakistan remain multi coated. The EU remains to be Pakistan's biggest trading associate and has constantly come to aid Pakistan at the time of natural catastrophe such as Earthquakes and Floods. He advised the Commissioner of the EU for educational improvement to allow the Discipline of Politics and International Relations at Quaid-E-Azam International University, Islamabad to agree to a memorandum of understanding (MOU) with The Oxford School of Politics and International Relations and also to sign the scholar's substitute program with the School of African & Oriental Studies (SOAS). 'This shall encourage lasting collaboration among Pakistan and the EU. Venture in schooling reinforces the Unions purpose of democratic system endorsement and superior control in Pakistan. Quaid-e-Azam International University is the solitary community sector institution of higher education in Islamabad, with a factual depiction of every province owing to quota method of student enrollment in every one of its programs. Quaid-e-Azam International University regards its affiliation with the Union important & noteworthy at all levels' he said. An event was attended by a large number of students and faculty members.

6. Most influential factors affecting foreign trade

A number of factors affect trade between two nations. These factors may be broadly categorized as internal and external factors. Here we shall attempt to gauge what affect different assessable internal and external factors have on trade between the European Union and Pakistan (Trade with the European Union the Pakistan Business Council, 2019).

6.1. Internal factors

Impact of Inflation

In the case the inflation rate of a country remains increasing in relation to the nations with which it does business, its current account will decline, and this trend is easily observable when taking a look at the import and export imbalance between Pakistan and the European Union. As discussed, earlier Pakistan's exports to the EU being majorly primary sector goods attain less revenue as compared to EU's exports to Pakistan which are mostly secondary and Tertiary sector goods thus scoring much more revenue and ever increasing the import export deficit between the two regions. Consumers and corporations in Pakistan mostly acquire more

commodities overseas (due to soaring home inflations), although its sale abroad to other states turn down.

Impact due to National Income

In the case a nation's income point (national income) enhances by a superior proportion than that of other countries, its current account is estimated to diminish, additional factors remaining unchanged. While the actual revenue level (accustomed for price rises) increases, thus does the utilization of supplies. A proportion of that raise in expenditure will almost certainly reflect an increased demand for distant commodities. Thus, it is seen that Pakistan should be able to gain from the increase in EU's national income as it will be able to export more goods to the European market. Similarly, with an increase in national income in Pakistan the European Union will also be able to benefit by increasing its exports to Pakistan (Trade with the European Union the Pakistan Business Council, 2019).

Impact due to Government Policies

A state's administration is able to comprise a main consequence on its equilibrium of trade owing to its guidelines on sponsoring exporters, limitations on trade in, or be deficient in enforcement on piracy. This is a major point in the EU-Pakistan trade relations as we seen that Pakistan has historically suffered from poor governance and sub-par policy making. If Pakistan is to increase bilateral trade with the European Union it must be clear and transparent in policy making. The European Union may also be able to help Pakistan by launching initiatives that promote political harmony and relations between Pakistan and itself.

Restrictions to Imports

In the case a nation's administration inflicts taxes on importation merchandise (regularly dubbed tariffs), the cost of overseas produce to domestic customers are in fact augmented. Tariffs forced by the United States administration are usually lesser than those forced by other administrations. A few businesses, on the other hand, are better protected by tariffs than others. Countries including the United States impose heavy import restriction on certain products in order to protect their home markets. Although Pakistan and the European Union enjoy trade at relatively friendly terms, if growth is to be expected drastic steps in the right direction must be taken.

6.2. External factors

Lack of limitations on Piracy

In a few instances a government may have an effect on intercontinental trade courses by its deficiency in limitations on piracy. Within China, the practice of piracy is awfully widespread; persons (referred to as pirates) fabricate counterfeit Computer Disks and Digital Video Disks that look more or less just like the genuine product created in the US and other nations. These CDs and DVDs are then sold locally at a price much lesser than that of the genuine creation. These CDs and DVDs are even sold to markets. It is anticipated that

U.S. manufacturers of music, film, and software lose 2 billion \$ in deals annually due to piracy inside China.

Such lack of policy restrictions on piracy are also rampant in Pakistan and negatively affect trade between Pakistan and the European Union. It is estimated that a number of software and Information Technology firms tend to reserve investment and cooperation with Pakistan due to its lax piracy laws. Pakistan would benefit tons by creating and implementing piracy laws (Trade with the European Union the Pakistan Business Council, 2019).

Impact due to Exchange Rates

Every nation's money is priced with respect to other currencies via exchange rates, such that legal tenders can be substituted to ease global dealings. These exchange rates have a chief impact on business amid two nations. The country whose currency is less valuable, in this case Pakistan would benefit much from exporting to the European Union thereby earning more profit due to the impact of the exchange rate. The European Union would be better off by partnering or investing in Pakistan in order to benefit more from trade with Pakistan.

7. PESTLE Analysis

PESTLE analysis is employed within the business world to estimate and analyze the growth potential of any business venture. According to business studies behind all triumphant achievement of any corporation, there is a team devoted to efficient tactical preparation. At the same time as attaining its objectives assists the corporation to develop within its business, devoid of a steady approach and a capable panel to implement it, a corporation cannot strengthen. If a corporation desires to accomplish an objective, it should furnish an efficient approach to achieve it. The policy ought to be aimed at setting priorities, allocating resources, deciding on a period, coming up with managing systems, assigning human resources and must contain course of action as to how all of the aforementioned facets ought to be treated in order to accomplish the explicit objective in the most efficient manner feasible. Your corporation might have a devoted and expert panel, but how to ensure the policies they procure are useful or not? The response is fairly straightforward; carry out a PEST analysis (Essays, UK, November 2018).

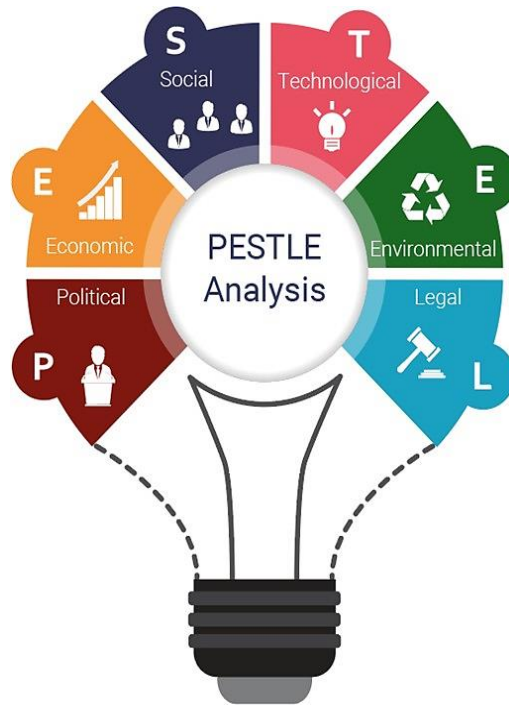


Figure 4. Infographic demonstrating the various factor dealt by the PESTLE analysis.

Source: www.ibisworld.com.

What constitutes PEST analysis?

PEST analysis is an extensively employed tactical Preparation instrument. It identifies the various factors including political, financial, communal and technical aspects that might be of consequence for a venture and its preceding preparation procedure. At times it is extended to contain official as well as ecological aspects and referred to as PESTLE analysis.

By the help of the aforementioned analysis, one can identify potential opportunities and threats associated with one's approach and work out techniques to obtain benefit from the opportunities and steer clear of the threats. Political factors take account of everything from tax guidelines, occupation regulations, excise & employment limitations, customer security laws to ecological conventions and political strength of a nation etc. Economic aspects comprise factors such as financial expansion pointers, interest rates, inflation charge, substitute rates, monetary guidelines, unemployment tendencies and other such factors. Social factors contain factors like educational facets, vocational outlook, societal classes, age division, health awareness, population increase rate and other similar issues. Technological factors as the name suggests include factors such as pace of technical alteration, knowledge inducements, expenditure on research & development, central road and rail network stage etc. Legal aspects comprise tax regulation, employment regulation and all further laws concerning trade not considered in political reasons. Environmental causes take account of real-life statistics about diverse periods, sun, snow, monsoon etc. Such factors may seem insignificant but prove decisive for a company. Evaluating the above-mentioned aspects aid in gaining a complete comprehension of the exterior (international ecological) aspects that could optimistically or pessimistically influence a corporation's tactical preparation procedure. With right to use to

such information, one is able to rapidly produce policies that would place a corporation on the fast track to attaining its objectives (Country Risk of Pakistan: International Trade).

- a) Envisage all the aspects by listing them together for improved managerial abilities. In terms of taking a decision or policy construction, covering the entire necessary data collectively in a single position is as imperative as having a panel in concert.
- b) A PEST study, comprising of a network with four subdivisions in place of every one of the aforementioned factors, puts together all the significant details needed to make judgments as well as put together fail proof policies. Thus, performing a PEST study before one's tactical preparation meeting is extremely imperative, since it not only helps in being vigilant about verdict building, however it also keeps one on the right track.
- c) It is the most effective way to make out chances and coercion.
- d) Collecting data is merely the primary stride of a PEST study; one time the data is gathered, the subsequent step is to calculate it. By evaluating the information provided by the various factors, one is capable of making out the prospects and pressures attributable to the internal and outer aspects. As a result, one can center on the mainly significant prospects and gaining from them whilst simultaneously coming up with strategies to counter the coercion.
- e) Usually a PEST study is utilized to collect the contribution to be incorporated in the prospects and coercion segment of a SWOT study, which sequentially is employed to create premeditated arrangement verdicts. PESTLE study also offers contribution for the SWOT analysis figures.
- f) PEST analysis grants the capability to collect data from specialists and contrast it with additional features.
- g) A PEST study is not regarding jotting down biased, financial, collective and technical aspects that one just knows of, has heard of or made hypothesis about. One needs to look for figures from specialists who are conscious of contemporary circumstances with consideration to every region (Essays, UK. November 2018).

Such information would be greatly helpful in constructing successful approaches. Subsequent to one separately gathering data for the related reasons the PEST figure will be exceedingly functional in evaluating them with further aspects. This makes it simpler invent explanations for coercions and techniques to build the greatest of the prospects on hand so as to assist one's company in attaining its objectives. A PEST study is an essential element of every tactical planning procedure. Lacking a universal plan regarding the exterior aspects that would have an effect on one's corporation or its approach, one will in no way be capable of reaching one's mark or achieving one's goals. Alternatively, the across-the-board imminent one might achieve by using PEST analysis will guarantee that the tactics one comes up with might be triumphant (Essays, UK. November 2018).

7.1. PEST examination of the European Union (EU)

The following thorough PESTEL study of the EU shall be aimed at exploring a number of the various biased, financial, communal, technical, ecological, and lawful aspects influencing the European Union in present day. The European Union came into being thanks to the efforts of European Economic Community (EEC) which was formed in 1958. The aim of the EEC at the time of its establishment was to augment trade and industry collaboration among the following six nations; Italy, Belgium, France, Germany, the Netherlands and Luxembourg (Rahman, PESTEL analysis of the European Union, 2019).

7.2. How to intensify trade

The European Union and Pakistan have decided to sign a new Strategic commitment Plan aimed at building a sturdy partnership in various turfs. The parties came to an understanding at the fourth round of Strategic exchange of ideas between the Union and Pakistan held in Islamabad. Foreign Minister Shah Mehmood Qureshi piloted the Pakistani side at the dialogue while the Union was led by Foreign Policy Chief Federica Moghireni. Later while dealing with a combined news convention along with EU Foreign Policy Chief, Shah Mahmood Qureshi was positive that the commitment arrangement, which will be officially signed in Brussels, will lay the basis for a brilliant outlook between the European Union and Pakistan. He alleged that the bilateral trade amid the European Union and Pakistan has almost doubled since the award of GSP Plus position to Pakistan in 2013. He held that the current administration is dedicated to improving exports to Europe and repair the trade deficit problem in addition to creating additional jobs for Pakistanis through trade with Europe. The Pakistani Foreign minister stated that he also debriefed the EU designation about the steps taken by Pakistan to fulfill the requirements imposed by the Financial Action Task Force (FATF) as well as the steps taken to purify the tribal belt.

The Foreign Minister held that both the parties also held negotiations regarding the status of International Non-Governmental Organizations (INGOs). The Federal Minister indicated that 75 INGOs were listed and operational in Pakistan. He also held that he updated the EU designation that Pakistan was willing to engage with India to determine all out remaining conflicts through a continued discourse as it is the lone rational way ahead. He further added that both the sides were certain that answer lies only in discussion course of action. He emphasized that India and Pakistan were two neighboring Atomic Powers and as such any little conflict between the two would be highly reckless. The Foreign Minister believed Pakistan had always displayed self- control and given a calculated reaction. He added that a variety of steps were taken to deescalate the stress between the two neighboring Atomic powers as well as the urgent freedom of detained Indian pilot. He emphasized that the global community was not unaware to the steps that were taken by Pakistan including the immediate reinstatement of Pakistan's high commissioner to India and reinstating the hotline between the military directorates.

On the topic of Afghanistan, Pakistan's Foreign Minister Shah Mahmood Qureshi held the European Union designation shared Pakistan's apprehension for harmony and steadiness in the region. He was reported as saying that there was no military resolution to the problem of Afghanistan, as is now clear by the recent US-Taliban peace negotiations. He said that the EU delegation respected Pakistan's role in the ongoing Afghan settlement process. Regarding Iran, Shah Mahmood Qureshi stated that the Pakistani delegation enlightened the European side that Iran, being a neighboring country, was extremely important for Pakistan. He also repeated Pakistan's worry regarding the growing Islamophobia in the West. (Khurram Abbas, Pakistan's Relations with European Union, 2015).

Ms. Moghireni, for her part was reported saying that the fresh Strategic Partnership Plan will lay a sturdy groundwork for collaboration between the European Union and Pakistan in an effort to further boost cooperation between the two parties in the future. She believed there was a common approach amid the two sides, counting the Afghanistan issue. She held that both parties had decided to work together on multiple grounds. EU Foreign Policy Chief Ms. Moghireni valued Pakistan's stance explicitly de-escalating stress with India and the crackdown of the Pakistani security forces against the terrorists. She also said that the European Union fully supported Pakistan in its war against terror. The high representative of the European Union also treasured Pakistan's labors for the harmony and constancy in the Afghanistan region.

7.3. Latest challenges to the EU's trade policy

The effectiveness of the Union's trade strategy is owed to the centralized arrangement of the Union and to a general strategy notion common between the constituent nations. The Union is a prominent participant in global business and the world foremost exporter of services. It follows a grand approach of free marketplace which is administrated by carefully planned regulations. The latest free-trade contract which was signed with Japan came to be implemented on 1st of February. The contemporary global business framework has altered owing to callous rivalry given by the up-and-coming nations and the growing distrust of the community of the industrial economies that believe they endure the unconstructive impacts of globalization. In reality, globalization has pulled more than one billion people out of poverty. The fall of multilateralism has an effect on the EU more than ever, since it is dedicated to a rules-based approach to international relations. Even though the EU gained triumph regarding its trade strategy, this will not be adequate to persuade its general public in the forthcoming European voting in May. A social strategy must be added to balance trade openness, jointly with a manufacturing strategy to help the Union preserve its place on the markets.

Past the contestation of economic globalization, the Union trade policy faces a string of challenges to which it will have to adjust (Ana Ballesteros-Peiró, 2015).

8. Conclusions

8.1. Which trade policy model to follow?

Europe's trade strategy, outlined during the 1990's requires an update to improved react to citizens' outlook and to the disputes put forward by globalization. Even though the odious loom causing numerous liberated trade discussions is still practical, its blow on worldwide expansion remains to be limited as 0.5% of the European gross national product (GNP) was anticipated from a liberated trade accord among the citizens of the EU and USA assurance, both in terms of substance and procedure, is deficient.

The Union has succeeded in setting superior lucidity in activity in regards to how the business strategy is administered. Nevertheless, it is exceedingly improbable that this will prove adequate. It may now accustom its trade strategy towards:

An effectual defense of its own welfare that the constituent nations are no longer able to assure at a nationwide level. It is factual that the European business defense strategy was significantly reinforced in 2017 and 2018, Courses of action that aim to moderate the unconstructive societal brunt of trade gap, many of which are without a doubt out of its trade capability. An absurdity of the trade strategy is that there are no European societal policies to recompense for the communal expenses of free-market economy. This opening has certainly nourished disapproval of a Europe prone to be too dependent on free-markets.

The conclusion of the domestic marketplace

A further synchronized move toward manufacturing strategy formulation. It can be identified, in the lack of any European manufacturing strategy, the similar contradiction as with the societal policy: a general trade policy for asymmetric economies.

Quite a few of these orientations go further than the trade policy and necessitate advancement towards a nearer financial and political amalgamation, thereby, ensuring a common political will.

8.2. Moving towards a more defensive trade policy?

The European move forward was by no means of "free trade" but rather of "open trade with rules" aimed at of exploiting globalization. Nevertheless, this advance is being disputed by the enthusiasm of emergent countries, the mount of protectionist proposals and an insight by the citizen's view that the trade guiding principle is not adequately defensive.

A domestic discussion was initiated in 2017, markedly by France, on three themes casing both the domestic market and peripheral trade:

1. An amendment of the subsequent employees' decree in the EU, dated back to 1996. France persisted on more stern circumstances, particularly the same wages and home circumstances to be reputable following twelve months. Subsequent to a vigorous

deliberation among the constituent countries a middle ground was established in October 2017.

2. Reciprocity in public procurement.
3. Better management of foreign reserves/attainment of tactical possessions, specifically bynationalized companies.

At the same time as the UK, one of the major proponents of liberated trade wants to depart the EU, and German manufacturing, conventionally not in favor of protective procedures, is sensing the anxiety of Chinese producers, conditions are in early stages of transformation. More than a few initiatives imply by now a more self-protective trade strategy: the restructuring of anti- dumping tools, better spotlight on the appliance of bilateral trade accords, growth towards better power over foreign reserves. The manufacturing facilities of eighteen constituent nations have urged the next Commission to reinforce the resources of the trade strategy as well as to offer an aggressive manufacturing strategy favoring European competitiveness. The EU's trade strategy direly needs to be redesigned. To be comprehended by the people it has to be held up by European scale community dealings to poise trade honesty in a sufficient way. Trade candidness has to be backed by a European industrial approach, so that it has the resourcesto keep hold of its position on acrimoniously uncertain global marketplace. While the Unions trade plan achieved optimistic results once, that might not be enough in the way of conveying thesupport of populace for the subsequent European voting. This May, the Union is due for a rendezvous with its people.

8.3. How to overcome these challenges?

A compound of internal and external factors affecting trade between the EU and Pakistan has been discussed in the prevailing document. A holistic approach needs to be followed in order to enhance bilateral relations between the two entities. A host of programs ranging from cultural exchange programs to development and aid programs have already been employed in the pursuit of betterment of relations.

Furthermore, other initiatives in the Tech and IT industry may also be employed in an effort to not only improve bilateral relations between the two entities but also as a means of transfer of knowledge from a more advanced nation to a less advanced nation. Political initiatives have beenlaunched in the past but political programs aimed at improving trade between the two nationswill prove to be highly effective.

References

1. Abbas, K., Khan, M.N., (2017). Pakistan-US Relations Under Trump Administration: Opportunities and Challenges for Pakistan. *Journal of Security & Strategic Analyses*,3(2), pp. 90-117.
2. Castillo-Triana, R. (2001). Legal Aspects of Equipment Leasing in Latin America. *Legal Aspects of Equipment Leasing in Latin America*, pp. 1-416.
3. Das, M. (2019). Financing of Terrorism in a Globalised World: A Case Study of Pakistan. *Emerging Conflicts and Regional Security in South Asia*, p. 172.
4. Fatima, Z. (2018). A brief overview of GSP+ for Pakistan. *Journal of European Studies (JES)*, 34(2), pp. 81-100.
5. Fuerea, A. (2021). EU-UK Brexit Agreement and its main legal effects. *Challenges of the Knowledge Society*, pp. 419-423.
6. Goñi, N., Ramírez, R., Vidal, A. (2020). *Strategic analysis report*, April 2020, pp. 1-68.
7. Howorth, J. (2014). *Security and defence policy in the European Union*. Bloomsbury Publishing, pp. 415-617.
8. Islam, M.S., Rahman, M.R., Prodhana, M.D.H., Sarker, D., Rahman, M.M., Uddin, M.K. (2021). Human health risk assessment of pesticide residues in pointed gourd collected from retail markets of Dhaka City, Bangladesh. *Accreditation and Quality Assurance*, 26, pp. 201-210.
9. Ismailzade, F., Krnjević Mišković, D., Pashayev, H., Aghayev, N., Chetin, H., Japaridze, T., Sachs, J.D., Safayev, S., Seyidov, S., Starr, F., Wimbush, E. (2020). *Baku Dialogues Vol. 4, No. 1, Winter 2020-2021*.
10. Jain, R.K. (ed.) (2017). *India, Europe and Pakistan*. KW Publishers Pvt Ltd., pp. 1-7.
11. Jubber, K.L. (2018). *A cross-cultural analysis of corporate press statements: A case study of Monsanto* (Doctoral dissertation). Stellenbosch: Stellenbosch University, pp. 4157-6176.
12. Kemal, A.R. (1998). Industrial development in Pakistan. *Pakistan Journal of Applied Economics*, 14(1), pp. 107-19.
13. Khattak, S. (2020). *The European Union's external relations: example of EU & Pakistan* (Doctoral dissertation). Université Paris-Saclay, pp. 490-617.
14. Khorana, S., Martínez-Zarzoso, I. (2020). Twenty-First-Century Trade Governance: Findings from the Commonwealth Countries. *Contemporary Economic Policy*, 38(2), pp. 380-396.
15. Ludmila, B. (2020). Public perception of human trafficking: a case study of Moldova. *Comparative Migration Studies*, 8(1).
16. Majeed, M.T., Malik, A. (2017). Selling souls: An empirical analysis of human trafficking and globalization. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, 11(1), pp. 353-388.

17. Mendoza Cassere, D., Valencia, G.E., Cárdenas-Gutiérrez, J.A. (2018). An integral PEST study of biomass as energy resource. *Contemporary Engineering Sciences*, 11(64), pp. 3167-3176.
18. Mirjat, N.H., Uqaili, M.A., Harijan, K., Valasai, G.D., Shaikh, F., Waris, M. (2017; 2025). A review of energy and power planning and policies of Pakistan. *Renewable and Sustainable Energy Reviews*, 79, pp. 110-127.
19. Mustafa, A., Qayyum, A. (2016). Impact of technical barriers to trade on trade between China and Pakistan. *The Pakistan Development Review*, pp. 235-250.
20. Soomro, M.I.A.A., Ansari, I.A. (2022). The GSP+ and Exports of Pakistan to the European Union. *Journal of European Studies (JES)*, 38(2), pp. 38-54.
21. Stang, G. (2013). *Building a Secure Future for Pakistan: A Role for the EU*, pp. 1-21.
22. Ulubeyli, S., Kazanci, O., Kazaz, A., Arslan, V. (2019). Strategic Factors Affecting Green Building Industry: A Macro-Environmental Analysis Using PESTEL Framework. *Sakarya University Journal of Science*, 23(6), pp. 1042-1055.
23. Whitfield, S., Sims-Williams, U. (eds.) (2004). *The Silk Road: trade, travel, war and faith*. Serindia Publications, Inc., pp. 1-100.
24. Wolf, S.O. (2019). The GSP+ Conundrum and the CPEC's Impact on EU-Pakistan Economic and Trade Relations. In: *The China-Pakistan Economic Corridor of the Belt and Road Initiative: Concept, Context and Assessment* (pp. 243-260). Cham: Springer International Publishing.
25. www.cigionline.org, 17.12.2019.
26. www.coursehero.com, 15.12.2019.
27. www.css.ethz.ch/en, 19.01.2020.
28. www.dw.com/en, 27.01.2020.
29. www.ec.europa.eu, 15.10.2019.
30. www.eeas.europa.eu, 15.10.2019.
31. www.en.wikipedia.org, 19.10.2019.
32. www.geo.tv, 5.02.2020.
33. www.global-counsel.com, 11.02.2020.
34. www.goi.org, 5.01.2020.
35. www.howandwhat.net, 22.11.2019.
36. www.import-export.societegenerale.fr, 27.10.2019.
37. www.ipripak.org, 22.12.2019.
38. www.m.economictimes.com, 6.11.2019
39. www.pbc.org.pk, 7.11.2019.
40. www.politico.eu, 5.11.2019.
41. www.qau.edu.pk, 21.10.2019.
42. www.radio.gov.pk, 21.10.2019.
43. www.robert-schuman.eu/en, 11.01.2020.

44. www.thecommonwealth.org, 17.10.2019.
45. www.ukessays.com, 12.11.2019.
46. www.unodc.org, 5.11.2019.
47. Zajączkowski, J., Wolf, S.O. (2014). EU-Pakistan relations: European perspectives at the turn of the twenty-first century. In: *The Merits of Regional Cooperation: The Case of South Asia* (pp. 131-151). Cham: Springer International Publishing.

HEALTH BEHAVIOUR IN BABY BOOMERS AND GENERATIONS X, Y, AND Z: FOCUS ON DIETARY FIBRE AND SATURATED FAT INTAKE

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Purpose: To assess the frequency of food intake as a source of dietary fibre and saturated fatty acid intake in terms of preventive health care for women and men of the baby boomer (BB), X, Y, and Z generations.

Design/methodology/approach: The research instrument was a survey questionnaire administered through the computer-assisted web interviewing (CAWI) method using Google Forms. The survey was conducted from February to March 2023. The survey included 204 respondents between the ages of 19 and 60, residents of Gdynia. Purposive group selection was used. The results of the survey are presented as the percentage distribution (percentage) of each evaluation (% of indications). A chi-square test with Yates correction was used to determine the effect of gender and age on lifestyle, dietary style and frequency of dietary fibre and saturated fatty acid intake in the study groups.

Findings: Analysis of the consumption of selected food groups by respondents showed that gender and age influenced the lifestyle and type of selected food products consumed by adults, and therefore the attainment of individual nutrient requirements, and the risk of chronic non-communicable diseases. It is satisfactory that the level of fat intake among the surveyed group of respondents was at an appropriately low level. On the other hand, the inadequate and very low intake of dietary fibre among women and men remains a concern.

Research limitations/implications: The research has certain limitations. The results obtained are not representative and cannot be generalised to the population of women and men of the baby boomer (BB), X, Y and Z generations in Poland.

Practical implications: The present study is part of health risk management and health promotion in the Polish population. It is important that adults (in Poland) pay attention to the impact of the products they consume on their health, since the lack of a balanced diet and an excessive supply of simple carbohydrates and saturated fatty acids carries a risk of reducing their quality of life. It is essential to conduct research monitoring the dietary behaviour of various population groups to evaluate the need for preventive actions to ensure health and better safeguard the mental and physical condition of current and future generations.

Social implications: The research is part of health risk management and health promotion in the Polish population.

Originality/value: The research adds to the knowledge of adult eating behaviour from the perspective of the Sustainable Development Goals.

Keywords: adult consumers, eating habits, health-related quality of life.

Category of the paper: Research paper.

1. Introduction

The analysis of changes in consumer behaviour worldwide suggests that trends in food consumer behaviour are a result of existing threats to food and food security (Garbowska, Radzymińska, Tarczyńska, 2021). The above values are closely related to the assumptions of the Sustainable Development Goals (SDGs). The SDGs represent a roadmap for transforming and reshaping the world in a sustainable manner, meeting the needs of the present generation while respecting the environment and taking into account the needs of future generations (Wiśniewska, 2022). The SDGs aim to develop and perpetuate specific trends in food consumption or contribute to their development. Linking SDGs to food and/or food security issues include: Goal 3 – Ensuring a healthy life for all at all ages and promoting well-being, i.e. "We must continue to work harder to overcome the incidence of many diseases and emerging health threats"; and Goal 4 – Ensuring quality education for all and promoting lifelong learning, as "Quality education is the foundation for improving people's lives and for sustainable development. Universal access to education improves the quality of life and enables innovative solutions to the world's biggest problems" (Wisniewska, 2022).

Non-communicable diseases (NCDs), including cardiovascular disease (CVD), are the leading cause of death worldwide, and account for the largest number of deaths (Bennett et al., 2018; WHO, 2022). An important element in the prevention, both primary and secondary, of CVD is an adequate diet. The results of numerous studies indicate that the type of dietary fat consumed significantly affects the cardiovascular system. The intake of saturated fatty acids significantly affects the lipid profile and may increase the risk of CVD. Implemented diets for individuals, as well as for entire populations, should include recommendations to reduce the intake of saturated fatty acids and increase the intake of fruit and vegetables (Riccardi et al., 2022; Vesnina et al., 2022). A scientific study on the effect of the consumption of saturated fatty acids and trans isomers by adults, children and adolescents confirmed that these substances are responsible for an increase in total cholesterol, LDL fraction cholesterol and diastolic blood pressure. In the prevention of cardiovascular diseases, and thus in the prevention of increased mortality, the intake of the aforementioned fat groups should be as low as possible (Ekhmke vel Emczyńska-Seliga, 2019; Schade, Shey, Eaton, 2020). According to dietary recommendations for the Polish population, in order to maintain the lipid profile and normal

body weight at an appropriate level, depending on age and gender, the supply of saturated fatty acids (SFA) should be limited to a maximum of 10% of the total daily energy intake of the diet. The rest of the energy requirement should be provided by unsaturated fatty acids, of plant origin and contained in marine fish, seafood or algae (Jarosz et al., 2020).

Fats and oils, whose over-consumption negatively affects human health, are essential components of the diet and cannot be completely eliminated from daily menus. From a physiological point of view, they are the main source of energy, being at the same time a carrier of fat-soluble vitamins (A, D, E and K) and components necessary for the proper development and functioning of the organism, i.e. essential unsaturated fatty acids (EFAs) or antioxidants (Dutkowska, Rachoń, 2015). Criteria for consumer evaluation of fats are taste, aroma, appearance, texture and consistency (Ognean et al., 2006, Zychnowska et al., 2015), and more recently, fat quality has also been associated by consumers with its nutritional value related to the presence of essential fatty acids or n-3 and n-6 fatty acids (Dutkowska, Rachoń, 2015; Gutkowska et al., 2012; Fattore, Massa, 2018). Zychnowska et al., 2015).

Another particularly important and recommended dietary component for healthy individuals and patients with metabolic diseases is dietary fibre (Godula, 2019). Its presence in the food consumed reduces the rate of absorption of carbohydrates and saturated fatty acids (Włodarek et al., 2014). An additional advantage of fibre consumption is its anti-obesity and weight-reducing effect, which is particularly important in the prevention of type 2 diabetes. Dietary fibre plays an important role in the functioning of the large intestine. It influences stool weight and composition and is important for the development and composition of the bacterial flora. Insulin and fructooligosaccharides are of particular interest because of their probiotic properties (Paczkowska, Białkowska, Kunachowicz, 2001; Searle et al., 2009). These compounds stimulate the growth of bacteria from the *Lactobacillus* and *Bifidobacterium* genera that live in the large intestine (Douglas, Sanders, 2008). The recommended amount of fibre in an adult's daily diet is 20 to 40 g (Jarosz et al., 2020). Dietary fibre intake for people with diabetes, obesity or overweight should be about 15 g/1000 kcal diet (2020 Guidelines). The presence of fibre in food, especially fermenting fibre, is the basis of a healthy diet, while prebiotics are specialized food ingredients that affect specific bacteria and their final fermentation products, and thus have a beneficial effect on the host's health (Hoyles, Vulevic, 2008; Macfarlane, Steed, Macfarlans, 2008).

The literature emphasises (Kaczor-Szkodny, Szkodny, 2021) that the emergence and formation of health attitudes and behaviours are determined by gender, self-perception in the health space and the performance of social roles. Nutrition is one of the basic factors influencing the physical and mental development of the human being, as well as the proper functioning of the organism at each stage of human life. Insufficient, excessive, or poor-quality food supply can affect well-being and health at any stage of life (Ojo et al., 2018, Suliga et al., 2021, Sagili et al., 2022). With the progress of civilisation, adults' lifestyles are changing, and this has consequences also with regard to health. Hence, knowledge about consumer dietary behaviour

and lifestyle factors that affect human health is constantly changing (Kelly, Ciclitira, 2011; Spencer et al., 2015; Wolnicka, Taraszewska, 2019). The relationship between attitudes towards health and eating behaviour is most often described in the literature as positive and characterised by varying strength (Backman et al., 2002; Hearty et al., 2007; Sun, 2008; Pieniak et al., 2010; Czarnocińska et al., 2013). A positive attitude towards nutrition does not determine the consumption of a properly composed meal on a given day, e.g. due to lack of access to appropriate food products, lack of time for meal preparation, etc. (Czarnocińska et al., 2013). For example, young women in Poland mostly show a positive attitude towards health and the health values of food, but they do not pay attention to the cholesterol and saturated fatty acid content of the food products they consume (Platta, Sawlewicz, 2022). Furthermore, the level of acceptance of innovations introduced in food products to reduce total fatty acids depended on the sociodemographic characteristics of female consumers, such as age and education level (Platta, Smigaj, 2021).

According to the authors of the publication, health behaviours, including eating habits, play a key role in maintaining health and reducing the risk of developing many chronic diseases. One important aspect of a healthy diet is to consume adequate amounts of dietary fibre and limit the intake of saturated fatty acids. In the context of public health, the study of these behaviours can contribute to the identification of risk factors and the implementation of effective educational programmes and health interventions. The aim of this study was to assess the frequency of food intake as a source of dietary fibre and saturated fatty acid intake in terms of preventive health for women and men of the baby boomer (BB), X, Y and Z generations.

2. Research methodology

The empirical research was conducted by means of a diagnostic survey, using an indirect interview technique via an online platform (CAWI) from January to February 2023. Respondents gave informed and voluntary consent to participate in the study. They also confirmed that they were familiar with the risk factors associated with the implementation of the CAWI survey.

The study involved 204 respondents aged 19 to 60, residents of Gdynia, including 114 women (55.88%) and 90 men (44.12%) (Table 1). Purposive group selection was used. The study group was dominated by people from generation Z (41.18%) and generation X (30.88%). Generation Y accounted for 14.22% and BB 13.72%. In terms of educational attainment, among both men and women there was a predominance of those with a secondary level of education (50.00 and 54.39% respectively) (Table 1).

Table 1.
Study sample characteristics

Sociodemographic features	% of indications	
	Men	Women
Sex	44.12	55.88
Generations		
Z	20.00	57.89
Y	15.55	13.16
X	37.78	25.44
BB	26.67	3.51
Educations		
Basic	24.44	9.65
Secondary	50.00	54.39
Higher	25.56	35.96

Source: own elaboration based on survey results.

The survey questionnaire included closed-type questions in thematic blocks covering information characterising the population surveyed (gender, age, level of education) and collecting respondents' opinions on their individual self-assessment: health status, diet, lifestyle and the importance of health values of food for consumption.

Two aspects of eating behaviour were assessed using the food frequency method: 1. fibre intake – as a measure of consumption of foods with health-promoting characteristics; 2. fat intake – as a measure of consumption of foods that are not conducive to health, especially when overconsumed.

Validated questionnaires were used in the assessment: 1. the Block Screening Questionnaire for Fruit/Vegetable/Fiber Intake (BSQFVF) (Thompson, Byers, 1994); 2. the Block Screening Questionnaire for Fat Intake (BSQF) (Thompson, Byers, 1994) as modified by Czarnocinska et al. (2013).

The BSQFVF questionnaire was used to obtain data on the habitual frequency of consumption of nine food groups that are sources of dietary fibre. Fibre intake was expressed on a point scale (0-36 points) (Thompson, Byers, 1994; BSQFVF questionnaire). Based on the sum of the points, individuals were assigned to groups of fibre intake as follows: very low (<20 points), inadequate (20-29 points), adequate (≥ 30 points).

Using the BSQF questionnaire, information was collected on the habitual frequency of consumption of 11 food groups, which are either separated fats or important sources of fat in the diet. Fat intake was expressed on a point scale (0-44 points) (Thompson, Byers, 1994). Based on the sum of the points, individuals with fat intake were distinguished between: very high (>27 points), high (25-27 points), moderately high (22-24 points), low (18-21 points), very low (best) (<18 points).

The empirical data collected were statistically analysed using Statistica 13.3. The results of the study were presented by means of the percentage distribution (percentage) of the individual scores (% of indications). A chi-square test with Yates correction was used to determine the effect of gender and age on lifestyle, dietary style and frequency of dietary fibre and saturated fatty acid intake in the study groups. For all analyses, significance was set at $p \leq 0.05$.

3. Results and discussion

Lifestyle and physical activity assessment

Lifestyle assessment of the respondents was carried out taking into account the gender of the respondents. Women and men differed significantly in their assessment of lifestyle and diet except for appreciation of tradition, where no differences were observed in the answers given ($p = 0.11$) (Table 2). Respondents were predominantly engaged in work, study (37.75 and 28.44% of men and 47.55 and 37.25% of women, respectively) and pleasure-oriented activity (36.28% of men and 37.25% of women). In the subjective assessment of their health consciousness, as many as 21.08% of men gave an ambivalent answer ("neither disagree nor agree"), while 33.33% of women answered "I mostly agree" and "agree". Both women and men were dominated by those who value tradition, 29.91 and 29.41%, respectively (Table 2).

Table 2.

Respondents' subjective self-assessment of the lifestyle pursued

Criteria assessed	% of indications		
	Men	Women	p (Chi2)
I consider myself to be a committed professional person			
I disagree	0.98	2.94	0.04
I mostly disagree	2.45	0.98	
I neither disagree nor agree	2.94	4.41	
I mostly agree	18.14	13.73	
I agree	19.61	33.82	
I consider myself to be a person committed to learning			
I disagree	3.43	5.89	0.05
I mostly disagree	2.94	3.43	
I neither disagree nor agree	9.31	9.31	
I mostly agree	15.69	11.27	
I agree	12.75	25.98	
I consider myself a pleasure-oriented person			
I disagree	0.50	8.82	0.01
I mostly disagree	2.45	3.43	
I neither disagree nor agree	4.90	6.37	
I mostly agree	22.06	25.98	
I agree	14.22	11.27	
I consider myself to be a health-conscious person			
I disagree	0.98	1.96	0.09
I mostly disagree	3.43	3.92	
I neither disagree nor agree	21.08	16.67	
I mostly agree	13.24	21.57	
I agree	5.39	11.76	
I consider myself a person who values traditions			
I disagree	1.47	2.94	0.11
I mostly disagree	1.96	6.37	
I neither disagree nor agree	10.78	17.16	
I mostly agree	15.69	12.25	
I agree	14.22	17.16	

Source: own elaboration based on survey results.

In subjective dietary assessment, men and women differed significantly in paying attention to the naturalness of food, convenience and speed of storage, and the health value of the food consumed ($p \leq 0.05$). More men than women considered that they paid attention to the naturalness of food (its low level of processing): 25.00% and 19.61% respectively. Also, more men (33.83%) than women (31.86%) valued the speed and convenience of food preparation and paid attention to the health value of the food consumed (23.04% and 22.55% respectively) (Table 3).

Table 3.

Respondents' subjective self-assessment of the diet implemented

Criteria assessed	% of indications		
	Men	Women	p (Chi2)
I consider myself a person who pays attention to the naturalness of food (low level of processing)			
I disagree	0.49	3.43	0.01
I mostly disagree	2.94	7.84	
I neither disagree nor agree	15.69	25.00	
I mostly agree	18.63	12.75	
I agree	6.37	6.86	
I consider myself to be a person who values the convenience and speed of food preparation			
I disagree	0.00	1.96	0.01
I mostly disagree	4.41	14.71	
I neither disagree nor agree	5.88	7.35	
I mostly agree	13.24	11.27	
I agree	20.59	20.59	
I attach great importance to the health benefits of the food I eat			
I disagree	0.00	4.41	0.03
I mostly disagree	4.41	14.22	
I neither disagree nor agree	16.66	14.71	
I mostly agree	17.16	19.12	
I agree	5.88	3.43	

Source: own elaboration based on survey results.

Subjective self-assessment of health

The subjective self-assessment of the respondents' health status was carried out taking into account two factors differentiating the study group: gender of the respondents and age. No significant differences were observed in the subjective assessment of health status between women and men ($p = 0.37$). However, significant differences were observed in groups where age was the dividing criterion ($p = 0.01$) (Table 4). In the group of men, regardless of age, those describing their health as "good" predominated (from 46.43% in the baby boomer generation to 9.52% in generation Z). Women also, apart from Generation Z (where those describing their health as "neither bad nor good" 27.38% predominated), described their health as good (Table 4). Interestingly, none of the respondents described their health status as "bad" or "very bad".

Table 4.*Respondents' subjective self-assessment of their health status*

Health status	Generations	% of indications		<i>p</i>
		Men	Women	
Very good	BB	3.57	0.00	0.01* 0.37**
Good		46.43	10.72	
Neither bad nor good		35.71	3.57	
Very good	X	17.47	9.52	
Good		22.22	26.98	
Neither bad nor good		14.29	9.52	
Very good	Y	13.79	6.90	
Good		17.24	37.93	
Neither bad nor good		17.24	6.90	
Very good	Z	8.33	9.52	
Good		9.52	27.38	
Neither bad nor good		3.58	41.67	

Explanatory notes: * Chi² health status v generation, **Chi² health status v gender.

Subjective self-assessment of diet

Significant differences were observed in the subjective self-assessment of respondents' diets, both between men and women ($p < 0.01$) and within groups, by age ($p < 0.01$). Among men, apart from generation Z (which was dominated by those describing their diet as "sometimes correct and sometimes incorrect" – 11.91%), those describing their diet as "mostly correct" predominated (from 20.69% in generation Y to 39.29% in the BB). In contrast, among women, regardless of age, those describing their diet as "sometimes correct and sometimes incorrect" predominated (from 7.14% for the BB to 54.76% for generation Z) (Table 5).

Table 5.*Respondents' subjective self-assessment of diet*

Diet	Generations	% of indications		<i>p</i>
		Men	Women	
Incorrect	BB	0.00	0.00	<0.01* <0.01**
Rather incorrect		3.57	0.00	
Sometimes correct and sometimes incorrect		39.29	7.14	
Mostly correct		42.86	7.14	
Definitely correct		0.00	0.00	
Incorrect	X	0.00	0.00	
Rather incorrect		3.17	3.17	
Sometimes correct and sometimes incorrect		17.46	23.81	
Mostly correct		25.40	17.46	
Definitely correct		7.94	1.59	
Incorrect	Y	0.00	0.00	
Rather incorrect		6.90	6.90	
Sometimes correct and sometimes incorrect		13.79	34.48	
Mostly correct		20.69	10.34	
Definitely correct		6.90	0.00	
Incorrect	Z	0.00	3.57	
Rather incorrect		1.19	7.15	
Sometimes correct and sometimes incorrect		11.91	54.76	
Mostly correct		5.95	11.90	
Definitely correct		2.38	1.19	

Explanatory notes: * Chi² diet v generation, **Chi² diet v gender

The reasons for the differences in eating behaviour and attitudes towards the implemented diet between men and women can be traced back to both psychological and socio-cultural factors. Some differences, depending on gender, appear as early as childhood or adolescence. Women tend to be more aware and knowledgeable about nutrition than men. Women consume more fruit, vegetables, processed cereals and whole grain products, while the consumption of red meat, especially pork, processed meats or eggs is higher in men. Men's approach to nutrition is more often less complex than women's and oriented towards pleasure (Kiefer, Rathmanner, Kunze, 2005). In our own study, women were characterised by greater restraint and a more critical appraisal of their diets, compared to men, in the answers they gave. It is significant that women, irrespective of their age, were most likely to give an ambivalent answer in their subjective self-assessment of their diet, indicating the difficulty of making an unambiguous assessment (Table 5). In contrast, men, and especially those from Generation X and baby boomers, were observed to have a higher subjective self-assessment of diet as mostly correct and ambivalent, with an orientation towards speed and convenience of meal preparation (Table 5).

Assessment of frequency of dietary fibre intake – as a measure of consumption of foods with health-promoting characteristics

As many as 52.94% of the total respondents were categorised as having inadequate dietary fibre intake and only 9.31% as having sufficient dietary fibre intake. No significant differences were observed in the level of fibre intake either by gender ($p=0.84$) or by age of the respondents ($p = 0.36$) (Table 6). In the group of men, apart from Generation Z (where people with very low fibre intake predominated – 14.29%), people with inadequate levels of dietary fibre intake prevailed (from 24.14% in Generation Y to 46.43% in BB). Among women, generations Z and X had the highest prevalence of people with inadequate levels of dietary fibre intake: 44.05 and 30.16%, respectively. Generation Y was dominated by those with very low (31.03%) and baby boomers with adequate fibre intake (10.72%) (Table 6).

Table 6.
Level of dietary fibre intake

Dietary fibre intake	Generations	% of indications		<i>p</i>
		Men	Women	
Very low	BB	32.14	3.57	0.36* 0.84**
Inadequate		46.43	0.00	
Adequate		7.14	10.72	
Very low	X	15.87	12.70	
Inadequate		31.75	30.16	
Adequate		6.35	3.17	
Very low	Y	17.24	31.03	
Inadequate		24.14	20.69	
Adequate		6.90	0.00	
Very low	Z	14.29	27.38	
Inadequate		7.14	44.05	
Adequate		0.00	7.14	

Explanatory notes: *Chi² level of fibre intake v generation, **Chi² level of fibre intake v gender.

Based on the survey, it was found that the surveyed group of respondents overall identified vegetable salads and raw vegetables ($\bar{x} = 3.1$; $SD = 1.3$; $M = 3.0$) and cooked potatoes ($\bar{x} = 3.0$; $SD = 1.3$; $M = 3.0$) as the two primary sources of dietary fibre intake. Other products presented in the study, such as day-old fruit/vegetable juice, raw and frozen fruit, legumes (beans, peas, lentils), other vegetables (cooked, frozen, pickled), flour products made from graham flour, wholemeal flour, rye flour, bran or groats, and brown rice or quinoa, were consumed by the respondents quite frequently; however, they did not constitute a significant source of dietary fibre intake in their habitual diet (mean values range from 1.3 to 3.3).

Women and men differed significantly ($p \leq 0.05$) in the frequency of intake of most products considered as sources of dietary fibre. No differences were observed in the frequency of consumption of raw vegetable and vegetable salads ($p = 0.76$), potatoes ($p = 0.63$) and other vegetables ($p = 0.19$). When grouped by age (generations Z, Y, X and baby boomers), no significant differences were observed in the frequency of consumption of raw vegetables and vegetable salads ($p = 0.33$), potatoes ($p = 0.10$) and dark rye bread ($p = 0.14$).

Although daily fibre intake has been recommended for many years, analysis of the dietary behaviours of different population groups indicates low fibre intake in implemented dietary patterns in different population groups (Jarosz et al., 2020). Dietary fibre intake provides a number of health benefits, including a reduction in the incidence of cardiovascular disease (Satija, Hu, 2012), diabetes, obesity, colorectal cancer and some gastrointestinal disorders. Dietary fibre intake also appears to improve immune function (Maslowski, Mackay, 2011; Slavin, 2013). People who consume adequate amounts of dietary fibre are less frequently diagnosed with inflammatory diseases (De Filippo, Cavalieri, Di Paola, 2010; Maslowski, Mackay, 2011). Dietary fibre influences immune function, particularly through the production of short-chain fatty acids, which are produced by the fermentation of dietary fibre and exert many beneficial effects in the human body (Hooper, Littman, Macpherson, 2012; Maslowski, Mackay, 2011). Zhang et al. (2012) conducted a study showing that increasing dietary fibre intake by 10 g per day contributed to a reduction in cancer risk by up to 44%. The dietary standards for the Polish population recommend an intake of 25 g/day of dietary fibre in a group of women and men aged 19-65 years. However, in a group of women and men over 66 years of age, it is 20 g/day (Jarosz et al., 2020). Due to the inadequate intake of dietary fibre by the study group, it can be concluded that they may constitute a high-risk group for obesity, diabetes, cardiovascular disease or cancer in the future.

Assessing the frequency of fat intake – as a measure of unhealthy food consumption, especially when overconsumed

Very low levels of fat intake were reported by 38.24% of respondents, low by 25.98%, and moderately high by 17.65%. No significant differences were observed in the level of total fat intake between men and women ($p = 0.21$), as well as in the groups divided by age ($p = 0.17$). In the group of men, irrespective of age, those with a very low intake of total fats predominated

(ranging from 17.24% in Generation Y to 28.57% in the baby boomers). In the women's group, apart from Generation Z (in which 28.57% belonged to the group with low fat intake), those characterised by very low total fat intake also predominated (Table 7).

Table 7.

Level of intake of isolated fats and foods that are a significant source of total fat intake from the diet

Level of fat intake	Generations	% of indications		p
		Men	Women	
Very high	BB	7.14	0.00	0.17* 0.21**
High		17.86	0.00	
Moderately high		7.14	0.00	
Low		25.01	7.14	
Very low		28.57	7.14	
Very high	X	1.59	0.00	
High		7.94	7.94	
Moderately high		12.70	11.11	
Low		9.52	4.76	
Very low		22.22	22.22	
Very high	Y	6.90	3.45	
High		3.45	3.45	
Moderately high		10.34	3.45	
Low		10.34	20.69	
Very low		17.24	20.69	
Very high	Z	2.38	4.76	
High		4.76	4.76	
Moderately high		2.38	15.48	
Low		2.38	28.57	
Very low		9.52	25.01	

Explanatory notes: *Chi² level of fat intake v generation, **Chi² level of fat intake v gender.

Among the total respondents, as well as within the group of men and women, the highest arithmetic mean (2.9 points) of the frequency of consumption of products that are sources of total fats was determined for margarine or extra butter (SD = 1.3; M = 3.0) and eggs (\bar{x} = 2.8; SD = 1.2; M = 3.0). Other products presented in the survey, such as fried chicken or turkey, melted and yellow cheeses, and whole milk (3%), were consumed quite frequently by respondents but did not constitute a significant source of fat intake in their usual diet (mean values range from 1.3 to 3.3).

Men and women differed significantly in the frequency of consumption of fried chicken or turkey ($p < 0.01$), sausages, frankfurters and kabanos ($p = 0.04$), salad dressings, mayonnaise ($p = 0.01$), eggs ($p = 0.04$), melted and yellow cheeses ($p = 0.01$), whole milk ($p < 0.01$) and crisps and fries ($p < 0.01$). There were no significant differences between women and men in the frequency of consumption of pizza, casseroles, lasagne and burgers ($p = 0.20$), beef, steaks and roasts ($p = 0.19$), fatty meats, pâté, black pudding, mince, bacon ($p = 0.12$), margarine or extra butter ($p = 0.36$). In contrast, the groups for which age was a dividing criterion (generations Z, Y, X and BB) did not differ significantly in the frequency of consumption of pizza, casseroles, lasagne and burgers ($p = 0.64$), sausages, frankfurters and kabanos ($p = 0.10$), fatty cold meats, pâté, black pudding, mince, bacon ($p = 0.18$) and eggs ($p = 0.13$).

It is satisfactory that the level of total fat intake in the study group of respondents is at an acceptably low level. A study conducted among students (in Poland) (Głodek et al., 2012), similarly to our own study, showed that the most commonly consumed product as a source of fats in women's diets was butter or margarine. According to nutrition standards for the Polish population (2020), dietary fat should provide no more than 35% of energy (Jarosz et al., 2020). According to the Central Statistical Office (CSO), Poland, compared to other members of the European Union, is characterised by a relatively high intake of animal fats, especially butter, while the intake of vegetable fats is lower than in many EU countries (Rosiak, 2016). The impact of saturated fatty acid and dietary fibre intake on the risk of cardiovascular disease in people with type 1 diabetes has been compared (Schoenaker et al., 2012).

It was observed that a 5 g/day increase in dietary fibre intake resulted in a decrease in morbidity and mortality among the study respondents. It is important to remember that non-communicable diseases are the leading cause of death worldwide, and among these, cardiovascular diseases account for the largest number (Bennett et al., 2018; WHO, 2022). Cardiovascular diseases are multifactorial. Modifiable factors include smoking, alcohol consumption, physical inactivity, and poor dietary habits, including high salt and saturated fat intake and deficient vegetable and fruit intake (Riccardi et al., 2022; Vesnina et al., 2022). Non-modifiable factors include age, gender and ethnicity (Johansson et al., 2021). Among the modifiable factors, it is the reduction of fat intake, especially saturated fatty acids, that is the main issue that can and should be worked on.

4. Conclusions and future perspectives

The survey found that both women and men considered themselves to be engaged in work and study. Women and men tended to agree with the statement that they were pleasure-oriented people. Men did not explicitly respond to the statement that they were or were not health-conscious people, while women said they tended to consider themselves health-conscious people. Both women and men declared ambivalent eating behaviour regarding the importance of the naturalness of the food they consume (low processing). Women and men valued the convenience and speed of food preparation and tended to pay attention to the health benefits of the food they consumed. Both women and men stated that they valued tradition. It is satisfactory that the level of fat consumption among the surveyed group of respondents was at an acceptably low level. On the other hand, inadequate and very low intake of dietary fibre remains a concern. Generally, the women considered themselves to be health-conscious, while they consumed dietary fibre at a very low or insufficient level, which may indicate their overly high subjective self-esteem.

The present results are limited due to the small study sample and its scope. However, the analysis of respondents' consumption of selected food groups showed that gender and age influenced lifestyle and the type of selected consumed food products by adults, and therefore the attainment of individual nutrient requirements, and the risk of chronic non-communicable diseases.

According to the authors, research on the dietary choices made by Polish adults should be continued. If adults (in Poland) do not pay attention to the impact of the products they consume on their health, do not have a balanced diet, and consume products rich in simple carbohydrates and saturated fatty acids, the risk of their quality of life falling as a result of contracting metabolic diseases will increase significantly. In light of the challenges of the SDGs, conducting research that monitors the dietary behaviour of various population groups is useful and legitimate to ascertain whether it is necessary to take preventive measures related to ensuring health and taking greater care of the mental and physical condition of current and future generations. The conducted research is part of health risk management and health promotion in the Polish population.

Acknowledgements

The publication was financed from a subsidy granted to the Maritime University of Gdynia – project number: WZNJ/2024/PZ/01.

References

1. Backman, D.R., Haddad, E.H., Lee, J.W., Johnston, P.K., Hodgkin, G.E. (2002). Psychosocial predictors of healthful dietary behavior in adolescents. *Journal of Nutrition Education Behaviour*, 4, 184-193. doi:10.1016/s1499-4046(06)60092-4.
2. Bennett, J., Stevens, G., Bonita, R., Rehm, J., Kruk, M., Riley, L., Dain, K., Kengne, A., Chalkidou, K., Beagley, J. et al. (2018). NCD countdown 2030: Worldwide trends in non-communicable disease mortality and progress towards sustainable development goal target 3.4. *Lancet North Am. Ed.*, 392, 1072-1088.
3. Czarnocińska, J., Jeżewska-Zychowicz, M., Babicz-Zielińska, E., Kowalkowska, J., Wądołowska, L. (2013). *Postawy względem żywności, żywienia i zdrowia, a zachowania żywieniowe dziewcząt i młodych kobiet w Polsce*. Olsztyn: Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego w Olsztynie (in polish).

4. De Filippo, C., Cavalieri, D., Di Paola, M. (2010). *Impact of diet in shaping gut microbiota revealed by a comparative study in children from Europe and rural Africa–PNAS*. Early Edition.
5. Douglas, L.C., Sanders, M.E. (2008). Probiotics and Prebiotics in Dietetics Practices. *Journal of American Dietetic Association*, 108(3), 510-521. doi: 10.1016/j.jada.2007.12.009.
6. 2020 Guidelines on the Management of Diabetic Patients. A Position of Diabetes Poland, 2020. *Clinical Diabetology*, 9(1).
7. Dutkowska, A., Rachoń, D. (2015). Role of n-3 and n-6 unsaturated fatty acids in the prevention of cardiovascular diseases. *Choroby Serca i Naczyń*, 12(3), 154-159. Downloaded from: https://journals.viamedica.pl/choroby_serca_i_naczyn/article/view/42657/29140, December 1, 2023.
8. Ekhmke vel Emczyńska-Seliga, E. (2019). *Dlaczego ogranicza się w diecie dzieci podaż nasyconych kwasów i izomerów typu trans?* Warszawa: Narodowe Centrum Edukacji Żywnościowej (in polish). Downloaded from: <https://ncez.pl/dzieci-i-mlodziez/dzieci-0-3/dlaczego-ogranicza-sie-w-diecie-dzieci-podaz-kwasow-tluszczowych-nasyconych-i-izomerow-typu-trans->, December 1, 2023.
9. Fattore, E., Massa, E. (2018). Dietary fats and cardiovascular health: a summary of the scientific evidence and current debate. *International Journal of Food Sciences and Nutrition*, 69(8), 916-927. doi: 10.1080/09637486.2018.1455813.
10. Garbowska, B., Radzymińska, M., Tarczyńska, A.S. (2021). *Marnotrawstwo żywności – studium zarządzania łańcuchem żywnościowym*. Olsztyn: Wydawnictwo Instytutu Badań Gospodarczych w Olsztynie (in polish), doi:10.24136/eep.mon.2021.4.
11. Głodek, E., Gil, M., Rudy, M. (2012). Ocena zawartości tłuszczu w dietach studentów Uniwersytetu Rzeszowskiego. *Bromatologia i Chemia Toksykologiczna*, 4, 1190-1196.
12. Godula, K., Czerniejewska-Surma, B., Dmytrów, I., Plust, D., Surma, O. (2019). Możliwość zastosowania błonnika pokarmowego do produkcji żywności funkcjonalnej. *Żywność. Nauka. Technologia. Jakość*, 26, 2(119), 5-13. doi: 10.15193/zntj/2019/119/281.
13. Gutkowska, K., Sajdakowska, M., Zakowska-Biemans, S., Kowalczyk, I., Kozłowska, A., Olewnik-Mikołajewska, A. (2012). Poziom akceptacji zmian na rynku żywności pochodzenia zwierzęcego w opinii konsumentów. *Żywność Nauka. Technologia. Jakość*, 5(84), 187-202.
14. Hearty, A.P., Andreson, R., Tatham, R., Black, W. (2007). Relationship between attitudes toward healthy eating and dietary habits, lifestyle and demographic factors in a representative sample of a Irish adults. *Appetite*, 48, 1-11, DOI: 10.1016/j.appet.2006.03.329.
15. Hooper, L.V., Littman, D.R., Macpherson, A.J. (2012). Interactions between the microbiota and the immune system. *Science*, 336(6086), 1268-1273.

16. Hoyles, L., Vulevic, J. (2008). Diet, Immunity and Functional Foods. In: Huffnagle, G.B., Noverr, M.C. (eds) GI Microbiota and Regulation of the Immune System. *Advances in Experimental Medicine and Biology*, 635, 79-92. https://doi.org/10.1007/978-0-387-09550-9_7
17. Jarosz, M., Rychlik, E., Stoś, K., Charzewska, J. (2020). *Normy żywienia dla populacji Polski i ich zastosowanie*. Warszawa: Narodowy Instytut Zdrowia Publicznego – Państwowy Zakład Higieny w Warszawie (in polish).
18. Johansson, A., Drake, I., Engström, G., Acosta, S. (2021). Modifiable and non-modifiable risk factors for atherothrombotic ischemic stroke among subjects in the Malmö diet and cancer study. *Nutrients*, 13, 1952.
19. Kaczor-Szkodny, P.M., Szkodny, W. (2021). Wybrane elementy wpływające na powstawanie i kształtowanie postaw i zachowań zdrowotnych. *Medycyna Ogólna i Nauki o Zdrowiu*, 27(1), 45-49.
20. Kelly, A., Ciclitira, K. (2011). Eating and drinking habits of young London-based Irish men. A qualitative study. *Journal of Gender Studies*, 20(3), 223-235. doi: 10.1080/09589236.2011.593322.
21. Kiefer, I., Rathmanner, T., Kunze, M. (2005). Eating and dieting differences in men and women. *The Journal of Men's Health & Gender*, 2(2), 194-201. doi.org/10.1016/j.jmhg.2005.04.010.
22. Macfarlane, G.T., Steed, H., Macfarlans, S. (2008). Bacterial Metabolism and Health-Related Effects of Galactooligosaccharidies and Other Prebiotics. *Journal of Applied Microbiology*, 104(2), 305-44. doi: 10.1111/j.1365-2672.2007.03520.x. PMID: 18215222.
23. Maslowski, K.M., Mackay, C.R. (2011). Diet, gut microbiota and immune responses. *Nature Immunology*, 12(1), 5-9.
24. Ojo, O., Ojo, O.O., Adebawale, F., Wang, X.H. (2018). The Effect of Dietary Glycaemic Index on Glycaemia in Patients with Type 2 Diabetes: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Nutrients*, 10(3), 373. doi: 10.3390/nu10030373.
25. Paczkowska, M., Białkowska, M., Kunachowicz, H. (2001). Rola frakcji rozpuszczalnych i nierozpuszczalnych błonnika pokarmowego w profilaktyce i leczeniu otyłości. *Medycyna Metaboliczna*, 4, 59-63.
26. Pieniak, Z., Verbeke, W., Olsen, S.O., Hansen, K.B., Brunsø, K. (2010). Health-related attitudes as a basis for segmenting European fish consumers. *Food Policy*, 35, 448-455. doi: 10.1016/J.FOODPOL.2010.05.002
27. Platta, A., Sawlewicz, K. (2022). Dietary behaviour and attitudes of a selected group of women (in Poland) towards health and health-promoting foods. *Management and Quality [Zarządzanie i Jakość]*, 3, 172-188.

28. Platta, A., Śmigaj, K. (2021). Ocena akceptacji żywności o właściwościach prozdrowotnych przez kobiety w wieku 60+. *Żywność. Nauka. Technologia. Jakość*, 3(128), 117-132. doi: 10.15193/zntj/2021/128/394.
29. Riccardi, G., Giosuè, A., Calabrese, I., Vaccaro, O. (2022). Dietary recommendations for prevention of atherosclerosis. *Cardiovasc. Res.*, 118, 11881204.
30. Rosiak, E. (2016). Spożycie tłuszczów w Polsce i Unii Europejskiej. *Zeszyty Naukowe Gospodarstwa Wiejskiego w Warszawie. Problemy Rolnictwa Światowego*, 16(XXXI), 2, 279-288 (in polish).
31. Sagili, V.S., Chakrabarti, P., Jayanty, S., Kardile, H., Sathuvalli, V. (2022). The Glycemic Index and Human Health with an Emphasis on Potatoes. *Foods*, 11(15), 2302. doi: 10.3390/foods11152302.
32. Satija, A., Hu, F.B. (2012). Cardiovascular benefits of dietary fiber. *Current Atherosclerosis Reports*, 14(6), 505-14. doi: 10.1007/s11883-012-0275-7.
33. Schade, D.S., Shey, L., Eaton, R.P. (2020). Cholesterol Review: A Metabolically Important Molecule. *Endocrine Practice*, 26(12), 1514-1523. doi: 10.4158/EP-2020-0347.
34. Searle, L.E., Best, A., Nunez, A., Salguero, F.J., Johnson, L., Weyer, U., Dugdale, A.H., Cooley, W.A., Carter, B., Jones, G., Tzortzis, G., Woodward, M.J., La Ragione, R.M. (2009). A Mixture Containing Galactooligosaccharidies, Produced by Enzymic Activity of *Bifidobacterium bifidum*, Reduces *Salmonella enterica* serovar Typhimurium Infection in Mice. *Journal of Applied Microbiology*, 58, 37-48.
35. Slavin, J. (2013). Fiber and prebiotics: mechanisms and health benefits. *Nutrients*, 5(4), 1417-1435.
36. Schoenaker, D., Toeller, M., Chaturvedi, N., Fuller, J.H., Soedamah-Muthu, S.S. (2012). Dietary saturated fat and fiber and risk of cardiovascular disease and all-cause mortality among type 1 diabetic patients: the EURODIAB Prospective Complications Study. *Diabetologia*, 55(8), 2132-41. doi: 10.1007/s00125-012-2550-0.
37. Spencer, R.A., Rehman, L., Kirk, S.F. (2015). Understanding gender norms, nutrition, and physical activity in adolescent girls: a scoping review. *International Journal of Behavioral Nutrition and Physical Activity*, 12, 6. doi: 10.1186/s12966-015-0166-8.
38. Suliga, E., Sobaś, K., Bryk, P., Wawrzycka, I., Głuszek, S. (2021). Assessment of eating habits of patients qualified for bariatric surgery – preliminary research. *Medical Studies/Studia Medyczne*, 37(3), 193-201, doi:10.5114/ms.2021.109563.
39. Sun, Y-H.C. (2008). Health concern, food choice motives, and attitudes towards healthy eating: The mediating role of food choice motives. *Appetite*, 51(1), 42-49, doi: 10.1016/j.appet.2007.11.004.
40. Thompson F.E., Byers, T. (1994). Dietary Assessment Resource Manual. *Journal of Nutrition*, 124, 2245-2317. https://doi.org/10.1093/jn/124.suppl_11.2245s.
41. WHO (2022). World Health Statistics 2022: Monitoring Health for the SDGs, Sustainable Development Goals. Geneva, Switzerland: World Health Organization, 1-131.

42. Wiśniewska, M.Z. (2022). Ewolucja trendów i zagrożeń w konsumpcji żywności w świetle celów zrównoważonego rozwoju. *Zeszyty Naukowe UEK*, 1(995), 63-79. <https://doi.org/10.15678/ZNUEK.2022.0995.0104>.
43. Włodarek, D., Lange, E., Kozłowska, L., Głabska, D. (2014). *Dietoterapia*. Warszawa: Wydawnictwo Lekarskie PZWL.
44. Wolnicka, K., Taraszewska, A. (2019). Downloaded from: <https://ncez.pzh.gov.pl/dzieci-i-mlodziez/piramida-zdrowego-zywienia-i-stylu-zycia-dzieci-i-mlodziezy-co-nowego-2/>, July 1, 2022 (in polish).
45. Vesnina, A., Prosekov, A., Atuchin, V., Minina, V., Ponasenko, A. (2022). Tackling atherosclerosis via selected nutrition. *Int. J. Mol. Sci.*, 23(15), 8233. doi: 10.3390/ijms23158233. PMID: 35897799. PMCID: PMC9368664.
46. Zhang, Z, Xu, G., Ma, M., Yang, J, Liu, X. (2013). Dietary fiber intake reduces risk for gastric cancer: a meta-analysis. *Gastroenterology*, 145(1), 113-120, doi: 10.1053/j.gastro.2013.04.001.
47. Zychnowska, M., Onacik-Gur, S., Krygier, K. (2015). Właściwości i możliwości wykorzystania zamienników tłuszczów dostępnych na rynku. *Probl. Hig. Epidemiol.*, 96(1), 42-50 (in polish).

PROCESS IMPROVEMENT: A KEY ELEMENT OF EFFECTIVE ORGANIZATION MANAGEMENT

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Purpose: The aim of the article is to portray process improvement as a key element of contemporary organizational management, along with a detailed analysis of the economic and organizational consequences of this process. Additionally, the article aims to precisely identify the main criteria for process improvement in organizations and position this process within the context of process management systems.

Design/methodology/approach: The objectives of the article were achieved through conducting thorough literature reviews, allowing for the presentation of detailed information regarding specific economic and organizational effects of process improvement. The literature analysis also facilitated the precise placement of the process of improvement within the context of process management systems, enhancing the theoretical and practical value of the presented conclusions.

Findings: The author of the article outlined the impact of process improvement on the functioning of an organization and provided a detailed analysis of its economic and organizational consequences. Additionally, based on a literature review, the author identified the specific role of process improvement within the framework of process management systems.

Originality/value: The originality of the article lies in its detailed focus on the specific economic and organizational effects of process improvement, while concurrently presenting a precise placement of this process within the context of process management systems.

Keywords: Process improvement, organisational management, criteria for improvement, economic and organisational impact.

Category of the paper: Literature review.

1. Introduction

When implementing a process-oriented approach in an organization, it is essential to consider process improvement, which is one of its key elements. In the ever-changing conditions of organizational functioning, process improvement becomes a challenge for all its components. The need for improvement is driven by the pressure for continuous quality

enhancement and constant cost competition. Process improvement is discussed in various management methods and concepts, such as quality management, knowledge management, broad logistics, and the philosophy of Kaizen (Trenkner, 2016). Process improvement can be divided into three fundamental stages: signaling the need, focusing on improving actions, and self-improvement study. Process improvement is oriented towards continuous, systematic enhancement within the organization's activities and the achievement of key strategic goals (Brajer-Marczak, 2019). To implement improvement, all employees in the organization should be involved, starting from top management, through lower-level managers, and ending with executive staff. In the organization's activities, attempting process improvement carries various consequences. In its basic assumptions, it is expected to contribute to increasing efficiency and improving the overall effectiveness of the organization (Raczyńska, 2022). However, literature presents numerous organizations that have experienced both anticipated positive and unanticipated negative effects of process improvement. The consequences of process improvement are considered in various aspects and on different levels, influencing the emergence of numerous organizational and economic effects (Gaitanides, 2012; Brajer-Marczak, 2009).

Improving processes has a direct impact on organizations setting increasingly higher and more ambitious goals. The establishment of goals in the management system is the responsibility of the organization's owners and should also result from continuously conducted process analyses. Process analysis is primarily about (Kowalczyk, 2009):

- assessment of adaptability to changes in the process environment,
- evaluation of the fulfillment of responsibilities and authorities,
- assessment of the efficiency and effectiveness in achieving the established goals for the process,
- evaluation of the effectiveness of information flow within the process,
- assessment of meeting the expectations and requirements of internal and external customers of the process,
- evaluation of flows and execution time,
- assessment of the efficiency of resource utilization,
- evaluation of the costs of the process, including quality costs.

The concept of continuous process improvement suggests that the majority of organization members should constantly seek opportunities to enhance key processes at every step. Every day, they should devise and implement solutions that increase the quality of products, operations, and productivity. As a result, process improvement aims to reduce operational costs, enhance productivity and quality, and contribute to overall organizational efficiency (Grajewski, 2007; Davenport, 1993).

In the long run, an organization's decision to abandon operations related to process improvement and operate based on previously established models and patterns may contribute to the emergence of hazardous dysfunctions in the entire management system (Cyfert, 2007).

2. Process improvement in organizations

In the literature, two main criteria for process improvement in organizations are distinguished (Cyfert, 2006; Nems, Knop, 2023):

- Criterion of the continuity of process improvement, which allows distinguishing two methods:
 1. Radical Process Improvement. It involves a thorough renewal of business processes at specific intervals. This can be achieved through redesigning existing processes, creating entirely new ones, or implementing process outsourcing.
 2. Continuous process improvement, or evolutionary improvement. It involves continuous and systematic enhancement of existing processes within the organization.
- Criterion of levels of process improvement, which should be divided into two subcriteria:
 1. Criterion of linking organizational development strategy with process improvement.
 2. Criterion of the comprehensiveness of the scope of improvement.

Both methods distinguished by the criterion of continuous process improvement continually complement each other. Through the radical approach to improvement, changes achieved in processes are stabilized through continuous evolutionary improvement. The main criterion that allows choosing the method of applying improvement in an organization is the statement: if improving the implemented process does not yield the intended effect in the form of expected values of the given process, a radical approach should be applied. The most commonly used radical method is reengineering. This method is recommended to be applied in situations where strategic changes occur in the organization or significant changes take place in its environment. It is characterized by the abruptness of changes. Reengineering leads to the quick support and identification of change concepts and also offers many innovative solutions (Antony, Gupta, 2019; Nowosielski, 2008).

As the main characteristics of reengineering, the following should be mentioned (Grudziewski, 2004):

- modern information technologies,
- preserving the natural order of work,
- emphasis on results rather than tasks as the basis for compensation,
- elimination of the industrial model of work,
- minimizing external contacts,
- directors becoming leaders,
- changes in the roles of individuals within the organization,
- pursuit of simplifying organization's processes,
- minimizing non-value-added activities from the customer's perspective,

- changing the role of managers,
- changing the nature of task preparation,
- consolidation of multiple job positions,
- application of outsourcing,
- flattening the organizational structure,
- providing autonomy to individual units through information technology that combines the benefits of centralization and decentralization,
- decentralization of authority,
- changing the nature of work,
- introducing multidimensionality of processes,
- changing promotion criteria,
- functional departments giving way to process-oriented departments.

On the other hand, among the methods of evolutionary process improvement, the philosophy of Kaizen is the most well-known and widely applied. The philosophy symbolizes systematic and continuous improvement of the process flow (Bakotić, Krnić, 2017). It is focused on solving current problems and identifying the weakest links that lower the efficiency and effectiveness of implemented processes. It is also a tool for increasing productivity and the competitiveness of the organization by improving processes incrementally (Kisielnicki, 2008; Kalinowski, 2010).

Continuous improvement and enhancement of processes within the philosophy involve (Skrzypek, 2000):

- comprehensive exploitation,
- customer orientation,
- functioning without defects,
- development of new products,
- comprehensive quality control,
- automation and robotics,
- collaboration between managers and lower-level employees,
- a system for submitting proposals,
- deliveries at a precisely defined time,
- discipline in the functioning of processes,
- activity of small groups,
- improvement of quality and productivity.

To effectively implement the philosophy of Kaizen in an organization, it is essential to systematically apply the following systems (Łuczak, 2007):

- Total Quality Management/Total Quality Control,
- Just in Time - timely and quality deliveries,
- Total Productive Maintenance - a methodology for the proper maintenance of machines,
- Policy Deployment - a systematic process of planning and achieving long-term goals,
- Suggestion System,
- Work in Small Groups,
- Quality, Cost, Delivery.

The criterion of levels of process improvement allows for distinguishing two additional subcriteria. In the context of the criterion of linking organizational development strategy with process improvement, we can mention: operational process improvement and strategic process improvement. Operational process improvement is strongly associated with the significant valorization of the importance of a single organizational goal. Additionally, it may aim to unravel a specific dysfunction within the management system. On the other hand, strategic process improvement results in adapting processes to the organization's business model, which is based on a specific development strategy (Cyfert, 2006).

The criterion of the comprehensiveness of the scope of improvement determines whether actions related to improvement should be limited to a single process or should be oriented towards all processes carried out in the organization. When deciding on the method and scope of improvement, it is crucial to assess the likelihood of negative changes occurring in the execution of other processes, which often lead to a deterioration in the efficiency of the organization. Process architecture improvement is usually implemented in the later stages of this process. It involves comprehensive actions aimed at improving the efficiency of all processes. On the other hand, activities related to individual improvement are focused on eliminating defects that arise in the initial phase of process improvement (Brajer-Marczak, 2009).

Improving processes is therefore a crucial element of process management. The placement of process improvement in the process management system is illustrated in Figure number 1.

The improvement of processes is based, in particular, on a sequence of stages that can be named and presented, focusing on the measurement, analysis, and enhancement of the processes under examination. During improvement, which is a part of process management, a holistic approach is crucial. This means that to effectively enhance processes, the organization under examination should be considered at three levels: the entire organization, the executed processes, and the existing positions (Brache, Rummler, 2000).

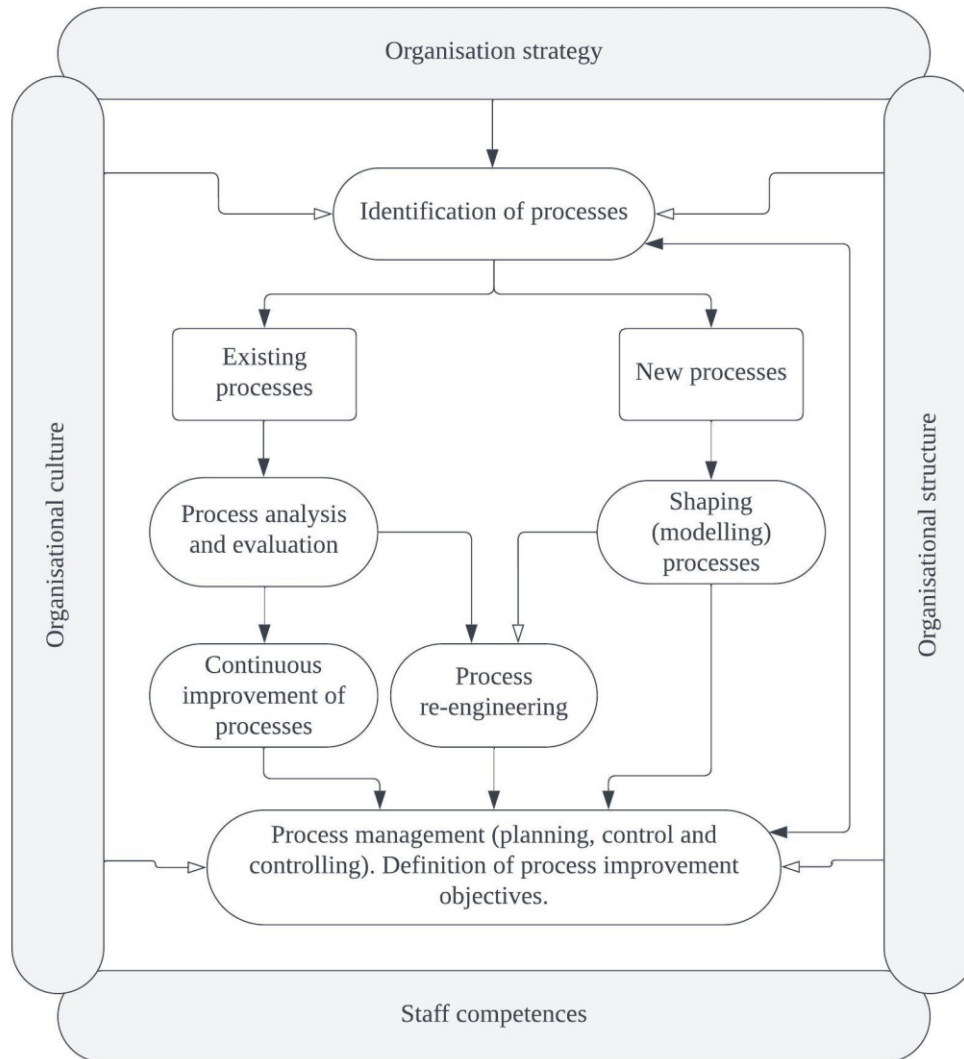


Figure 1. The place of process improvement in the process management system.

Source: own elaboration based on Nowosielski, 2014.

3. Economic effects of process improvement

An organization aiming to improve its processes must rely on information regarding the engagement of individual resources utilized in the process execution. In this manner, the organization gains knowledge about the costs incurred during the implementation cycle of individual processes and the consumption of utilized resources. To enable the identification of the costs of executed activities, process costing must be applied. The use of this method provides employees with the ability to control processes within the organization. Additionally, the method employed during process improvement creates an informational foundation for the reduction and rationalization of process costs. The consequence of the utilized method is the deepening of analytical research into the profitability assessment of the provided service or

manufactured product. Research into the course of processes is also intensified, focusing on full optimization. Managers in the organization, thanks to the ongoing process improvement, are compelled to analyze and determine the point where value is created. In the course of improvement, process controlling and budgeting of activity costs are often introduced in the organization (Brajer-Marczak, 2009; Witt, Witt, 2010; Głodziński, Marciniak, 2016).

Controlling in an organization is a management system that supports the control of the course of economic processes carried out within it. It also aids in coordinating various areas of activity from the organization's perspective as a whole to achieve previously set goals (Koontz, Weihrich, 2009).

Selected division criteria and types of controlling are presented in figure number 2.

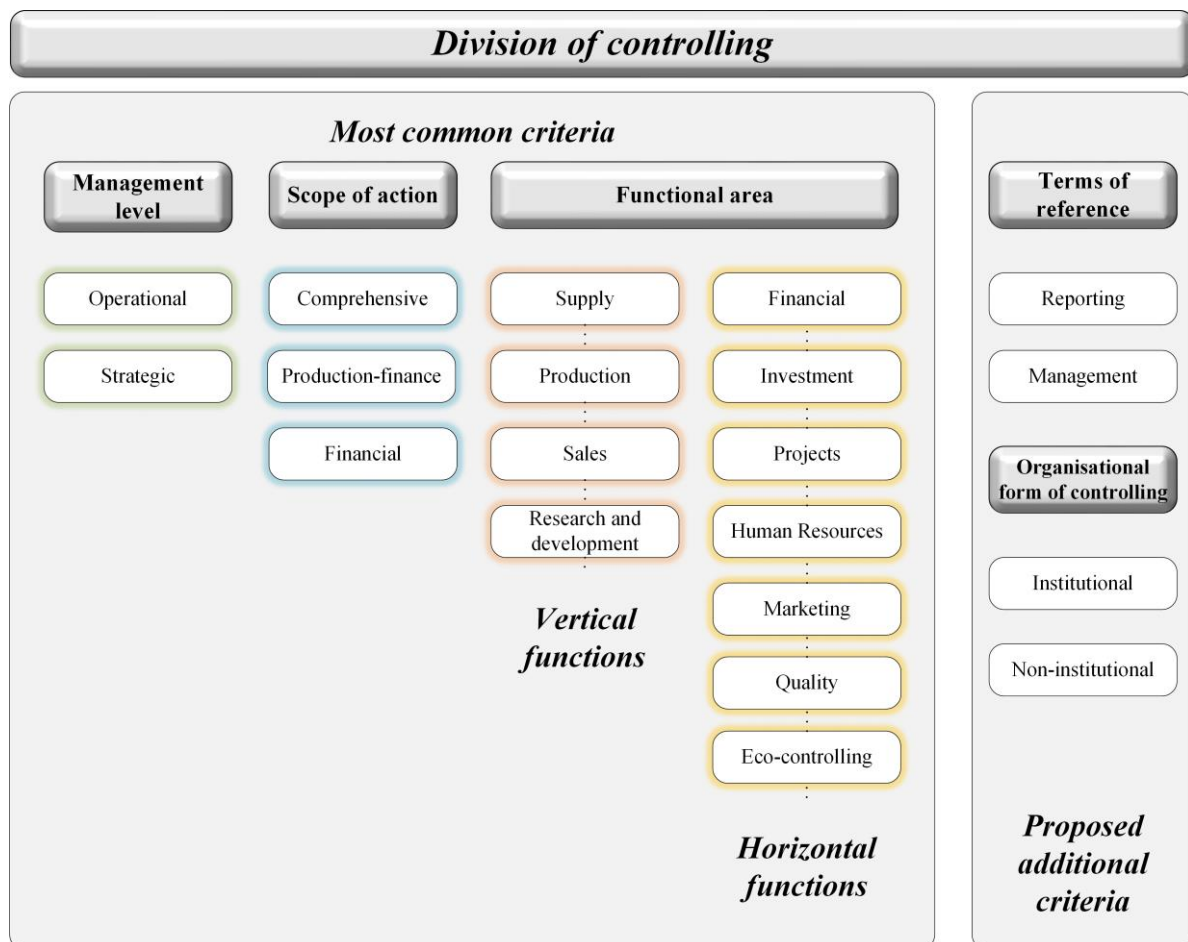


Figure 2. Selected division criteria and types of controlling.

Source: own elaboration based on Nesterak, 2015.

In the field of scientific literature, various methods and tools used in the field of controlling are extensively discussed, which constitutes a significant contribution to understanding the complexity of this area and enables effective management of processes. Table 1 presents selected methods and tools of controlling.

Table 1.
Selected methods and tools of controlling

ID	Authors	Controlling methods and tools
1.	H.J. Vollmuth	ABC analysis; Order volume analysis; Break-even analysis; Direct costing; Investment account methods; Quality circles; Discount analysis; Value analysis; XYZ analysis
2.	W. Radzikowski, J. Wierzbiński	Deviation analysis; Regression analysis; Risk analysis; Just in time; Early warning systems; Management by objectives; Balanced scorecard; Mathematical programming
3.	S. Marciniak	BEP analysis; Market analysis; Composite analysis
4.	S. Nahotko	Systems theory; New management concepts

Source: own elaboration based on Siekierski, 2010.

Controlling is a complex management process consisting of several key stages. In the first stage, it is essential to establish clear standards that serve as a reference point for subsequent actions. Next, in the second stage, we measure the actual performance, and in the third stage, we compare it to the previously established standards. In case of discrepancies, the fourth stage involves taking corrective actions to optimize the processes (Preißler, 2020). The activities carried out during controlling in organizations are presented in Figure number 3.

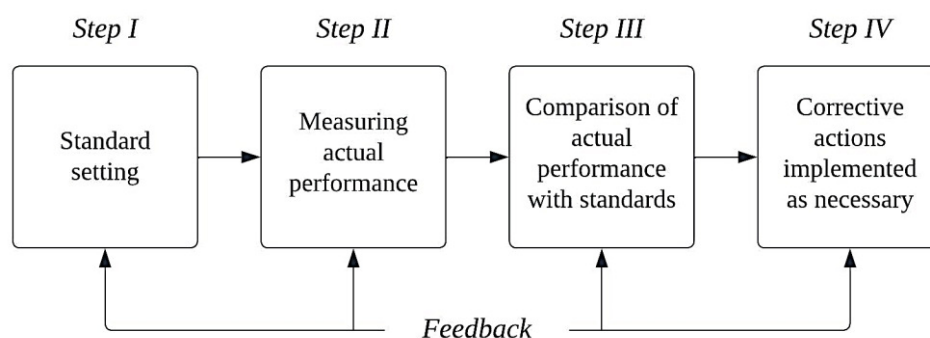


Figure 3. The activities carried out during controlling in organizations.

Source: own elaboration.

The most common effect of process improvement is the organization's focus on issues occurring "at the interface" of individual activities contributing to the process, as well as on issues between processes that cross the boundaries of functional departments. The most significant skills become the ability to eliminate, recognize, mitigate, or identify so-called bottlenecks. To initiate and implement changes in the organization, the use of controlling in the area of process improvement is recommended. It allows choosing between an evolutionary and a radical approach to implementing changes. Reference standards are established, and measurements of individual results are made and compared with assumptions. Periodic reports on the progress of implemented processes are also prepared (Jochem, Geers, 2010).

Process improvement relies on evaluations determined by appropriately chosen metrics. This results in the development of a coherent internal process control system using reliable and relevant measures. The literature on the subject indicates that, in practice, this is not a simple task for organizations. In many cases, inappropriate assessment indicators are selected,

especially when measuring customer satisfaction and expectations. Managers often lack the skills to define process goals, leading to a mismatch of assessment metrics. The aggregated result of a company's performance, such as profit or market share, is the most commonly used metric among organizations. Organizations often neglect the use of partial indicators that would determine the effectiveness of the processes themselves (Szczepańska, 2008).

4. Organizational effects of process improvement

The results of process improvement in an organization are related to specific strategic goals. They depend on the applied techniques and improvement tools, fulfilled initial conditions, and the requirements of the adopted procedure. The first condition that an organization must meet is the complete identification of processes, particularly specifying suppliers and customers. The process of improvement, as well as process management, requires a comprehensive mapping of processes (Brajer-Marczak, 2009).

Process mapping is used to streamline processes and is a tool that illustrates the entire course of processes within an organization. It allows for the identification of discontinuities, bottlenecks, and the analysis of process execution from the perspective of a specific goal. Relationships between suppliers and recipients within the organization are also established. Understanding these relationships explains the conditions of physical and informational flows and enables the proper organization of work (Sanders et al., 1999; Szymonik, 2011).

The factors influencing process improvement include information from customers, internal reviews, and insights gained from organizational experience. Employees focus not on departments or functions, but on the services provided or products manufactured. This results in a holistic view of the organization. Managers acquire the ability to differentiate and classify processes within the organization. This allows assigning significance to processes based on diverse outcomes and their impact on organizational efficiency. It's crucial to develop the ability to focus on the most essential processes from a strategic perspective and the value delivered to the customer. Process improvement also requires changes in responsibilities, scope of duties, and the authority of individual employees. Empowerment is introduced, expanding responsibility and duties, engaging employees in decision-making about the organization. Process improvement is aimed at combining tasks to simplify processes. Previously separate tasks are consolidated and assigned to a single employee. This reduces coordination efforts and saves time in executing activities. This leads to the professionalization of employees, who are now accountable for the effectiveness of their work, not just seniority. Managers gain influence over employees with the same specialization, dispersed across subprocesses and processes throughout the entire enterprise. Over time, competence centers may emerge to enhance the skill levels of employees assigned to various processes in different parts of the

organization. The exchange of information often occurs through an IT network, and these centers take on a virtual character. Radical changes sometimes occur, leading to transformations in the organizational structure. These changes align with the needs for an effective and efficient flow of processes within the organization (Conger, Kanungo, 1988; Brajer-Marczak, 2021).

The transformation of organizational structure can progress through three distinct stages, starting with considering process logic in a function-based organization, moving on to a matrix organization, and ultimately adopting a complete process-oriented structure. These stages aim to enhance the flow of process-related information and minimize the number of hierarchical levels. Introducing a process or matrix structure exposes the organization to internal challenges. A critical aspect is the coexistence of two managers, where one is responsible for the process department, and the other oversees the functional department. However, having equal competencies between the line manager and the process owner can lead to conflicts. Conflicts of goals may also arise during task execution in processes, particularly when resources used in processes are controlled by functional area managers rather than the process owner. To eliminate these weaknesses, it is essential to designate either the process line or the specialized line as dominant in the entire process. However, this may generate additional internal issues among subordinates who are accustomed to a stable and clear hierarchy. Often, these are deeply ingrained beliefs and habits that are challenging to modify (Brilman, 2002; Kerzner, 2005).

5. Conclusion

Engaging in efforts to improve processes in organizational activities entails various consequences. In basic assumptions, it is expected to contribute to the increase in efficiency and improvement of the overall effectiveness of the organization. However, the literature presents many organizations that have achieved both anticipated positive and unforeseen negative effects of process improvement. The consequences of process improvement are considered in various dimensions and on different levels, impacting the emergence of numerous organizational and economic effects.

In the longer perspective, an organization's decision to abandon operations related to process improvement and function based on previously established models and patterns can contribute to the emergence of dangerous dysfunctions in the entire management system. Process improvement is, therefore, a crucial element of process management. Process improvement is based particularly on a sequence of stages that can be named and presented, and that involve measuring, analyzing, and improving the studied processes. During improvement, which is part of process management, a holistic approach is crucial. This means that to effectively improve processes, the organization under examination should

be considered on three levels: the entire organization, the executed processes, and the existing positions.

Managers of an organization, through the ongoing process improvement, are compelled to analyze and determine the point where added value is created. During improvement initiatives, organizations often introduce process controlling and budgeting of activity costs. The most common outcome of process improvement is the organization's focus on issues occurring at the intersection of individual activities that make up a process, as well as on problems between processes that transcend the boundaries of functional departments. The most significant skills become the ability to eliminate, recognize, eliminate, or find so-called bottlenecks.

Process improvement is based on assessments determined by appropriately chosen metrics. This results in the development of a coherent internal system for controlling processes using reliable and relevant measures. Improvement also requires changes in responsibilities, duties, and privileges of individual executive employees. Empowerment is introduced, expanding responsibility and duties and involving employees in making decisions regarding the organization. Improvement is focused on combining tasks to simplify processes. Previously separate tasks are consolidated and assigned to a single employee, reducing coordination efforts and saving time in task execution.

In the constantly changing conditions of organizational operation, process improvement becomes a challenge for all its elements. The key condition for efficient, effective, and successful execution of individual tasks is the collaboration of all individuals designated to carry out a specific process. Openness to the views of others and an undisturbed flow of information play a particularly important role.

References

1. Antony, J., Gupta, S. (2019). Top Ten Reasons for Process Improvement Project failures. *International Journal of Lean Six Sigma*, 10(1). Bradford.
2. Bakotić, D., Krnić, A. (2017). Exploring the relationship between business process improvement and employees' behaviour. *Journal of Organizational Change Management*, 30(7). Rotterdam.
3. Brache, A.P., Rummler, G.A. (2000). *Podnoszenie efektywności organizacji*. Warszawa: PWE.
4. Brajer-Marczak, R. (2009). Konsekwencje ciągłego doskonalenia procesów w organizacjach. In: S. Nowosielski (ed.), *Podejście procesowe w organizacjach*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.

5. Brajer-Marczak, R. (2019). Doskonalenie procesów biznesowych – analiza występujących problemów. *Przedsiębiorczość i Zarządzanie XX, 4, I*. Łódź.
6. Brajer-Marczak, R. (2021). *Zaangażowanie pracowników w doskonalenie procesów biznesowych*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.
7. Brillman, J. (2002). *Nowoczesne koncepcje i metody zarządzania*. Warszawa: PWN.
8. Conger, J.A., Kanungo, R.N. (1988). The Empowerment Process: Integrating Theory and Practice. *Academy of Management Review, vol. 13, no. 3*.
9. Cyfert, Sz. (2006). *Strategiczne doskonalenie architektury procesów w zarządzaniu przedsiębiorstwem*. Poznań: Wydawnictwo AE.
10. Cyfert, Sz. (2007). Ograniczenia metod doskonalenia procesów wykorzystywanych w polskich przedsiębiorstwach. In: A. Potocki (ed.), *Mechanizmy i obszary przeobrażeń w organizacjach*. Warszawa: Difin.
11. Davenport, T.H. (1993). Reed radical innovation and continuous improvement? Integrate process reengineering and TQM. *Planing Review, May/Jun, vol. 21, no. 3*.
12. Gaitanides, M. (2012). *Prozessorganisation. Entwicklung, Ansätze und Program des Managements von Geschäftsprozessen*. München: Verlag Franz Vahlen.
13. Głodziński, E., Marciniak, S. (2016). Development of controlling conception regarding project management: current situation and further research studies. *Research papers of Wrocław University of Economics, no. 421*. Wrocław.
14. Grajewski, P. (2007). *Organizacja procesowa*. Warszawa: PWN.
15. Grudziewski, W.M. (2004). *Metody projektowania systemów zarządzania*. Warszawa: Difin.
16. Jochem, R., Geers, D. (2010). Prozessgestaltung mit Business Process Reengineering. In: R. Johem, K. Mertins, T. Knothe (eds.), *Prozessmanagement. Strategien, Methoden, Umsetzung*. Düsseldorf: Symposium.
17. Kalinowski, T.B. (2010). *Innowacyjność przedsiębiorstw a systemy zarządzania jakością*. Warszawa: Wolters Kluwer Polska.
18. Kerzner, H. (2005). *Zarządzanie projektami. Studium przypadków*. Gliwice: Helion.
19. Kisielnicki, J. (2008). *Zarządzanie. Jak zarządzać i być zarządzanym*. Warszawa: PWE.
20. Koontz, H., Weihrich, H. (2009). *Essentials of Management, An International Perspective*. New Delhi: Tata McGraw Hill Education Private Limited.
21. Kowalczyk, J. (2009). *Zarządzanie organizacją turystyczną*. Warszawa: CeDeWu.
22. Łuczak, J. (2007). *Metody i techniki zarządzania jakością: kompendium wiedzy*. Poznań: Quality Progress.
23. Nems, J., Knop, K. (2023). *Doskonalenie procesu realizacji zamówień z wykorzystaniem wybranych metod*. *Management and Quality, 5(2)*. Katowice.
24. Nesterak, J. (2015). *Controlling zarządczy. Projektowanie i wdrażanie*. Warszawa: Oficyna a Wolters Kluwer Business.

25. Niedbała, B. (2008). *Controlling w przedsiębiorstwie zarządzanym przez projekt*. Kraków: Wydawnictwo Wolters Kluwer Polska.
26. Nowosielski, S. (2014). Ciągłe doskonalenie procesów w organizacji. Możliwości i ograniczenia. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, no. 340.
27. Nowosielski, S. (ed.) (2008). *Procesy i projekty logistyczne*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.
28. Preißler, P.R. (2020). *Controlling*. München: Verlag Franz Vahlen GmbH.
29. Raczyńska, E. (2022). Lean management czy doskonalenie procesów biznesowych - co wybrać dla ochrony zdrowia. In: N. Iwaszczuk (ed.), *Podejmowanie decyzji w działalności gospodarczej*. Kraków: Akademia Górniczo-Hutnicza im. Stanisława Staszica w Krakowie.
30. Sanders, D., Ross, B., Coleman, J. (1999). The process map. *Quality Engineering*, vol. 11, no. 4, New York.
31. Siekierski, W. (2010). *Controlling jako narzędzie usprawniające funkcjonowanie spółki PKP Polskie Linie Kolejowe S.A.* Warszawa: CeDeWu.
32. Skrzypek, E. (2000). *Jakość i efektywność*. Lublin: Wydawnictwo Uniwersytetu Marii Curie-Skłodowskiej.
33. Szczepańska, K. (2008). Praktyka podejścia procesowego. *Problemy Jakości*, 8.
34. Szymonik, A. (2011). *Logistyka i zarządzanie łańcuchem dostaw. Część II*. Warszawa: Difin.
35. Trenkner, M. (2016). Doskonalenie procesów i ich uwarunkowania. *Zarządzanie i Finanse*, nr 2, cz. 1. Gdańsk.
36. Witt, J., Witt, T. (2010). *Kontinuierliche Verbesserungsprozess (KVP). Konzept-System-Massnahmen*. Hamburg: Winmuehle Verlag.

PRO-QUALITY IMPROVING OF PRODUCTS IN SMES FROM THE VISEGRAD GROUP COUNTRIES (V4)

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Purpose: The aim of the article was to analyse the qualitative approach to product improvement by Small and Medium Enterprises (SMEs) from the Visegrad Group (V4) countries (Poland, Slovakia, Czech Republic, and Hungary).

Design/methodology/approach: The analysed results included a research sample of 379 companies in the electromechanical industry (machinery processing industry). The sample was obtained between March and September 2023 by means of a guided survey. Analyses of the results of quantitative research were carried out to verify the approaches of SMEs from V4 countries to pro-quality product, including comparative analyzes of the results obtained. Analyses were performed using the ANOVA test (repeated measure designs). The Mann Whitney U test was used to identify statistically significant differences in entrepreneurs' responses. The significance level adopted was $\alpha = 0.05$.

Findings: It has been shown that SMEs from V4 countries have different approaches to improving product quality. Additionally, it was shown that both in the case of pro-quality activities of SMEs from the V4 countries, the lowest consistency of assessments occurs in the following countries: Poland and Slovakia, Poland and Hungary, Slovakia and Hungary.

Practical implications: Research results may contribute to more effective and coherent development activities of SMEs in the V4 countries as part of their sustainable development.

Social implications: Based on the research conducted, it is possible to provide SMEs in V4 countries with a more adequate approach to undertake consistent and effective quality activities as part of the improvement of the product.

Originality/value: Determining the current pro-quality approach to product improvement in SMEs in the V4 countries. The novelty is also the identification of the importance (level of importance) of these approaches in each V4 country, as well as the determination of the similarities and differences between these approaches in SMEs from countries in the Visegrad Group.

Keywords: Visegrad Group (V4), SMEs, quality product improvement, production engineering.

Category of the paper: Research paper.

1. Introduction

Small and medium-sized enterprises (SMEs) are treated as the most important in the development of the economy, e.g., they create jobs, stimulate competition, and the creation of innovations and ventures (Ključnikov et al., 2023; Song et al., 2023). SMEs are important in both developed and developing countries (Nguyen, Ho, 2021; Siwiec, Pacana, 2021c) such as the countries of the Visegrad Group (V4) (Domaracká et al., 2018; Gavurova et al., 2022; Hudakova et al., 2021). One of the key factors generating their market position is the quality of the products (Pacana, Siwiec, 2022a; Siwiec, Pacana, 2022), that is, customer satisfaction with their use (Kiran, 2017; Siwiec, Pacana, 2021a). Therefore, to meet customer expectations and global competition, SMEs focus on, for example, the efficiency of their processes, optimising resource use, or achieving efficiency in cost consumption (Bednárová, Liberko, 2008; Pacana, Siwiec, 2021; Xu et al., 2023).

Improving product quality in SMEs involves the use of various instruments, as well as examining practices, approaches, and other aspects of SMEs' activities (Pacana, Siwiec, 2022b; Siwiec, Pacana, 2021d). The basic activity is to acquire customer expectations and then take actions to meet customer satisfaction (Ostasz et al., 2022; Siwiec, Pacana, 2021c, 2021a). Other activities include, for example, the modernisation of enterprises within the framework of Industry 4.0, as proposed by, for example, the authors of the studies (Gajdzik et al., 2023; Ingaldi, Ulewicz, 2019; Ivascu, 2020; Shqair, Altarazi, 2022). However, in the study (Biea et al., 2023), it was proposed to analyse recruitment procedures in the changing business environment after the COVID-19 pandemic. The analyses were carried out in SMEs among managers of these enterprises, where they analysed, for example, digital technologies, human resources, and other technological improvements. In turn, the authors of the article (Gomathi Prabha, Yuvaraja, 2023) implemented Lean Six Sigma and the Internet of Things (IoT) to streamline SMEs processes, thus improving the quality of products and shorten the implementation time of these processes. Another example is the study (Chaithanapat et al., 2022), which examined the connections between customer knowledge, leadership, quality, and innovation in SMEs. The results indicated, for example, that the mediating roles of customer knowledge management and knowledge-orientated leadership in these relationships are important (Nagy, Veresné Somosi, 2022).

Based on a review of the literature on the subject, it was shown that small businesses undertake pro-quality activities as part of the improvement of the product. However, no research has been found that would analyse quality-based approaches when improving

products in small businesses in the countries of the Visegrad Group (V4). This was considered a research gap, which was attempted to fill in the ongoing research. The purpose of the article was to analyse the qualitative approach to product improvement by SMEs from countries of the Visegrad Group.

The research involved qualitative-environmental approaches to the improvement of products and was carried out as part of an international project „Qualitative-environmental aspects of products improvement” (IVF 22230264).

2. Method of research

The research was carried out as part of a survey among entrepreneurs of small and medium-sized enterprises (SMEs) belonging to the electromechanical industry (machinery processing industry). These were SMEs from the countries of the Visegrad Group (Poland, Czech Republic, Slovakia and Hungary). The article analyses the results of surveys collected in the period from March to November 2023.

The survey results included 379 SMEs from the countries of the Visegrad Group, i.e. Czech Republic (39), Poland (156), Hungary (94), Slovakia (90). Most of the surveyed SMEs from the V4 countries were located in city from 150000 to 500000 residents (117), and city from 20000 to 150000 residents (99). Most of them were international companies (175).

The survey was conducted in paper and electronic form using MS FORMS. The developed survey is presented in the literature on the subject, i.e. (QuEn - Research Questionnaire For Enterprise, 2023). The survey questions were developed according to preliminary research, e.g.: (Hajduk-Stelmachowicz et al., 2022; Siwiec et al., 2022, 2023) and based on a review of the literature on the subject, e.g. (Benito-Hernández et al., 2023; Bryła, 2020; Hudakova et al., 2021; Saqib et al., 2023; Wysocki, 2018).

Pro-quality approach of SMEs in the V4 countries to improving product quality were analysed. As part of the research, the following hypotheses were verified:

H₁: Do SME entrepreneurs from the V4 countries have a similar approach to pro-quality product improvement?

Question: What is your opinion about every statement refers to pro-quality improving of products? Mark one answer for each statement in scale: 1 – I totally don't agree, 2 – less than once every three years, 3 – once every two to three years, 4 – I mostly agree, 5 – I totally agree.

Statements:

1. All customers in the supply chain attach great importance to the quality of products.
2. Customers will pay more if they get high quality product.
3. A high-quality product is the product that meets the current requirements of customers.

4. Currently, high-quality products have also a high level of environmental friendliness.
5. Wealthy customers usually choose high-quality products.
6. Choosing a high-quality product can improve a customer's self-esteem.
7. Customers pay attention to the high-quality of packaging of product.
8. High-quality products are sufficiently promoted.
9. We as a company strive to continuously improve products' quality.
10. The higher price of high-quality products significantly discourages customers from buying them.
11. Customers are more likely to buy a high-quality product if it has been previously recommended/tested.
12. Customers have a lot of knowledge about the attributes of products that affect their high quality.
13. Higher quality products have a higher price.
14. Customers will pay more for products from enterprises that are active in improving the quality of products.

Analyses were performed using the ANOVA test (repeated measure designs). The appearance of statistically significant differences in responses regarding product improvement approaches in SMEs from the V4 countries was also analysed. The Mann Whitney U test was used for this purpose. All analyses were performed at the significance level of $\alpha = 0.05$. Using STATISTICA 13.3.

3. Results

As part of the ongoing research, statements regarding pro-quality activities were initially analysed. An ANOVA test (repeated measurement designs) was used for this purpose. Analyses were performed at the significance level of $\alpha = 0.05$. This is shown in Figure 1.

To standardise the analysis, the mean values obtained from the responses were grouped into two groups, i.e. statements with high scores for mean values $<2.84;3.51$), and statements with low scores for mean values $<3.51;4.19>$. In line with this assumption, in all V4 countries, SME entrepreneurs highly rated the statement, that is, (9) we as a company strive to continuously improve the quality of the products. However, SME entrepreneurs from Poland, Slovakia, and the Czech Republic jointly rated it highly (11) customers are more likely to buy a high-quality product if it has been previously recommended/tested. It was observed that SME entrepreneurs from Poland and Hungary rated most of the statements highly, e.g.: 1, 3, 6, 7, 12, 13, 14, according to the method of research. However, most statements were given low ratings by SME entrepreneurs from Slovakia and the Czech Republic, i.e.: 1, 2, 4, 5, 6, 7, 8, 10, 12, 13, 14, according to method of research.

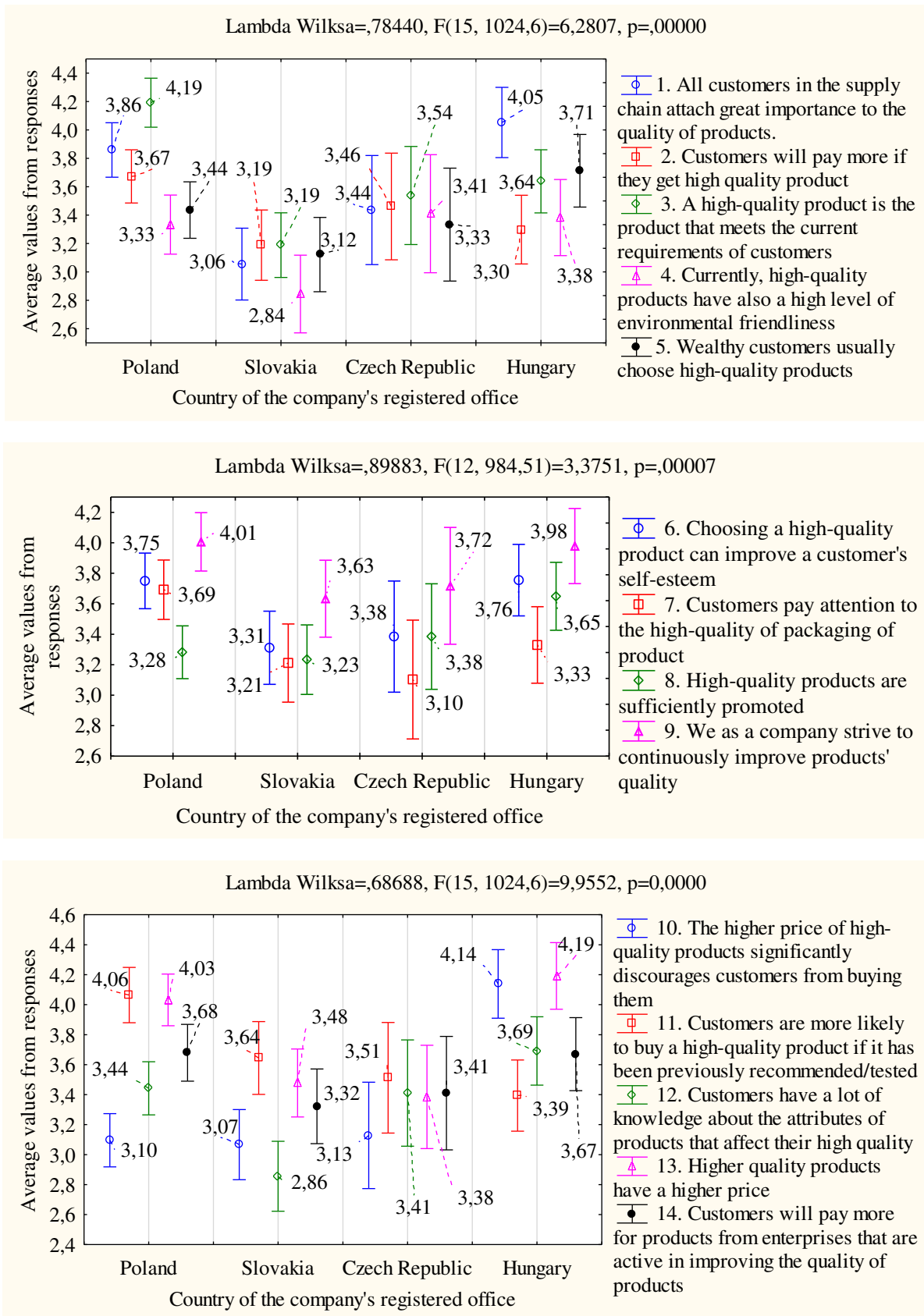


Figure 1. Average values of assessments of SME entrepreneurs by V4 country for pro-quality activities.

Then, it was checked whether there were statistically significant differences in the responses of SME entrepreneurs from individual V4 countries. Responses to statements regarding pro-quality activities were analysed. On their basis, the Mann Whitney U test was carried out. The analyses were carried out at the significance level of $\alpha = 0.05$. The results of the analysis are presented in Table 1.

Table 1

Results of the Mann-Whitney U test for pro-quality activities of SMEs from the V4 countries

Number of actions	Poland-Slovakia	Poland - Hungary	Poland - Czech Republic	Slovakia - Hungary	Slovakia - Czech Republic	Hungary - Czech Republic
1	0.000	0.275	0.079	0.000	0.155	0.016
2	0.006	0.003	0.112	0.620	0.320	0.399
3	0.000	0.000	0.002	0.017	0.139	0.842
4	0.005	0.593	0.789	0.005	0.031	0.972
5	0.104	0.152	0.569	0.009	0.519	0.098
6	0.008	0.500	0.085	0.035	0.786	0.189
7	0.011	0.005	0.012	0.573	0.636	0.429
8	0.960	0.020	0.571	0.107	0.665	0.384
9	0.031	0.826	0.181	0.083	0.748	0.308
10	0.797	0.000	0.923	0.000	0.765	0.000
11	0.011	0.000	0.004	0.104	0.487	0.419
12	0.000	0.110	0.764	0.000	0.008	0.126
13	0.001	0.450	0.001	0.000	0.555	0.000
14	0.038	0.561	0.100	0.045	0.833	0.052

where: 1-14 statements as in method research for pro-quality activities.

The research shows that the relatively largest statistically significant differences in the answers given regarding pro-quality activities occur in Poland and Slovakia, but also in Slovakia and Hungary. SME entrepreneurs from Poland and Slovakia have different views on the following issues: (1) all customers in the supply chain attach great importance to the quality of products ($p < \alpha$, $p = 0.000$), (2) customers will pay more if they get high quality product ($p < \alpha$, $p = 0.006$), (3) a high-quality product is the product that meets the current requirements of customers ($p < \alpha$, $p = 0.000$), and 4, 6, 7, 9, 11, 12, 13, 14, according to method of research. However, entrepreneurs from Slovakia and Hungary evaluated the claims significantly differently, that is, 1, 3, 4, 5, 6, 10, 12, 13, 14, according to method of research. Less statistically significant differences were observed in the responses of SME entrepreneurs from Poland and Hungary. These differences concerned the following statements: 2, 3, 7, 8, 10, 11, according to the research method. The least statistically significant differences were observed in SMEs from Poland and the Czech Republic, respectively, that is, 3, 7, 11, 13, Hungary and the Czech Republic, that is, 1, 10, 13, and Slovakia and the Czech Republic, that is, 4, 12, according to method of research. Therefore, after verifying hypothesis (H_1), it was shown that V4 SME entrepreneurs have a relatively similar approach to improving quality products.

4. Discussion and conclusions

Companies are trying to meet the challenges of climate change and strive to achieve the expected quality of their products. Intensified efforts in this area are undertaken mainly by SMEs. They strive to consistently implement activities that will support their effective development. However, this remains a challenge for SMEs in the V4 countries. This results, for example, from the dynamics of changes and the turbulent environment (e.g., as a result of the COVID-19 pandemic), still make it difficult to make accurate development decisions.

Therefore, research was carried out in the area of the qualitative approach of SMEs from countries in the Visegrad Group to product improvement (Civelek et al., 2021; Domaracká et al., 2018; Siwec, Gawlik et al., 2023). For this purpose, a survey was used; the results presented included a sample of 379 enterprises from the electromechanical industry (machine processing industry). The sample was obtained in the period from March to September 2023. The analyses of the research results were carried out by examining the approach of SMEs from V4 countries to the improvement of quality and environmental products, including comparative analyses of the results obtained. An ANOVA test (repeated measurement designs) was used for this purpose. However, to identify statistically significant differences in the responses of entrepreneurs, the Mann Whitney U test was used. Analyses were performed at the significance level of $\alpha = 0.05$.

Based on the qualitative approach of SMEs from the V4 countries, it was shown that:

- the greatest consistency in the assessments of SME entrepreneurs occurs in the countries of Slovakia and the Czech Republic, Hungary and the Czech Republic, and Poland and the Czech Republic,
- the lowest consistency of assessments of SME entrepreneurs occurs in the countries: Poland and Slovakia, Poland and Hungary, Slovakia and Hungary,
- SMEs analysed SMEs from the V4 countries strongly agree with the statement that we as a company strive to continuously improve product quality,
- Poland, Slovakia and the Czech Republic collectively agree most with the statements, e.g.: customers are more likely to buy a high-quality product if it has been previously recommended/tested, or a high-quality product is the product that meets the current requirements of customers,
- Slovakia, the Czech Republic and Hungary collectively least agree with the statement that customers pay attention to the high-quality of packaging of product,
- Poland least agrees with the statement that the higher price of high-quality products significantly discourages customers from buying them.

It is concluded that the approach to improving product quality in SMEs in the V4 countries is different in most aspects.

The originality of the research is the determination of the current pro-quality approach to product improvement in SMEs in the V4 countries. What is also new is the identification of the importance of these approaches in improving products in SMEs from countries of the Visegrad Group.

Future research will focus on comparing pro-quality and pro-environmental approaches to product improvement in SMEs from the Visegrad Group countries with enterprises in western Europe or other regions of the world.

Acknowledgements

The article was created as part of research conducted in the project Visegrád Fund, project ID: 22230264, Title: Qualitative-environmental aspects of products improvement, carried out from February 1, 2023 to March 31, 2024: Applicant: Politechnika Rzeszowska im. Ignacy Łukasiewicz. Rzeszow University of Technology, Rzeszów, PL.

References

1. Bednárová, L., Liberko, I. (2008). Benchmarking application in firms for production of chamotte bricks. *Acta Montanistica Slovaca*, 13(4), 502–511.
2. Benito-Hernández, S., López-Cózar-Navarro, C., Priede- Bergamini, T. (2023). The influence of government support over environmental protection investment on SMEs: R&D collaboration and financial aspects. *Business Ethics, the Environment & Responsibility*, 32(2), 836–846. <https://doi.org/10.1111/beer.12496>
3. Biea, E.A., Dinu, E., Bunica, A., Jerdea, L. (2023). Recruitment in SMEs: the role of managerial practices, technology and innovation. *European Business Review*. <https://doi.org/10.1108/EBR-05-2023-0162>
4. Bryła, P. (2020). Znaczenie marki na rynku ekologicznych produktów żywnościowych. In: *Strategie budowania marki i rozwoju handlu. Nowe trendy i wyzwania dla marketingu*. Wydawnictwo Uniwersytetu Łódzkiego. <https://doi.org/10.18778/8142-903-0.03>
5. Chaithanapat, P., Punnakitikashem, P., Khin Khin, Oo, N.C., Rakthin, S. (2022). Relationships among knowledge-oriented leadership, customer knowledge management, innovation quality and firm performance in SMEs. *Journal of Innovation & Knowledge*, 7(1), 100162. <https://doi.org/10.1016/j.jik.2022.100162>
6. Civelek, M., Ključnikov, A., Kloudová, J., Vozňáková, I. (2021). Digital Local Currencies As An Alternative Digital Payment Method For Businesses To Overcome Problems Of

- Covid-19 Pandemic. *Polish Journal of Management Studies*, 23(2), 57–71. <https://doi.org/10.17512/pjms.2021.23.2.04>
7. Domaracká, L., Tausová, M., Muchova, M., Janocková, I., Bednárová, L. (2018). Limestone in V4 countries. *Acta Montanistica Slovaca*, 23(4), 390–401.
 8. Gajdzik, B., Wolniak, R., Grebski, W.W. (2023). Electricity and Heat Demand in Steel Industry Technological Processes in Industry 4.0 Conditions. *Energies*, 16(2), 787. <https://doi.org/10.3390/en16020787>
 9. Gavurova, B., Schonfeld, J., Bilan, Y., Dudas, T. (2022). Study of the Differences in the Perception of the Use of the Principles of Corporate Social Responsibility in Micro, Small and Medium-Sized Enterprises in the V4 Countries. *Journal of Competitiveness*, 14(2), 23–40. <https://doi.org/10.7441/joc.2022.02.02>
 10. Gomathi Prabha, M., Yuvaraja, M. (2023). Development of an IoT integrated DMAIC model for process improvement in Indian SMEs: An empirical study. Proceedings of the Institution of Mechanical Engineers, Part E. *Journal of Process Mechanical Engineering*, 237(2), 589–601. <https://doi.org/10.1177/09544089221122015>
 11. Hajduk-Stelmachowicz, M., Bełch, P., Siwec, D., Bednárová, L., Pacana, A. (2022). Instruments Used To Improve The Betterment Of Products Quality. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 157, 157–171. <https://doi.org/10.29119/1641-3466.2022.157.10>
 12. Hudakova, M., Gabrysova, M., Petrakova, Z., Bugarova, K., Krajcik, V. (2021). The Perception of Market and Economic Risks by Owners and Managers of Enterprises in the V4 Countries. *Journal of Competitiveness*, 13(4), 60–77. <https://doi.org/10.7441/joc.2021.04.04>
 13. Ingaldi, M., Ulewicz, R. (2019). Problems with the Implementation of Industry 4.0 in Enterprises from the SME Sector. *Sustainability*, 12(1), 217. <https://doi.org/10.3390/su12010217>
 14. Ivascu, L. (2020). Measuring the Implications of Sustainable Manufacturing in the Context of Industry 4.0. *Processes*, 8(5), 585. <https://doi.org/10.3390/pr8050585>
 15. Kiran, D.R. (2017). Quality Function Deployment. In: *Total Quality Management* (pp. 425–437). Elsevier. <https://doi.org/10.1016/B978-0-12-811035-5.00030-1>
 16. Ključnikov, A., Civelek, M., Červinka, M., Vozňáková, I., Vincúrová, Z. (2023). The Role of SMEs' Innovativeness and Competitiveness in Their Financial Risk Management Concerns. *Journal of Competitiveness*, 14(4). <https://doi.org/10.7441/joc.2022.04.06>
 17. Nagy, S., Veresné Somosi, M. (2022). The relationship between social innovation and digital economy and society. *Regional Statistics*, 12(2), 3–29. <https://doi.org/10.15196/RS120202>
 18. Nguyen, T., Ho, M. (2021). Evaluation of Accounting Information Quality of Small and Medium-Sized Enterprises: An Empirical Study in Vietnam. *Journal of Asian Finance Economics And Business*, 8(7), 161–167.

19. Ostasz, G., Siwiec, D., Pacana, A. (2022). Model to Determine the Best Modifications of Products with Consideration Customers' Expectations. *Energies*, 15(21), 8102. <https://doi.org/10.3390/en15218102>
20. Pacana, A., Siwiec, D. (2021). Universal Model to Support the Quality Improvement of Industrial Products. *Materials*, 14(24), 7872. <https://doi.org/10.3390/ma14247872>
21. Pacana, A., Siwiec, D. (2022a). Method of Determining Sequence Actions of Products Improvement. *Materials*, 15(18), 6321. <https://doi.org/10.3390/ma15186321>
22. Pacana, A., Siwiec, D. (2022b). Model to Predict Quality of Photovoltaic Panels Considering Customers' Expectations. *Energies*, 15(3), 1101. <https://doi.org/10.3390/en15031101>
23. *QuEn - Research Questionnaire For Enterprise*. <https://Forms.Gle/EaGoCSMSERndUsUm9>.
24. Saqib, Z.A., Qin, L., Menhas, R., Lei, G. (2023). Strategic Sustainability and Operational Initiatives in Small- and Medium-Sized Manufacturers: An Empirical Analysis. *Sustainability*, 15(7), 6330. <https://doi.org/10.3390/su15076330>
25. Shqair, M.I., Altarazi, S.A. (2022). Evaluating the Status of SMEs in Jordan with Respect to Industry 4.0: A Pilot Study. *Logistics*, 6(4), 69. <https://doi.org/10.3390/logistics6040069>
26. Siwiec, D., Pacana, A. (2021a). A Pro-Environmental Method of Sample Size Determination to Predict the Quality Level of Products Considering Current Customers' Expectations. *Sustainability*, 13(10), 5542. <https://doi.org/10.3390/su13105542>
27. Siwiec, D., Pacana, A. (2021b). Method of improve the level of product quality. *Production Engineering Archives*, 27(1), 1–7. <https://doi.org/10.30657/pea.2021.27.1>
28. Siwiec, D., Pacana, A. (2021c). Model of Choice Photovoltaic Panels Considering Customers' Expectations. *Energies*, 14(18), 5977. <https://doi.org/10.3390/en14185977>
29. Siwiec, D., Pacana, A. (2021d). Model Supporting Development Decisions by Considering Qualitative–Environmental Aspects. *Sustainability*, 13(16), 9067. <https://doi.org/10.3390/su13169067>
30. Siwiec, D., Pacana, A. (2022). A New Model Supporting Stability Quality of Materials and Industrial Products. *Materials*, 15(13), 4440. <https://doi.org/10.3390/ma15134440>
31. Siwiec, D., Belch, P., Hajduk-Stelmachowicz, M., Pacana, A., Bednárová, L. (2022). Determinants Of Making Decisions In Improving The Quality Of Products. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 157, 497–507. <https://doi.org/10.29119/1641-3466.2022.157.31>
32. Siwiec, D., Gawlik, R., Pacana, A. (2023). Fuzzy Multi-criteria Decision Model to Support Product Quality Improvement. *Management and Production Engineering Review*. <https://doi.org/10.24425/mper.2023.146030>
33. Siwiec, D., Pacana, A., Simková, Z., Metszösy, G., Vozňáková, I. (2023). Current activities for quality and natural environment taken by selected enterprises belonging to SMEs from the electromechanical industry. *Scientific Papers of Silesian University of Technology*

- Organization and Management Series*, 172. <https://doi.org/10.29119/1641-3466.2023.172.33>
34. Song, Z., Zhu, J., Shi, J. (2023). Evolution Analysis of Green Innovation in Small and Medium-Sized Manufacturing Enterprises. *Systems*, 11(2), 95. <https://doi.org/10.3390/systems11020095>
35. Wysocki, J. (2018). Działalność proekologiczna dużych przedsiębiorstw produkcyjnych w Polsce - wyniki badań ankietowych. In: K. Poznańska, *Nowe formy innowacji* (pp. 82-109).
36. Xu, S., Nupur, R., Kannan, D., Sharma, R., Sharma, P., Kumar, S., Jha, P.C., Bai, C. (2023). An integrated fuzzy MCDM approach for manufacturing process improvement in MSMEs. *Annals of Operations Research*, 322(2), 1037–1073. <https://doi.org/10.1007/s10479-022-05093-5>

COMPARISON ANALYSIS OF PRO-QUALITY AND PRO-ENVIRONMENTAL APPROACHES TO PRODUCTS IMPROVING IN SMES FROM THE VISEGRAD GROUP COUNTRIES

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Purpose: The purpose of the research was to perform an in-depth comparative analysis of pro-quality and pro-environmental approaches to the products improvement in SMEs (belonging to the electrical machinery industry) from V4 countries.

Design/methodology/approach: An in-depth comparative analysis of pro-quality and pro-environmental approaches to product improvement was carried out in SMEs from V4 countries. Based on previous research (survey research conducted from March to September 2023 including 379 SMEs from V4 countries), two benchmarks for these approaches were developed and further analysed. Statistical analyses were used, i.e. Box-and-whisker chart and Wilcoxon paired test in STATISTICA 13.3. on the level of significance $p < 0.05$.

Findings: It was shown that SME entrepreneurs from V4 countries have a relatively similar approach to the improvement of pro-quality and pro-environmental products. The pro-quality approach is more important than pro-environmental in case of product improvement.

Practical implications: Research results can be the basis for defining more precise directions for the development of SMEs in V4 countries and increasing cooperation between consortium regions in the development of product production in line with the idea of sustainable development and current customer expectations.

Social implications: The results can have a positive impact on public attitudes, mainly entrepreneurs from SMEs, but not only in making further efforts to improve the quality of products while reducing the negative impact on the environment. This behavior may contribute to increased customer satisfaction with purchased products, but also to the development of the economies of the V4 countries and to meeting the requirements of sustainable development.

Originality/value: Originality of the research includes determining the current approach of SMEs in the electrical machinery industry in V4 countries to meeting customer expectations regarding product quality, while striving to achieve environmentally friendly products.

Keywords: V4, Visegrad Group, product quality, environmental impact, sustainable development, SMEs, production engineering.

Category of the paper: Research paper.

1. Introduction

The countries of the Visegrad group (V4, i.e. Poland, Slovakia, Czech Republic, and Hungary) (Siwiec, Varga, Pacana, 2023). The V4 countries are in the centre of Europe and are policy group. In the V4 countries, many decisions both external and internal are made together by governments of these countries. These countries have a similar history and similar development of market (Lacko et al., 2021). In these countries, it is important to develop open economies, and simultaneously development of system transformation. It is favourable when investments offer a relative good localization and resources by the small cost. These activities are powered by small and medium-sized enterprises (SMEs) (Golovko, Valentini, 2011; Ključnikov et al., 2023; Lu et al., 2022), which are the largest group of enterprises in the world. SMEs ensure many workplaces, and has important participation of market (Pacana, Siwiec, 2022; Siwiec, Pacana, Pacana, 2023). However, SMEs' activities translate into impact on natural environment, and this impact is significant given the large number of these enterprises (Masocha, 2018).

As part of sustainable development, it is necessary to reduce the negative impact of SMEs on natural environment (Khan et al., 2021; Wolf, Chomkham Sri, 2015). However, actions that reduce negative impact should be combined with actions that achieve customers' requirements from products' quality (Ostasz et al., 2022; Pacana, Siwiec, Bednárová, et al., 2023). It is difficult during turbulent and dynamic changes of customers' expectations and market. In the last period, these difficulties were mainly caused by SARS-CoV-2 and the Russian-Ukrainian war (Renzi et al., 2022). Mainly, it is problematic for countries still developing like V4 countries, which strive to reach the level of highly developed countries. Visegrad Group countries are still searching for optimal cooperation with all countries, mainly with neighboring ones. Their aim is to develop democracy in all part of Europe (Drews, 2016). Therefore, it is important to analyse current actions and also general approaches of V4 countries to sustainable development (Gajdzik, Wolniak, 2022; Gawlik, 2015). As mentioned, it has an important impact on the development in these countries of small businesses. Based on the literature review, for example (Belas et al., 2022; Falkowski, 2023; Golovko, Valentini, 2011; Hoogendoorn et al., 2015; Ivanová, Masárová, 2018; Lacko et al., 2021; Lopes de Sousa Jabbour et al., 2020; Lu et al., 2022), it was concluded that current approaches to qualitative and environmental aspects of product improvement in SMEs from V4 countries were not analysed in comparative way.

Therefore, the purpose of the research was to perform an in-depth comparative analysis of pro-quality and pro-environmental approaches to improving products in SMEs (belonging to electrical machinery industry) from V4 countries.

Originality of the research includes determining the current approach of SMEs in the electrical machinery industry in V4 countries to meeting customer expectations regarding product quality, while striving to achieve environmentally friendly products.

2. Method research

The research was carried out as part of the survey research. The survey was distributed to small and medium-sized enterprises (SMEs) belonging to electromechanical industry (Pacana, Siwiec, Stolarik, et al., 2023). These SMEs were from countries of the Visegrad Group (V4), i.e.: Poland, Slovakia, Czech Republic and Hungary (Hudakova et al., 2021).

The survey was realised in paper form, and also by electronic form (by using MS FORMS). The survey is presented in QuEn - Research Questionnaire For Enterprise. The survey questions were created as part of initial research, for example: Hajduk-Stelmachowicz et al., 2022; Siwiec et al., 2022; Siwiec et al., 2023. Also, the questions included in the survey resulted from literature review, i.e.: Benito-Hernández et al., 2023; Bryła, 2020; Hudakova et al., 2021; Saqib et al., 2023; Wysocki, 2018).

The survey included 36 questions, of which a few as presented, for example, in the study (Siwiec, Pacana, Simková et al., 2023). From these questions, two main questions which refer to pro-quality and pro-environmental approaches to the improvement (Siwiec, Varga, Pacana, 2023). These questions included 14 statements covering pro-quality and pro-environmental approaches, respectively. These questions were analysed separately in before articles. In this study, an in-depth comparative analysis of these two approaches which were based on the two questions of survey research. The following hypothesis was checked:

H₁: SMEs from V4 countries have a relatively similar approach to the improvement of pro-quality and pro-environmental products.

The comparative analysis of the pro-quality and pro-environmental approaches in terms of product improvement included:

- Calculation of average ratings given to the analysed pro-quality and pro-environmental statements;
- Calculation of indicators from the average of the ratings given to the analysed pro-quality and pro-environment statements;
- Analysis of results.

The analysis of results was supported by created indicators that were developed based on average assessments of each statement. Comparison analysis was also supported by the box-and-whisker chart and Wilcoxon's paired test. The box and whisker chart was created to show the difference between pro-quality and pro-environmental approaches. The Wilcoxon paired test was performed to check whether the differences between these assessments are significant

in a statistical way. The choice of these tests resulted from their suitability for the analysis of two independent variables. Statistical analyses were realized in STATISTICA 13.3. on the level of significance $p < 0.05$.

Figure 1 presented the assumed method of analysing the pro-quality and pro-environmental approaches to improving products in SMEs from V4 countries.

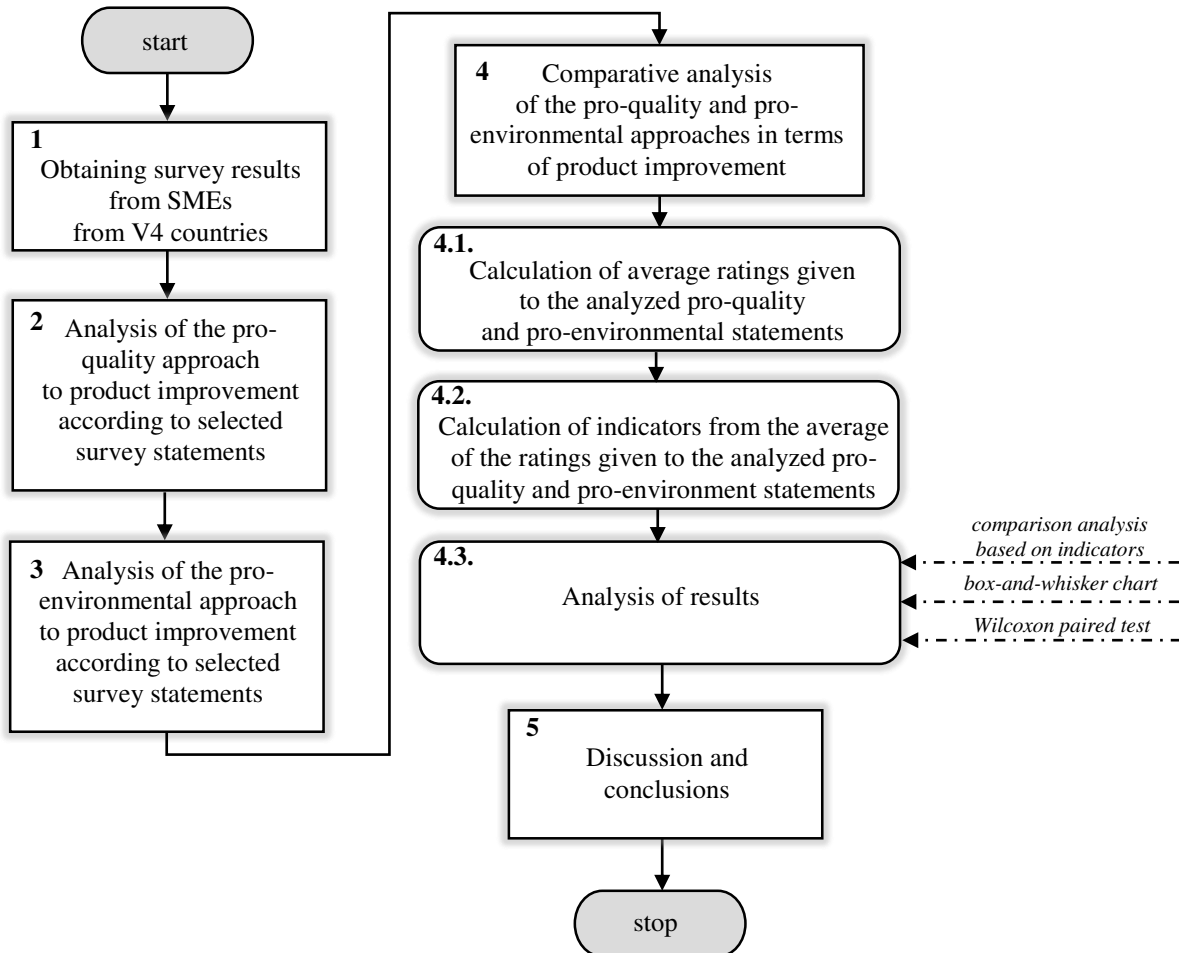


Figure 1. Method of analysis of pro-quality and pro-environmental approaches to products' improvement in SMEs from V4 countries.

Source: Own elaboration.

The method of comparison analysis of these approaches was realized in fifth main stages. Stages 1 to 3 were carried out as part of previous activities that were carried out as part of an international project (IVF 22230264), during which the results presented in this study were obtained. Stages 4 and 5 (with steps 4.1, 4.2, and 4.3) refer to realized comparison analysis presented in the next chapter of the study.

3. Results

The study presented part of research results that refers to pro-quality and pro-environmental approach to product improvements. The research involved qualitative-environmental approaches to the improvement of products and was carried out as part of an international project „Qualitative-environmental aspects of products improvement” (IVF 22230264). The results presented in the study refer to two main questions of the research and including detailed information about SMEs that participated in the research. The sample size was equal to 379 SMEs from V4 countries (41% Poland, 25% Hungary, 24% Slovakia, 10% Czech Republic). This sample size was obtained from March to November 2023.

Firstly, analyzed status of implementing systems, i.e.: ISO 9001:2015, ISO 14001:2015, and EMAS. Figure 2 presented this results.

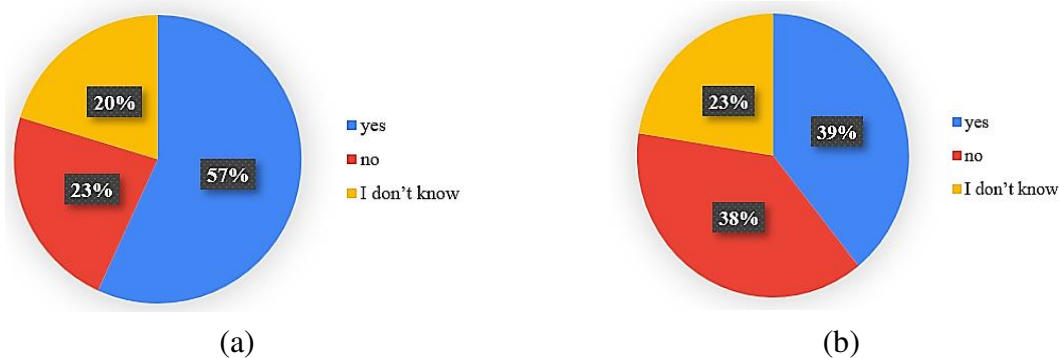


Figure 2. Results of implemented: (a) ISO 9001:2015 system, (b) ISO 14001:2015 system or EMAS system.

Source: Own elaboration.

Based on the results of the survey datasheet, it was shown that 57% of SMEs from V4 countries implemented the ISO 9001:2015 system, 20% of entrepreneurs did not know about the implementation of this system, and 23% declared that had not implemented this system. Less than half of the SMEs in the V4 countries (39%) implemented the ISO 14001: 2015 system or the EMAS system. 23% of the entrepreneurs did not know if these systems were implemented and 38% of entrepreneurs declared that had not implemented the ISO 14001:2015 system or EMAS system.

Then, it was analyzed the range of activity and company headquarters of SMEs from V4 countries. Figure 3 presented this results.

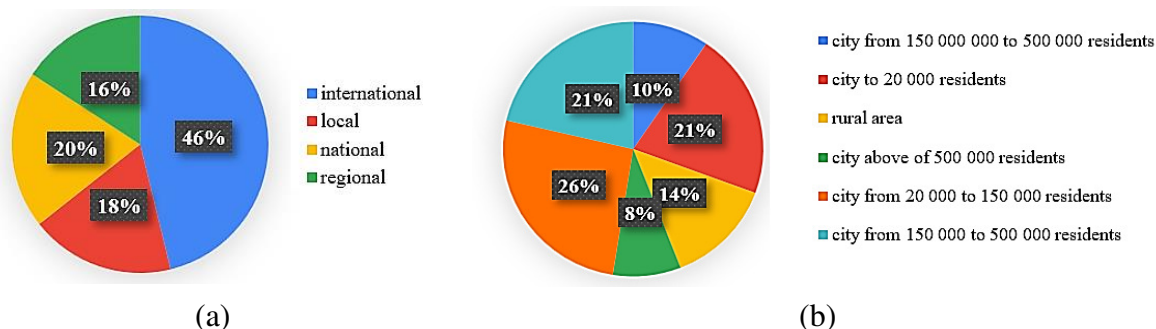


Figure 3. Results of: (a) range of activity, (b) company headquarters.

Source: Own elaboration.

46% of SMEs form V4 belong to international range, then 20% national, 18% local, and 16% regional. In case of company headquarters: 26% were city from 20 000 to 150 000 residents, then 21% were city from 150 000 to 500 000 residents, and also city to 20 000 residents. Other SMEs were located in rural area (14%), city from 150 000 to 500 000 residents (10%) and city above of 500 000 residents (8%).

Then, the approaches of the V4 countries to pro-quality and environmental products were compared. The analysed questions are presented in Table 1. For these questions it was possible to mark one answer for each statement in scale: 1 – I totally don't agree, 2 – less than once every three years, 3 – once every two to three years, 4 – I mostly agree, 5 – I totally agree.

Table 1.

Survey questions for pro-quality and pro-environmental approaches of products improvement

No.	What is your opinion about every statement refers to pro-quality improving of products?	What is your opinion about every statement refers to pro-environmental improving of products?
1	All customers in the supply chain attach great importance to the quality of products	Customers attach great importance to the pro-environmental actions of analyzed enterprise
2	Customers will pay more if they get high quality product	Customers will pay more if the product is pro-ecological
3	A high-quality product is the product that meets the current requirements of customers	A pro-ecological product is the product that meets the current requirements of customers
4	Currently, high-quality products have also a high level of environmental friendliness	Currently, pro-ecological products have also a high level of quality
5	Wealthy customers usually choose high-quality products	Wealthy customers usually choose pro-ecological products
6	Choosing a high-quality product can improve a customer's self-esteem	Choosing a pro-ecological product can improve a customer's self-esteem
7	Customers pay attention to the high-quality of packaging of product	Customers pay attention to the pro-ecological packaging of product
8	High-quality products are sufficiently promoted	Pro-ecological products are sufficiently promoted
9	We as a company strive to continuously improve products' quality	We as a company strives to produce pro-ecological products
10	The higher price of high-quality products significantly discourages customers from buying them	The higher price of pro-ecological products significantly discourages customers from buying them
11	Customers are more likely to buy a high-quality product if it has been previously recommended/tested	Customers are more likely to buy a pro-ecological product if it has been previously recommended/tested

Cont. table 1.

12	Customers have a lot of knowledge about the attributes of products that affect their high quality	Customers have a lot of knowledge about the attributes of products that affect their pro-ecological features
13	Higher quality products have a higher price	Pro-ecological products have higher prices
14	Customers will pay more for products from enterprises that are active in improving the quality of products	Customers will pay more for products from enterprises that take real pro-ecological actions

These pro-quality and pro-environmental approaches were analysed in other studies. Therefore, in this article, only the average values of the ratings of SME entrepreneurs from V4 countries for the pro-quality and pro-environmental approaches. Table 2 presents these average values.

Table 2.

Average values from the ratings given by entrepreneurs for pro-quality and pro-environmental statements for product improvement

No. of statement	Poland	Slovakia	Czech Republic	Hungary	Poland	Slovakia	Czech Republic	Hungary
	Pro-quality approach				Pro-environmental approach			
1	3.86	3.06	3.44	4.05	3.06	2.72	3.05	3.20
2	3.67	3.19	3.46	3.30	2.99	3.00	3.00	2.94
3	4.19	3.19	3.54	3.64	3.14	2.86	3.21	2.82
4	3.44	2.84	3.41	3.38	3.16	2.82	3.00	3.56
5	3.44	3.12	3.33	3.41	3.27	2.91	3.18	3.64
6	3.75	3.31	3.38	3.76	3.38	3.14	3.44	3.73
7	3.69	3.21	3.10	3.33	3.17	2.98	3.28	3.44
8	3.28	3.23	3.38	3.65	3.08	3.11	3.28	3.52
9	4.01	3.63	3.72	3.98	3.38	3.00	3.72	3.44
10	3.10	3.07	3.13	4.14	3.30	3.28	2.95	4.28
11	4.06	3.64	3.51	3.39	3.58	3.27	3.69	3.52
12	3.44	2.86	3.41	3.69	3.09	2.77	3.49	3.41
13	4.03	3.48	3.38	4.19	3.89	3.50	3.54	4.29
14	3.68	3.32	3.41	3.67	3.15	3.09	3.31	3.37

Based on average values of pro-quality and pro-environmental approaches to products' improvement, two indicators were calculated, that is, the pro-quality indicator (the average of the average values of the ratings of SME entrepreneurs from the V4 countries for the pro-quality approach) and the pro-environmental indicator (the average of the average values of the ratings of SME entrepreneurs from the V4 countries for the pro-environmental approach). These indicators are presented in Table 3.

Table 3.
Pro-quality and pro-environmental indicators

No. of statement	Pro-quality indicator	Pro-environmental indicator
1	3.60	3.01
2	3.41	2.98
3	3.64	3.01
4	3.27	3.14
5	3.33	3.25
6	3.55	3.42
7	3.33	3.22
8	3.39	3.25
9	3.84	3.39
10	3.36	3.45
11	3.65	3.52
12	3.35	3.19
13	3.77	3.81
14	3.52	3.23

These indicators are compared by using Box-and-whisker (in STATISTICA 13.3), as shown in Figure 4.

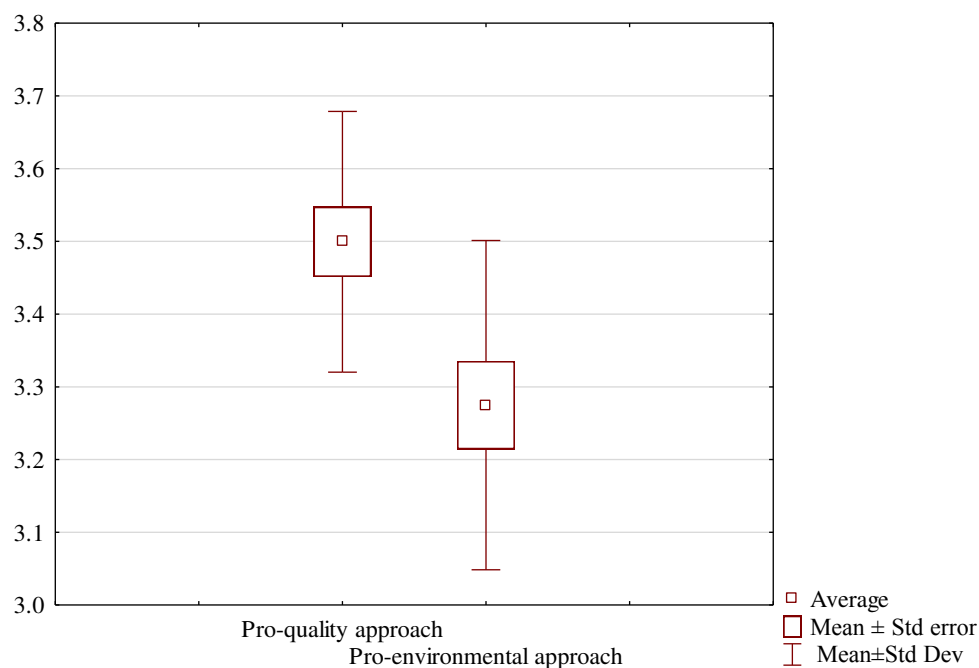


Figure 4. Box-and-whisker chart including the average of the average values of entrepreneurs' assessments for pro-quality and pro-environmental product improvement.

Source: Own elaboration.

Based on box-and-whisker chart shown that pro-quality and pro-environmental approaches in general approach were assessed in different way. The highest ratings were obtained for the pro-quality approach, which demonstrates greater involvement of SMEs from V4 countries in these activities.

Then, the Wilcoxon paired test was used to check if the difference between these assessments is significant by statistic way. This test was carried out using STATISTICA 13.3 software. Based on the results, it was shown that the pro-quality and pro-environmental approaches differ statistically significantly ($p < 0.05$). A detailed analysis of the differences between the indicators is presented in Figure 5.

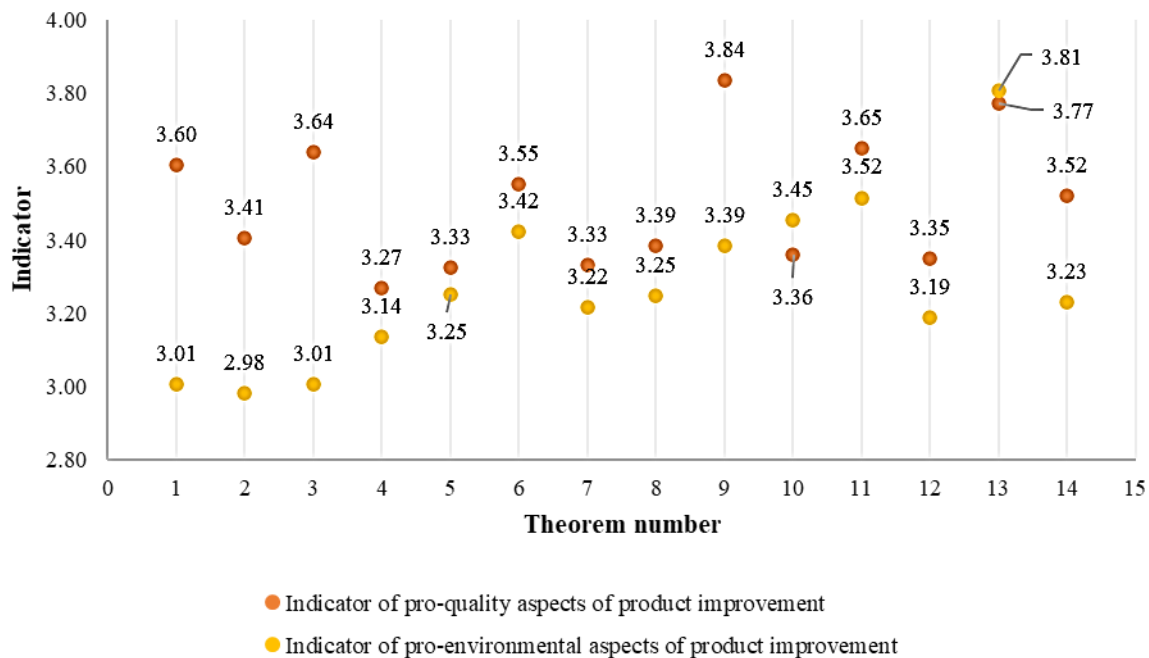


Figure 5. Comparison of approaches to pro-quality and pro-environmental product improvement by SMEs from the V4 countries.

Source: Own elaboration.

The approach to improving the quality of the product was observed to be much better in most aspects by the entrepreneurs of the V4 countries, for example: (1) all customers in the supply chain attach great importance to the quality of the products (3.60), or (2), customers will pay more if they get a high quality product (3.41).

Compared to the evaluation of the pro-environmental aspects, only several the pro-quality aspects were rated worse, that is, (10) the higher price of high-quality products significantly discourages customers from buying them (3.36), and (13) higher quality products have a higher price (3.77).

Both the pro-quality and pro-environmental aspects can be assumed to be on relatively similar level, that is, 4,5,6,7,8,10,11,13. However, as shown in previous analyses, all differences in pro-quality and pro-environmental indicators were statistically significant ($p < 0.05$).

Therefore, it was concluded that the pro-quality aspects are in the vast majority of cases more important to SMEs in the V4 countries. Therefore, as part of hypothesis (H_1), it was shown that SME entrepreneurs from V4 countries have a relatively similar approach to the

improvement of pro-quality and pro-environmental products. The pro-quality approach is more important than pro-environmental in case of product improvement.

4. Discussion and conclusion

Striving for sustainable development continues to be a challenge, mainly in developing countries, such as the countries of the Visegrad group. It is important to take appropriate action in the largest group of enterprises, which are small and medium enterprises (SMEs). Therefore, the purpose of the research was to perform an in-depth comparative analysis of pro-quality and pro-environmental approaches to improving products in SMEs (belonging to electrical machinery industry) from V4 countries. This analysis was carried out based on survey results obtained from March to September 2023 from 379 SMEs from V4 countries. The method of analysis refers to a thorough comparative analysis of pro-quality and pro-environmental approaches to improving products in SMEs from the V4 countries. This analysis was supported by statistical analysis, i.e. the box-and-whisker chart and Wilcoxon paired test which were performed at the level of significance $p < 0.05$. After analysis, it was shown that:

- pro-quality and pro-environmental approaches in general approach were assessed in different way;
- the highest ratings were obtained for the pro-quality approach, which demonstrates greater involvement of SMEs from V4 countries in these activities;
- pro-quality and pro-environmental approaches differ statistically significantly ($p < 0.05$);
- compared to the evaluation of the pro-environmental aspects, only several the pro-quality aspects were rated worse, that is, the higher price of high-quality products significantly discourages customers from buying them, and higher quality products have a higher price.

After analysis, it was concluded that SMEs from V4 countries have a relatively similar approach to the improvement of pro-quality and pro-environmental products, but the pro-quality approach are more important than pro-environmental in case of products' improvement.

Originality of the research includes determining the current approach of SMEs in the electrical machinery industry in V4 countries to meeting customer expectations regarding product quality, while striving to achieve environmentally friendly products.

These results can be used by SMEs from V4 countries to make more precise decisions about product improvement and reduce the negative impact of these products on the natural environment. Furthermore, these results can be the basis for increasing cooperation between consortium regions in the development of product production according to the idea of sustainable development and the current customer expectations. These results can be good tips

for the development of the economies of the V4 countries and meeting the requirements of sustainable development.

Acknowledgements

The article was created as part of research conducted in the project Visegrád Fund, project ID: 22230264, Title: Qualitative-environmental aspects of products improvement, carried out from February 1, 2023 to March 31, 2024: Applicant: Politechnika Rzeszowska im. Ignacy Łukasiewicz. Rzeszow University of Technology, Rzeszów, PL.

References

1. Belas, J., Gavurova, B., Novotna, L., Smrcka, L. (2022). Examination of Differences in Using Marketing Tools in the Management of SMEs in the Visegrád Group Countries. *Www.Amfiteatruconomic.Ro*, 24(60), 447. <https://doi.org/10.24818/EA/2022/60/447>
2. Benito-Hernández, S., López-Cózar-Navarro, C., Priede-Bergamini, T. (2023). The influence of government support over environmental protection investment on SMEs: R&D collaboration and financial aspects. *Business Ethics, the Environment & Responsibility*, 32(2), 836–846. <https://doi.org/10.1111/beer.12496>
3. Bryła, P. (2020). Znaczenie marki na rynku ekologicznych produktów żywnościowych. In: *Strategie budowania marki i rozwoju handlu. Nowe trendy i wyzwania dla marketingu*. Wydawnictwo Uniwersytetu Łódzkiego. <https://doi.org/10.18778/8142-903-0.03>
4. Drews, A. (2016). Komparacja warunków prowadzenia działalności gospodarczej w państwach Grupy Wyszehradzkiej. *Acta Universitatis Nicolai Copernici Zarządzanie*, 43(1), 89. https://doi.org/10.12775/AUNC_ZARZ.2016.006
5. Falkowski, K. (2023). Sustainable competitiveness of the visegrad group countries. *Optimum. Economic Studies*, 1(111), 3–19. <https://doi.org/10.15290/oes.2023.01.111.01>
6. Gajdzik, B., Wolniak, R. (2022). Smart Production Workers in Terms of Creativity and Innovation: The Implication for Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(2), 68. <https://doi.org/10.3390/joitmc8020068>
7. Gawlik, R. (2015). Editorial: Social Entrepreneurship and Socio-Economic Development. *Entrepreneurial Business and Economics Review*, 3(1), 7–8. <https://doi.org/10.15678/EBER.2015.030101>

8. Golovko, E., Valentini, G. (2011). Exploring the complementarity between innovation and export for SMEs' growth. *Journal of International Business Studies*, 42(3), 362–380. <https://doi.org/10.1057/jibs.2011.2>
9. Hajduk-Stelmachowicz, M., Bełch, P., Siwiec, D., Bednárová, L., Pacana, A. (2022). Instruments used to improve the betterment of products quality. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 157, 157–171. <https://doi.org/10.29119/1641-3466.2022.157.10>
10. Hoogendoorn, B., Guerra, D., van der Zwan, P. (2015). What drives environmental practices of SMEs? *Small Business Economics*, 44(4), 759–781. <https://doi.org/10.1007/s11187-014-9618-9>
11. Hudakova, M., Gabrysova, M., Petrakova, Z., Buganova, K., Krajcik, V. (2021). The Perception of Market and Economic Risks by Owners and Managers of Enterprises in the V4 Countries. *Journal of Competitiveness*, 13(4), 60–77. <https://doi.org/10.7441/joc.2021.04.04>
12. Ivanová, E., Masárová, J. (2018). Performance evaluation of the Visegrad Group countries. *Economic Research - Ekonomska Istraživanja*, 31(1), 270–289. <https://doi.org/10.1080/1331677X.2018.1429944>
13. Khan, I.S., Ahmad, M.O., Majava, J. (2021). Industry 4.0 and sustainable development: A systematic mapping of triple bottom line, Circular Economy and Sustainable Business Models perspectives. *Journal of Cleaner Production*, 297, 126655. <https://doi.org/10.1016/j.jclepro.2021.126655>
14. Ključnikov, A., Civelek, M., Červinka, M., Vozňáková, I., Vincúrová, Z. (2023). The Role of SMEs' Innovativeness and Competitiveness in Their Financial Risk Management Concerns. *Journal of Competitiveness*, 14(4). <https://doi.org/10.7441/joc.2022.04.06>
15. Lacko, R., Hajduová, Z., Zawada, M. (2021). The Efficiency of Circular Economies: A Comparison of Visegrád Group Countries. *Energies*, 14(6), 1680. <https://doi.org/10.3390/en14061680>
16. Lopes de Sousa Jabbour, A.B., Ndubisi, N.O., Roman Pais Seles, B.M. (2020). Sustainable development in Asian manufacturing SMEs: Progress and directions. *International Journal of Production Economics*, 225, 107567. <https://doi.org/10.1016/j.ijpe.2019.107567>
17. Lu, Q., Yang, Y., Yu, M. (2022). Can SMEs' quality management promote supply chain financing performance? An explanation based on signalling theory. *International Journal of Emerging Markets*. <https://doi.org/10.1108/IJOEM-03-2022-0456>
18. Masocha, R. (2018). Does Environmental Sustainability Impact Innovation, Ecological and Social Measures of Firm Performance of SMEs? Evidence from South Africa. *Sustainability*, 10(11), 3855. <https://doi.org/10.3390/su10113855>
19. Ostasz, G., Siwiec, D., Pacana, A. (2022). Universal Model to Predict Expected Direction of Products Quality Improvement. *Energies*, 15(5). <https://doi.org/10.3390/en15051751>

20. Pacana, A., Siwec, D. (2022). Model to Predict Quality of Photovoltaic Panels Considering Customers' Expectations. *Energies*, 15(3), 1101. <https://doi.org/10.3390/en15031101>
21. Pacana, A., Siwec, D., Bednárová, L., Petrovský, J. (2023). Improving the Process of Product Design in a Phase of Life Cycle Assessment (LCA). *Processes*, 11(9), 2579. <https://doi.org/10.3390/pr11092579>
22. Pacana, A., Siwec, D., Stolarik, P., Ključnikov, A., Vozňáková, I. (2023). Comparative analysis of the current approach of customers and SMEs from the V4 countries to pro-environmental improving products' quality. *Acta Montanistica Slovaca*, 28(v28/i3), 696–708. <https://doi.org/10.46544/AMS.v28i3.14>
23. QuEn - *Research Questionnaire For Enterprise*. (n.d.). <https://Forms.Gle/EaGoCSMSERndUsUm9>.
24. Renzi, M.F., Ungaro, V., Di Pietro, L., Guglielmetti Mugion, R., Pasca, M.G. (2022). Agenda 2030 and COVID-19: A Young Consumer's Perception of Sustainable Consumption. *Sustainability*, 14(23), 15627. <https://doi.org/10.3390/su142315627>
25. Saqib, Z.A., Qin, L., Menhas, R., Lei, G. (2023). Strategic Sustainability and Operational Initiatives in Small- and Medium-Sized Manufacturers: An Empirical Analysis. *Sustainability*, 15(7), 6330. <https://doi.org/10.3390/su15076330>
26. Siwec, D., Bełch, P., Hajduk-Stelmachowicz, M., Pacana, A., Bednárová, L. (2022). Determinants Of Making Decisions In Improving The Quality Of Products. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 157, 497–507. <https://doi.org/10.29119/1641-3466.2022.157.31>
27. Siwec, D., Pacana, A., Simková, Z., Metszösy, G., Vozňáková, I. (2023). Current activities for quality and natural environment taken by selected enterprises belonging to SMEs from the electromechanical industry. *Scientific Papers of Silesian University of Technology Organization and Management Series*, 172. <https://doi.org/10.29119/1641-3466.2023.172.33>
28. Siwec, D., Pacana, J., Pacana, A. (2023). A Novelty Procedure to Identify Critical Causes of Materials Incompatibility. *Materials*, 16(10), 3884. <https://doi.org/10.3390/ma16103884>
29. Siwec, D., Varga, K., Pacana, A. (2023). Qualitative-Environmental Actions Expected By SMEs from V4 Countries to Improve Products. *System Safety: Human - Technical Facility - Environment*, 5(1), 28–35. <https://doi.org/10.2478/czoto-2023-0004>
30. Wolf, M.-A., Chomkamsri, K. (2015). *From Sustainable Production to Sustainable Consumption* (pp. 169–193). https://doi.org/10.1007/978-94-017-7221-1_13
31. Wysocki, J. (2018). Działalność proekologiczna dużych przedsiębiorstw produkcyjnych w Polsce - wyniki badań ankietowych. In: K. Poznańska, *Nowe formy innowacji* (pp. 82-109).

THE CONCEPT AND THE STATE OF RESEARCH ON THE PERFORMANCE OF FAMILY BUSINESSES

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Purpose: This study's primary goal is to present the theoretical concept of family enterprises. Specifically, the results of earlier studies and the issues facing this field of research now will be described. The article also examines the underlying impacts that family control has on business management in order to fill the research gap left by earlier studies on the performance differences between family and non-family enterprises. A thorough analysis of the literature revealed that family firms place equal value on non-financial performance as they do on financial performance.

Design/methodology/approach: The study's survey focuses on critical analysis methods used in the literature. Critical theoretical analysis will also be accompanied by comparative, analytical and monographic methods implied to draw conclusions on further research directions in the family business sector.

Findings: The current work makes a significant contribution by broadening the theoretical foundation for family business research. Therefore, a sound foundation for the explanation of distinctive strategic management components may be established using the behavior-oriented approach, stakeholder theory, target composition, and balanced scorecard approach.

Research limitations/implications: Unconfirmed theories may be examined more closely, particularly in a modified setting.

Practical implications: The findings of this theoretical study are not only important for business research but also for business practice. The study is primarily addressed to the top management of family and non-family businesses. Moreover, potential investors, banks and consultants could benefit from the results of this study.

Originality/value: This study aims to provide a better understanding of the relationship between the variables of family influence, goal setting and selection of key performance indicators and organizational performance and business success. That is how a contribution can be made to the ongoing discussion about the success of family businesses and its underlying factors.

Keywords: Family business, Goal setting, Business performance, Small and medium-sized enterprises.

Category of the paper: literature review.

1. Introduction

One of the world's oldest and most enduring types of organisations is the family business. Their economic dominance extends to many economies, where they serve as a foundation for wealth and progress (Eddleston et al., 2020; Hennart et al., 2019). Family firms have become more cautious and long-term-oriented, especially during economic downturns (Calabrò, Frank, 2021; Molly et al., 2019). It follows that recent years have seen a steady rise in interest in family enterprises from both the academic and practical domains (Neckebrouck et al., 2018; Neubaum, 2018). The "infancy" of research on family firms, according to McAdam et al. (2020), is justified given the significant economic impact of this organisational structure. This is especially true for the way family ownership influences the way firms are designed and managed. One of the key issues in this area provides the explanations for this type of organization's success. The study's survey focuses on critical analysis methods used in the literature. Critical theoretical analysis will also be accompanied by comparative, analytical and monographic methods implied to draw conclusions on further research directions in the family business sector.

2. Definition and Essence of Family Businesses

This section will explain the concepts, requirements, and theories of the family business sector. Each part provides an analysis of the perspectives and characteristics of family businesses that were previously covered in the consequences. According to J. Chrisman et al. (2003), the majority of definitions are categorized by distinguishing between family and non-family enterprises. In the editorial of the first issue of *Family Business Review*, Lansberg (1988, p. 1) asked, "What is a family business?". Thirty-one years later, there is still no satisfactory definition of family business in the literature. The fact that this field was seen as a playground for professionals serving as family therapists and financial consultants is one of the reasons no definition was created in those early days (Alderfer, 1988; Brockhaus, 1994). These practitioners were the primary editors of scientific articles back then. Their professional experiences have had a significant impact on the way family businesses are defined in the literature. A large number of publications in the 1990s countered this lack of enthusiasm in the early years. In their analysis, P. Sharma et al. (1996) discovered that 226 articles had 34 distinct definitions of family companies. To determine various definitions of family businesses, Steiger et al. (2015) examined 238 papers published between 2002 and 2011. As a result, no dominant definition is present. One explanation could be that this line of inquiry is very new and that more work and study have to be done on the ideas behind definitions.

Due to the distinct overlap of family, ownership, and management inside the business, family businesses have particular characteristics (Neubaum et al., 2019). According to Diaz-Moriana et al. (2018), this singularity creates a situation in which the family functions not only as a social unit but also as an economic unit. The family business operates as both, which has several benefits. According to Blanco-Mazagatos et al. (2007), "family altruism" fosters cooperative behaviour that maximises financial resources for the family collective and lowers agency costs. Furthermore, the presence of family members monitors and controls expenses, which contributes to increased efficiency. Because family members have a higher level of trust than non-family members, this lowers costs (Schulze et al., 2003; Smith, 2008). These benefits are extremely beneficial, particularly in the long run and in terms of sustainability (Miller et al., 2008; Wang, 2010). The absence of leverage generated by external stakeholders to produce favourable outcomes in the short term further catalyses favourable economic consequences (Zhang, Rowan, 2022). There are currently over twenty different definitions of family business, according to Wortman (1995, p. 3). It appears that each researcher comes up with a unique term for their work. Even after more than 26 years, the aforementioned assessment of the condition of research in the middle of the previous century remains true. "Ideally, all researchers should start with a common definition and distinguish particular types of family businesses through a hierarchical system of classification consistent with that definition", suggest Chrisman et al. (2005, p. 556). Thus far, very few researchers have given this call any thought (Daspit et al., 2021).

The definition and conceptualization of family companies by academics have a considerable impact on the findings of their research. Currently, there is no widely agreed definition for research, which makes it difficult for academics to conduct comparative and multidisciplinary studies (Comino-Jurado, 2018; Harms, 2014). The definition and conceptualization of family companies by academics have a considerable impact on the findings of their research. Currently, there is no widely agreed definition for research, which makes it difficult for academics to conduct comparative and multidisciplinary studies (Comino-Jurado, 2018; Harms, 2014).

A European expert panel used role models provided by the ministries of Spain and Finland in 2009 to develop the European definition using meta-analyses of over 90 definitions (European Commission, 2009b). According to this definition, ownership, management, strategic control, and active family member involvement in day-to-day business operations set family firms apart from non-family businesses. Because of its dichotomous nature, the European definition provides a clear-cut line that separates family firms from non-family enterprises. The European Commission (2009) characterised businesses of all sizes as follows (Karlsson, 2018):

1. The natural person or people who founded the company, the natural person or people who have acquired the company's share capital, or the spouses, parents, children, or direct heirs of the children, have the majority of the decision-making powers.

2. Indirect or direct decision-making rights predominate.
3. At least one member of the family or kin participates formally in the firm's governance.
4. Listed firms are considered family businesses if the founder or purchaser of the company (share capital) or their ancestors own a quarter of the company as required by their share capital.

The European Commission (2009b) defines a family business as a non-listed company in which a natural person or a family holds the majority of the decision-making power. Listed family firms are those in which a natural person or members of the business's family hold at least 25% of the decision-making authority, according to the same definition. It is required in both situations that a minimum of one family member participate in the management or control of the business. Even though this definitional approach has not been extensively explored in research, it has the benefit of being very operational and complete, which may increase the comparability of studies.

3. Differences between Family and Non-Family Businesses

Each company often assesses its performance concerning the state of the economy. Consequently, a fundamental distinction between these two organisational structures is that family firms gauge their success not just in monetary terms but also in terms of their social and human capital—that is, non-financial metrics (Fuetsch, 2022). Family business owners and executives have a strong bond with their companies, value their influence on them, look out for their devoted staff, and remain conscious of social concerns and acts of kindness in the local community. Consequently, compared to non-family enterprises, family business executives are more knowledgeable and engaged with their stakeholders (Kaslow, Friedland, 2021).

Because most non-family enterprises have a short-term view, non-family business managers face greater pressure to achieve financial success than family business managers. Conversely, the desire of family business owners to pass down their company to the next generation motivates them to adopt long-term plans and minimise risks (Gomez-Mejia et al., 2010). The objectives, principles, and priorities of a family business have a significant impact on the decision-making process of family business leaders. Conversely, non-family enterprises place a greater emphasis on maximising earnings and pay less attention to social and emotional factors (Kaslow, Friedland, 2021). According to Stalk and Foley (2012), the average tenure of family business leaders is 20–25 years, while that of non-family business leaders is only 6 years. The long-term investment horizons of family firms, which give the company stability and improve its long-term profitability, are closely correlated with the longer tenure of family business executives (Hernández-Linares et al., 2020).

Many researchers explore the empirical distinctions between family and non-family firms employing a combination of ownership and management techniques. As stated by Caputo et al. (2018), a business cannot be considered a family business unless the founding family is still involved. This criterion may be equivalent to ownership in the company or a position on the board of directors. According to this line of thinking, Zellweger et al. (2019) and Villalonga & Amit (2006) include the founder's or family's involvement on the board of directors. Unlike research done after the year 2000, the majority of the publications from the early 1990s looked at privately owned small enterprises where the owner also serves as the management. For instance, a definition that views the owner as the same individual as the top manager is used in the Daily & Dollinger (1992) study. Research on the effects of ownership structures bases its definition solely on the ownership of the company. Megaravalli & Sampagnaro's (2019) study defines family firms as those in which family ownership surpasses 50% and no other shareholder owns more than 10% of the company's shares. This is because ownership above 50% ensures that family control is maintained. In contrast, Anderson & Reeb (2003) do not apply a particular threshold to prevent data distortion. It is crucial to remember that there are two types of shares, such as shares with and without voting rights, particularly for German companies. Therefore, ownership varies greatly depending on the type of share. As a result, several authors also distinguish between voting rights owned by a family business, as demonstrated by Sestu & Majocchi (2020) and Rau et al. (2018).

Franzoi & Mietzner (2021) and Nowak et al. (2011) assert that family members' management activities have less of an influence on corporate actions when it comes to control than the usage of voting rights at the annual general meeting. A few writers began extending the term to include ownership, management, and control components (Calabrò et al., 2019). To account for the element of family control on three different levels, Maury (2006) constructs three variables. A family, an individual, or an unlisted company that owns more than 10% of the voting rights is considered to be at the first level. Firms that cannot be directly linked to a family are segregated away for the second level. It is assumed that at least one family member will participate in management for the third variable.

4. The State of Research and the Performance Advantage of Family Businesses

In order to explain variations in organisational performance between family businesses and non-family businesses, as well as within the category of family businesses, prior research has primarily depended on established theories of strategic management (Chrisman, 2019; Wall, 2021).

Because of this, the three philosophical perspectives that characterise the majority of the research that has been conducted on organisational performance in the context of family businesses are agency theory, stewardship theory, and resource-based approach (Casprini et al., 2020). The logic of strategic management implies that performance differences between family-owned and non-family-owned enterprises must result from the variations in strategy, structure, and processes between the two types of organisations. As a result, the performance differences between family-owned and non-family enterprises are the subject of an extensive body of empirical research (Azila-Gbettor et al., 2018; 2021).

The choice of definitional components is related to the restricted opportunities for data collection. If a theoretically strong and exceptionally well-thought-out definition cannot be operationalized, it is of limited use in empirical studies. Chua et al. (1999) introduce the term "operational definition" in this regard to differentiate it from a theoretical definition.

In practice, the component approach is often applied, although its definition varies depending on the respective author. The European family business definition is particularly strong and operational because it is the outcome of a meta-analysis of definitions, despite its limited use in research to date (Karlsson, 2018).

Anderson and Reeb (2003) carried out one of the most important studies on the financial and organisational performance of family firms between 1992 and 1999. They selected a sample of 403 companies from the S&P 500 stock market index for their analysis. Based on return on assets and Tobin's q, their analyses concentrate on how the variables "family share of equity" and "management of the business by family members" affect financial performance. Tobin's q is calculated by dividing a company's market value (stock market value plus liabilities) by its replacement value. According to Anderson & Reeb (2003), there is a non-linear relationship between the family's ownership stake in the company's capital and its financial performance. As a result, the family business grows at first with the family's capital contribution before beginning to shrink further. The authors' principal-agent theory explains the findings. The authors use the principal-agent theory to explain this outcome.

As a result of more effective control, agency disputes between owners and managers are reduced when ownership is concentrated in the hands of a family. Furthermore, family managers may pursue objectives that undervalue the business's overall advantage and harm its financial success as a result of having family-specific ambitions. Similarly, family ownership only benefits up to roughly one-third of the shares, according to Kowalewski et al. (2010). At that point, the family business's financial performance begins to deteriorate once more. Thus, up to 40% of family ownership is associated with improved firm success.

Lee (2006) expands on Anderson & Reeb's (2003) research by extending the period from 1999 to 2002. He discovered that family-run enterprises had greater rates of employee and sales growth in addition to being more lucrative. According to Alves & Gama (2020), family businesses perform financially better when they possess the F-PEC aspects of family commitment and a culture of family values. Furthermore, they conclude that better family

business performance may be associated with the company's alignment with its non-financial objectives. According to Leopizzi et al. (2021), family firms with a high ownership concentration perform financially better because they make better decisions. Anderson & Reeb (2003) and Neubaum et al. (2019) concluded that the positive financial performance of the business is related to the management structure. Accordingly, family businesses managed by a family CEO show a higher return on assets than non-family businesses. However, market performance measured as Tobin's Q only increased if the CEO was the founder or an external manager. They explain this result by the fact that a family CEO knows the business longer, understands it better, and, to that extent, acts as a steward of his business. Consequently, the authors emphasize the importance of the influence of the founding family in management but also provide a first insight into the importance of external managers for the performance of the business. Therefore, if members of the entrepreneurial family or external managers hold management positions, it has a significant positive impact on business performance.

A large number of studies are examining this very issue. Often, the studies show a fundamentally positive influence of the managing founder or a family member in the management (Casillas et al., 2019; Lude, Prügl, 2018; Stanley et al., 2019). Villalonga & Amit (2006) are building their study on the findings of Anderson & Reeb (2003). They show that the ownership share of an entrepreneurial family has a positive effect on the market value of a business in combination with family management and the control value of the business. In contrast to previous studies, Villalonga & Amit (2006) explicitly point to the necessary influence of the family in the area of control and management. Barontini & Caprio (2006) and Caprio et al. (2020) examine businesses from European markets and support the view that founder-managed publicly traded companies are the most efficient family businesses. The significant positive impact of the founding family was also found in other studies (Farooque et al., 2020). Accordingly, founders seem to have a unique influence on the growth and performance of family businesses (Koji et al., 2020; McConaughy et al., 2001; Srivastava, Bhatia, 2022). In their studies, Craig & Dibrell (2006) and Koji et al. (2020) conclude that family businesses perform better than non-family businesses because non-family businesses tend to be more short-term-oriented and family businesses have a stronger focus on long-term goals.

5. Conclusion

There is an extensive amount of evidence that indicates that the entrepreneurial family's management influence can affect the company's financial performance. This article presented an overview of the main hypotheses and conclusions of various studies, as well as other factors influencing the success of family businesses. In summary, it can be stated that previous studies

on performance differences between family and non-family businesses are heterogeneous and partly contradictory, although the majority of studies find a performance advantage for family businesses. Until now, it could not be clarified how the impact of the family on the business affects business performance. Due to the complexity of the considered relationships between family influence, strategic management, and business success, the theoretical constructions of the hypotheses contribute to a deeper understanding of family businesses and they set directions for further empirical research.

References

1. al Farooque, O., Buachoom, W., Sun, L. (2020). Board, audit committee, ownership and financial performance – emerging trends from Thailand. *Pacific Accounting Review*, 32(1). <https://doi.org/10.1108/PAR-10-2018-0079>
2. Alderfer, C.P. (1988). Understanding and Consulting to Family Business Boards. *Family Business Review*. <https://doi.org/10.1111/j.1741-6248.1988.00249.x>
3. Alves, C.A., Gama, A.P.M. (2020). Family business performance: A perspective on family influence. *Revista Brasileira de Gestao de Negocios*, 22(1). <https://doi.org/10.7819/rbgn.v22i1.4040>
4. Anderson, R.C., Reeb, D.M. (2003). Founding-Family Ownership and Firm Performance: Evidence from the S&P 500. *Journal of Finance*. <https://doi.org/10.1111/1540-6261.00567>
5. Azila-Gbettor, E.M., Honyenuga, B.Q., Berent-Braun, M.M., Kil, A. (2018). Structural aspects of corporate governance and family firm performance: a systematic review. *Journal of Family Business Management*, Vol. 8, Iss. 3. <https://doi.org/10.1108/JFBM-12-2017-0045>
6. Azila-Gbettor, E.M., Honyenuga, B.Q., Blomme, R.J., Kil, A. (2021). Review of differences between listed and unlisted family business research trends: a corporate governance context. *Journal of Family Business Management*. <https://doi.org/10.1108/JFBM-03-2020-0023>
7. Barontini, R., Caprio, L. (2006). The effect of family control on firm value and performance: Evidence from continental Europe. *European Financial Management*. <https://doi.org/10.1111/j.1468-036X.2006.00273.x>
8. Blanco-Mazagatos, V., de Quevedo-Puente, E., Castrillo, L.A. (2007). The trade-off between financial resources and agency costs in the family business: An exploratory study. *Family Business Review*. <https://doi.org/10.1111/j.1741-6248.2007.00095.x>
9. Brockhaus, R.H. (1994). Entrepreneurship and Family Business Research: Comparisons, Critique, and Lessons. *Entrepreneurship Theory and Practice*. <https://doi.org/10.1177/104225879401900102>

10. Calabrò, A., Frank, H. (2021). Business families in times of crises: The backbone of family firm resilience and continuity. *Journal of Family Business*, 23(6), 57-78. <https://www.sciencedirect.com/science/article/pii/S1877858521000231>
11. Calabrò, A., Vecchiarini, M., Gast, J., Campopiano, G., de Massis, A., Kraus, S. (2019a). Innovation in Family Firms: A Systematic Literature Review and Guidance for Future Research. *International Journal of Management Reviews*, 21(3). <https://doi.org/10.1111/ijmr.12192>
12. Caprio, L., del Giudice, A., Signori, A. (2020). Cash holdings in family firms: CEO identity and implications for firm value. *European Financial Management*, 26(2). <https://doi.org/10.1111/eufm.12233>
13. Caputo, A., Marzi, G., Pellegrini, M.M., Rialti, R. (2018). Conflict management in family businesses: A bibliometric analysis and systematic literature review. *International Journal of Conflict Management*, 29(4). <https://doi.org/10.1108/IJCMA-02-2018-0027>
14. Casillas, J.C., Moreno-Menéndez, A.M., Barbero, J.L., Clinton, E. (2019). Retrenchment Strategies and Family Involvement: The Role of Survival Risk. *Family Business Review*, 32(1). <https://doi.org/10.1177/0894486518794605>
15. Casprini, E., Dabic, M., Kotlar, J., Pucci, T. (2020). A bibliometric analysis of family firm internationalization research: Current themes, theoretical roots, and ways forward. *International Business Review*. <https://doi.org/10.1016/j.ibusrev.2020.101715>
16. Chrisman, J.J. (2019). Stewardship Theory: Realism, Relevance, and Family Firm Governance. In *Entrepreneurship: Theory and Practice*, Vol. 43, Iss. 6. <https://doi.org/10.1177/1042258719838472>
17. Chrisman, J.J., Chua, J.H., Sharma, P. (2005). Trends and directions in the development of a strategic management theory of the family firm. In: *Entrepreneurship: Theory and Practice*. <https://doi.org/10.1111/j.1540-6520.2005.00098.x>
18. Chrisman, J., Chua, J., Sharma, P. (2003). Current trends and future directions in family business management studies: Toward a theory of the family firm. *Coleman White Paper Series*.
19. Comino-Jurado, M. (2018). An Alternative Approach on Family Business Definition. *Papers.Ssrn.Com*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3218967
20. Craig, J., Dibrell, C. (2006). The natural environment, innovation, and firm performance: A comparative study. *Family Business Review*. <https://doi.org/10.1111/j.1741-6248.2006.00075.x>
21. Daily, C.M., Dollinger, M.J. (1992). An Empirical Examination of Ownership Structure in Family and Professionally Managed Firms. *Family Business Review*. <https://doi.org/10.1111/j.1741-6248.1992.00117.x>
22. Daspit, J.J., Chrisman, J.J., Ashton, T., Evangelopoulos, N. (2021). Family Firm Heterogeneity: A Definition, Common Themes, Scholarly Progress, and Directions Forward. *Family Business Review*, 34(3). <https://doi.org/10.1177/08944865211008350>

23. Diaz-Moriana, V., Hogan, T., Clinton, E., Brophy, M. (2018). Defining family business: A closer look at definitional heterogeneity. In *The Palgrave Handbook of Heterogeneity among Family Firms*. https://doi.org/10.1007/978-3-319-77676-7_13
24. Eddleston, K.A., Jaskiewicz, P., Wright, M. (2020). Family firms and internationalization in the Asia-Pacific: the need for multi-level perspectives. *Asia Pacific Journal of Management*, Vol. 37, Iss. 2. <https://doi.org/10.1007/s10490-018-9608-6>
25. European Commission (2009b). *Overview of family–business–relevant issues: research, networks, policy measures and existing studies*. European Commission - Enterprise and Industry Directorate-General.
26. Franzoi, F., Mietzner, M. (2021). Family affairs – Corporate governance involvement of families and stock market returns. *Investment Management and Financial Innovations*, Vol. 18, Iss. 2. [https://doi.org/10.21511/imfi.18\(2\).2021.28](https://doi.org/10.21511/imfi.18(2).2021.28)
27. Fuetsch, E. (2022). Innovation in Family Farms: The Roles of the Market, the Family, and Farm Performance. *Journal of Small Business*, 32(4), 56-78. <https://doi.org/10.53703/001c.31714>
28. Gehrke, N. (2013). *Tobins q: die Beziehung zwischen Buch-und Marktwerten deutscher Aktiengesellschaften*. https://books.google.de/books?hl=de&lr=&id=YpN9BwAAQBAJ&oi=fnd&pg=PA7&dq=Tobins+q:+die+Beziehung+zwischen+Buch-und+Marktwerten+deutscher+Aktiengesellschaften&ots=FXs2_099xA&sig=2SjX_ciZKVSjq
29. Gomez-Mejia, L.R., Makri, M., Kintana, M.L. (2010). Diversification decisions in family-controlled firms. *Journal of Management Studies*. <https://doi.org/10.1111/j.1467-6486.2009.00889.x>
30. Harms, H. (2014). Review of Family Business Definitions: Cluster Approach and Implications of Heterogeneous Application for Family Business Research. *International Journal of Financial Studies*. <https://doi.org/10.3390/ijfs2030280>
31. Hennart, J.F., Majocchi, A., Forlani, E. (2019). The myth of the stay-at-home family firm: How family-managed SMEs can overcome their internationalization limitations. *Journal of International Business Studies*, Vol. 50, Iss. 5. <https://doi.org/10.1057/s41267-017-0091-y>
32. Hernández-Linares, R., Kellermanns, F.W., López-Fernández, M.C., Sarkar, S. (2020). The effect of socioemotional wealth on the relationship between entrepreneurial orientation and family business performance. *BRQ Business Research Quarterly*, 23(3). <https://doi.org/10.1177/2340944420941438>
33. Karlsson, J. (2018). Does regional context matter for family firm employment growth? *Journal of Family Business Strategy*, 9(4), 293-310.
34. Kaslow, F.W., Friedland, L. (2021). Similarities and Differences Between Family and Nonfamily Business Enterprises. In: *Consultation to Family Business Enterprises*. https://doi.org/10.1007/978-3-030-72022-3_3

35. Koji, K., Adhikary, B.K., Tram, L. (2020). Corporate Governance and Firm Performance: A Comparative Analysis between Listed Family and Non-Family Firms in Japan. *Journal of Risk and Financial Management*, 13(9). <https://doi.org/10.3390/jrfm13090215>
36. Koji, K., Adhikary, B.K., Tram, L. (2020). Corporate Governance and Firm Performance: A Comparative Analysis between Listed Family and Non-Family Firms in Japan. *Journal of Risk and Financial Management*, 13(9). <https://doi.org/10.3390/jrfm13090215>
37. Kowalewski, O., Talavera, O., Stetsyuk, I. (2010). Influence of family involvement in management and ownership on firm performance: Evidence from Poland. *Family Business Review*. <https://doi.org/10.1177/0894486509355803>
38. Lansberg, I. (1988). The Succession Conspiracy. *Family Business Review*. <https://doi.org/10.1111/j.1741-6248.1988.00119.x>
39. Lee, J. (2006). Family firm performance: Further evidence. *Family Business Review*. <https://doi.org/10.1111/j.1741-6248.2006.00060.x>
40. Leopizzi, R., Pizzi, S., D'addario, F. (2021). The relationship among family business, corporate governance, and firm performance: an empirical assessment in the tourism sector. *Administrative Sciences*, 11(1). <https://doi.org/10.3390/admsci11010008>
41. Lude, M., Prügl, R. (2018). Why the family business brand matters: Brand authenticity and the family firm trust inference. *Journal of Business Research*, 89. <https://doi.org/10.1016/j.jbusres.2018.03.040>
42. Maury, B. (2006). Family ownership and firm performance: Empirical evidence from Western European corporations. *Journal of Corporate Finance*, 12(2), 321-341. <https://doi.org/10.1016/j.jcorpfin.2005.02.002>
43. McAdam, M., Clinton, E., Dibrell, C. (2020). Navigation of the paradoxical landscape of the family business. *International Small Business Journal: Researching Entrepreneurship*, 38(3). <https://doi.org/10.1177/0266242619898610>
44. McConaughy, D.L., Matthews, C.H., Fialko, A.S. (2001). Founding family controlled firms: Performance, risk, and value. *Journal of Small Business Management*, 39(1). <https://doi.org/10.1111/0447-2778.00004>
45. Megaravalli, A.V., Sampagnaro, G. (2019). Predicting the growth of high-growth SMEs: evidence from family business firms. *Journal of Family Business Management*, 9(1). <https://doi.org/10.1108/JFBM-09-2017-0029>
46. Miller, D., le Breton-Miller, I., Scholnick, B. (2008). Stewardship vs. stagnation: An empirical comparison of small family and non-family businesses. *Journal of Management Studies*. <https://doi.org/10.1111/j.1467-6486.2007.00718.x>
47. Molly, V., Uhlaner, L.M., de Massis, A., Laveren, E. (2019). Family-centered goals, family board representation, and debt financing. *Small Business Economics*. <https://doi.org/10.1007/s11187-018-0058-9>
48. Neckebrouck, J., Schulze, W., Zellweger, T. (2018). Are family firms good employers? *Academy of Management Journal*. <https://doi.org/10.5465/amj.2016.0765>

49. Neubaum, D.O. (2018). Family Business Research: Roads Travelled and the Search for Unworn Paths. *Family Business Review*, 31(3), 259-270.
50. Neubaum, D.O. (2018). Family Business Research: Roads Travelled and the Search for Unworn Paths. *Family Business Review*, 31(3), 259-270. <https://doi.org/10.1177/0894486518792948>
51. Neubaum, D.O., Kammerlander, N., Brigham, K.H. (2019). Capturing Family Firm Heterogeneity: How Taxonomies and Typologies Can Help the Field Move Forward. *Family Business Review*, Vol. 32, Iss. 2. <https://doi.org/10.1177/0894486519848512>
52. Nowak, E., Ehrhardt, O., Weber, F.M. (2011). "Running in the Family": The Evolution of Ownership, Control, and Performance in German Family-Owned Firms, 1903-2003. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.891255>
53. Schulze, W.S., Lubatkin, M.H., Dino, R.N. (2003). Toward a theory of agency and altruism in family firms. *Journal of Business Venturing*. [https://doi.org/10.1016/S0883-9026\(03\)00054-5](https://doi.org/10.1016/S0883-9026(03)00054-5)
54. Sestu, M.C., Majocchi, A. (2020). Family Firms and the Choice Between Wholly Owned Subsidiaries and Joint Ventures: A Transaction Costs Perspective. *Entrepreneurship: Theory and Practice*, 44(2). <https://doi.org/10.1177/1042258718797925>
55. Sharma, P., Chrisman, J.J., Chua, J.H. (1996). A Review and Annotated Bibliography of Family Business Studies. *A Review and Annotated Bibliography of Family Business Studies*. <https://doi.org/10.1007/978-1-4419-8768-6>
56. Smith, M. (2008). Differences between family and non-family SMEs: A comparative study of Australia and Belgium. *Journal of Management and Organization*. <https://doi.org/10.5172/jmo.2008.14.1.40>
57. Srivastava, A., Bhatia, S. (2022). Influence of Family Ownership and Governance on Performance: Evidence from India. *Global Business Review*, 23(5). <https://doi.org/10.1177/0972150919880711>
58. Stalk, G., Foley, H. (2012). Avoid the traps that can destroy family businesses. *Harvard Business Review*, 90(1-2).
59. Stanley, L.J., Hernández-Linares, R., López-Fernández, M.C., Kellermanns, F.W. (2019). A Typology of Family Firms: An Investigation of Entrepreneurial Orientation and Performance. *Family Business Review*, 32(2). <https://doi.org/10.1177/0894486519838120>
60. Steiger, T., Duller, C., Hiebl, M.R.W. (2015). No Consensus in Sight: An Analysis of Ten Years of Family Business Definitions in Empirical Research Studies. *Journal of Enterprising Culture*. <https://doi.org/10.1142/s0218495815500028>
61. Villalonga, B., Amit, R. (2006). How do family ownership, control and management affect firm value? *Journal of Financial Economics*. <https://doi.org/10.1016/j.jfineco.2004.12.005>
62. Villalonga, B., Amit, R. (2006). How do family ownership, control and management affect firm value? *Journal of Financial Economics*. <https://doi.org/10.1016/j.jfineco.2004.12.005>

63. Wall, W.P. (2021). Strategic management and evaluation of the performance of family firms using management control system. *Transnational Corporations Review*. <https://doi.org/10.1080/19186444.2021.1967104>
64. Wang, C. (2010). Family small businesses: definition, 'essence' and 'true' prevalence. *International Journal of Entrepreneurial Venturing*. <https://doi.org/10.1504/IJEV.2010.037113>
65. Wortman, M.S. (1995, June). *Critical issues in family business: An international perspective of practice and research*. Proceedings of the ICSB 40th world conference. Sydney, Australia: Institute of Industrial Economics, pp. 53-76.
66. Zellweger, T.M., Chrisman, J.J., Chua, J.H., Steier, L.P. (2019). Social structures, social relationships, and family firms. *Entrepreneurship: Theory and Practice*, 43(2) Special Issue. <https://doi.org/10.1177/1042258718792290>
67. Zhang, Z., Rowan, P. (2022). The variation of family business branding across stakeholders: a social identity perspective. *Journal of Family Business Management*. <https://doi.org/10.1108/JFBM-06-2022-0078/FULL/HTML>

FORECASTS FOR GENERATIONAL BACKGROUND OF CONSUMER BEHAVIOR IN ECOLOGICAL AND ECONOMIC TERMS

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Purpose: The basic purpose of the article was to determine the awareness of different generation groups in terms of ecological and economic aspects of life.

Design/methodology/approach: The article presents the theoretical framework of consumer behavior and the implemented pro-ecological activities of representatives of Generations X, Y, Z. Subsequently, social involvement in pro-ecological activities in the immediate vicinity was determined based on own research and exemplary results of international research.

Findings: The main hypothesis put forward is as follows: ecological and economic awareness is related to the age difference. The research indicates that there are differences in the consumer behavior of representatives of different generations in relation to environmental protection and the global energy crisis.

Research limitations/implications: The research confirmed the formulated hypotheses. The financial possibilities of various social groups may indicate a different image of consumerism in the era of commonly required pro-ecological behavior.

Practical implications: The respondents showed great awareness and knowledge as well as commitment to pro-ecological activities, considering economic aspects.

Social implications: Contemporary promotion of pro-ecological activities leads to an increase in social awareness.

Originality/value: The analyzes of the conducted surveys emphasize the increasing awareness of pro-ecological and economic behavior of consumers in many countries and the need to adapt urban space to social and ecological requirements. Consumption leads primarily to an increase in production, which is an important factor of economic growth in the world markets.

Keywords: generations, pro-ecological initiatives, ecological and economic awareness, sustainable environment.

Category of the paper: Research paper.

1. Introduction

Global consumer behavior in many countries is very similar and oriented to care for the natural environment, which has been badly damaged through many years of neglect. Nowadays, it is necessary to minimize the negative impact on the natural environment (Heinonen, Strandvik, 2021, p. 109). Particular attention is paid to the use of energy resources and reduction in global consumerism (Lissitsa, Kol, 2016, p. 310). Pro-environmental activities among representatives of different age groups are noticeable (Chaney et al., 2017, pp. 179-189). An increasingly common phenomenon is increased care for the natural environment among representatives of the younger generation (Pencarelli et al., 2020, p. 245). As opposed to such actions one may place the awareness and views of representatives of the older generation, who, in addition to ecological considerations, also notice economic considerations (Gharzai, Beeler, Jagsi, 2020, p. 680). The conducted research allowed for creating a forecast for future consumer behavior considering ecological and economic behavior. The own research was carried out in the city of Częstochowa, Poland, among the residents of the Municipal Housing Authority, named ZGM TBS LLC. The survey was conducted to examine the awareness and social responsibility in terms of ecological and economic activities of the surveyed city dwellers. Among representatives of Generations X, Y, Z, there is a noticeable need to implement modern pro-ecological solutions in the immediate vicinity. Based on the research material obtained, future social behavior in terms of ecology and consumption in accordance with social responsibility was predicted.

2. Theoretical definition of the awareness of pro-ecological consumer behavior

When examining social and economic behavior, there are noticeable differences between representatives of different groups of generations. When presenting consumer behavior, it is necessary to refer to their definition. The consumer is defined as a consuming unit acting on the demand side and creating this demand (Sarraf, 2019, p. 46). From the economic point of view, consumer behavior is associated with the consumption process consisting in meeting social and economic needs (Zalega, 2012, p. 1). Consumer behavior is influenced by various factors, both dependent and independent of them (Hultman, Yeboah-Banin, Boso, 2019, p. 1186; Cranfield, 2020, pp. 153-154). Contemporary consumer behavior is more difficult to predict and currently more complex due to dynamic changes taking place in the environment. Factors influencing consumer behavior include external and internal factors (Fig. 1).

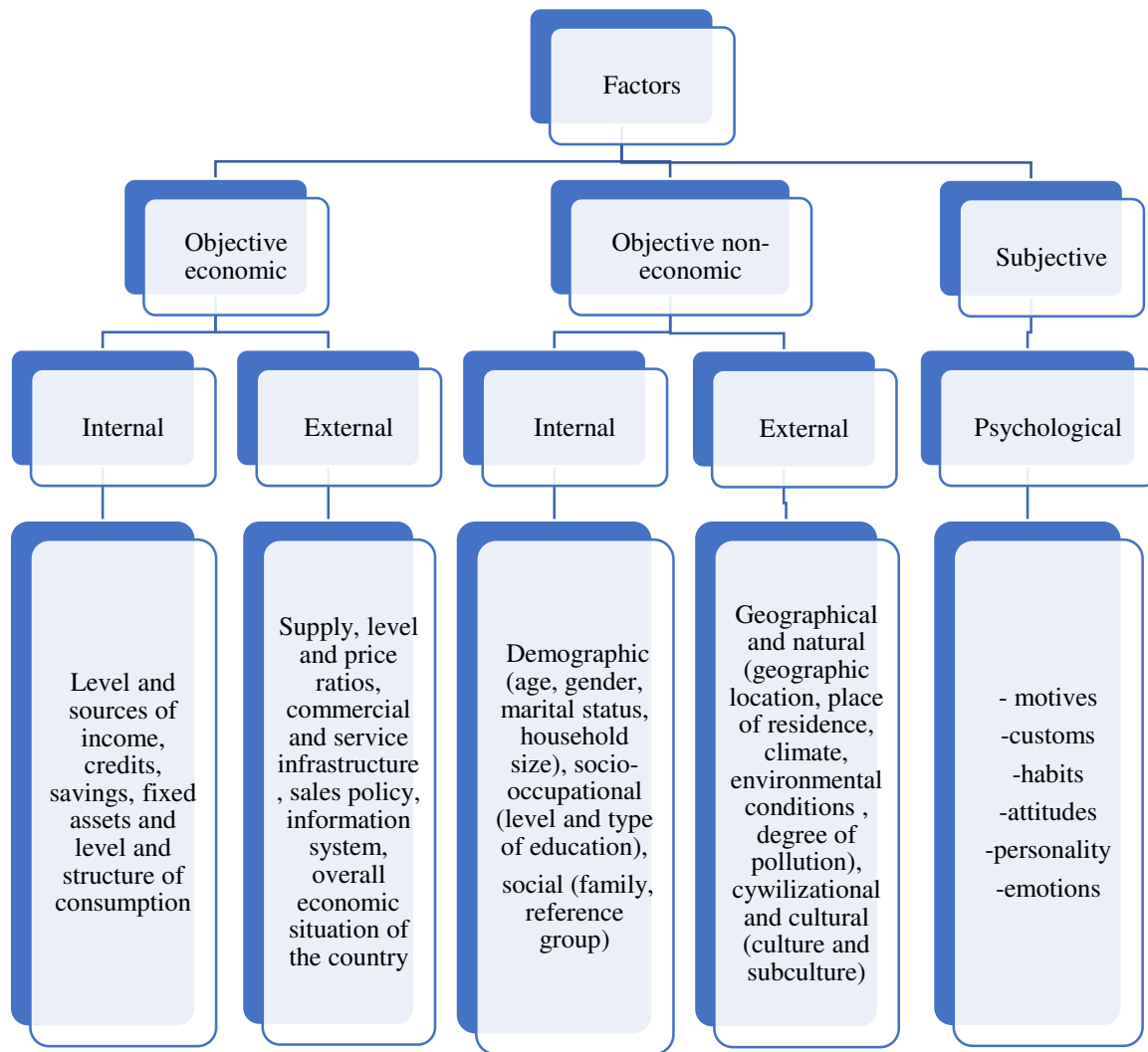


Figure 1. Factors shaping consumer behavior.

Source: Study based on Kieźel, 2010, pp. 104-107.

Consumer behavior factors are divided into objective economic and non-economic as well as subjective. Subjective or psychological factors are all customs, habits, and attitudes of citizens. Economic factors primarily include financial resources possessed and the economic situation of the country. On the other hand, non-economic factors include demographic, and geographical and natural factors. The authors of the article focused on demographic factors, particularly the age of consumers. When characterizing consumer behavior in terms of age groups, a division into three generational groups called X, Y, Z was made (Kurz, Li, Vine, 2019, p. 230). Generation X are people born between 1965 and 1980. Representatives of Generation Y are people born in the years 1981-2000. On the other hand, people born since 2001 are representatives of Generation Z (Fazlagić, 2010, p. 63).

Each generation is guided by a different way of perceiving the world, paying attention to other factors, which in turn affects their choices and behavior (Tevšić, Nanić, 2020, p. 81). The consumer is a very important element in the market. As a participant, they influence, among others, the labor market, indirectly affecting unemployment, the market of goods and services, where they purchase products that allow for satisfying their needs, and the financial market and, indirectly, the state budget. It is due to the right attitude of consumers that the economy can function properly, develop and lead to economic growth. Therefore, the information provided and received from consumers is such an important economic factor (Fig. 2).

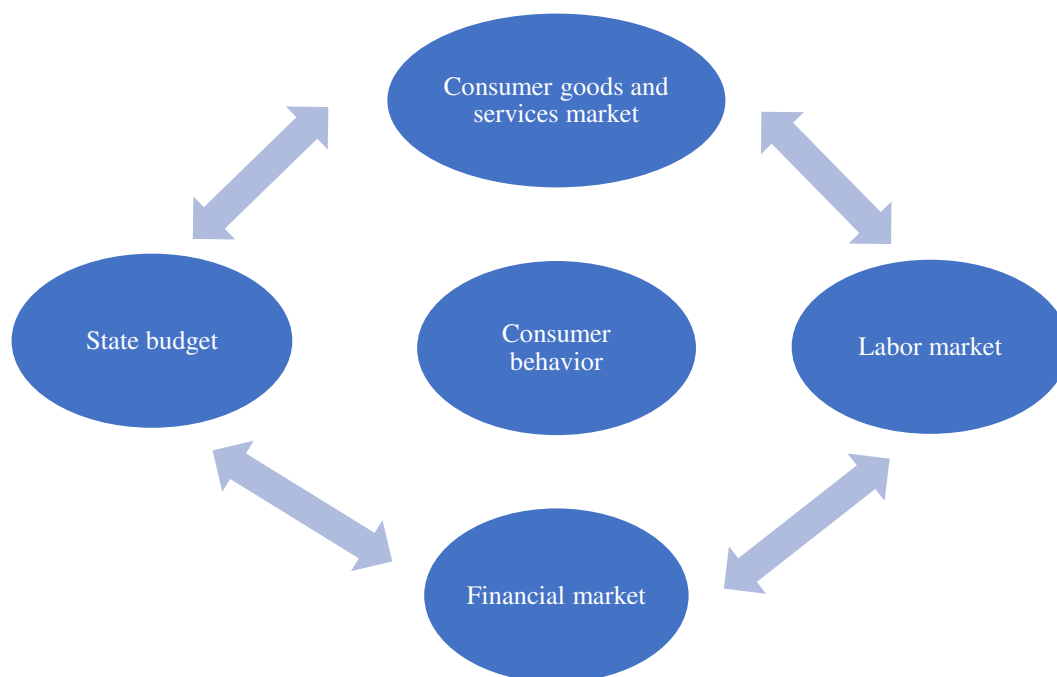


Figure 2. Place of the consumer in the market economy.

Source: Study based on: Daszkowska, Senyszyn, p. 40; Smyczek, Sowa, 2005, p. 25.

Environmental awareness is present among representatives of all generations, but many of them must also be guided by economic reasons (Hopkins, 2016, p. 155). Generational diversity on many levels among representatives of different generation groups allows for a broader view of ecological and economic choices in everyday life (Fernandes, Moreira, 2019, p. 278). Differences in views have always aroused great controversy and led to many discussions (Kroenke, 2015, p. 95). Wishing to study consumption behavior, it is necessary to characterize representatives of individual generations. Representatives of Generation X are attached to one job and very rarely show professional mobility. These people are also characterized by the need to have their own place on earth. When building a house or buying an apartment, they want to stay in it for the rest of their lives. They surround themselves with things that are to serve them for a long time, therefore this does not serve excessive consumerism (Reisenwitz, Iyer, 2009, p. 97) They respect the goods they have and are not too wasteful, because they remember the times when few goods were available.

Generations Y and Z show great commitment to shopping behavior, they are consumers who want to acquire as many modern gadgets as possible to mark their status and social prestige (Parment, 2013, p. 191; Kureshi, Thomas, 2020, p. 288). People who are representatives of Generation Y remember worse times, therefore they try to buy reasonably, but they often succumb to the temptation to buy. However, they are of a certain age and must manage their financial resources wisely. They care about energy resources and try to have a positive impact on the natural environment.

The youngest generation called Z are people born since 2001. It is predicted that these will be people with a very low level of loyalty to the employer (Nolan, 2015, p. 70). These people are demanding and focused on their own benefits, not paying attention to others. Millennials like to be surrounded by nature and appreciate similar attitudes in their environment. Generation Z are also ecological consumers. For Generation Z, care for the natural environment is very important. This is a generation that is very conscious, limits their negative impact on the environment and willingly engages in pro-ecological initiatives (<https://noizz.pl/eko-generacja-z/xdjgl7t>, 3.03.2023). Young people are not able to act on their own, their upbringing was done by planning time for them by their parents and rewarding them immediately after the task was completed (Ormerod, 2021, p. 114). Therefore, they continue such practices into adulthood.

Representatives of all generations have a different approach to life and professional work. Lifestyle and generational changes create many challenges for companies and additionally increase the need to shift demand in consumption activities (Hopkins, 2017, p. 380). However, pro-ecological attitudes are noticeable in activities throughout society.

3. Research review on the awareness of consumers of selected EU countries

The subject matter of the awareness of consumer behavior in the era of the climate and energy crisis relates primarily to the responsible management of available resources and their rational use. Increased consumption and lack of care for the natural environment have led to irreversible climate and socio-economic changes. The scale of changes taking place in the natural environment and their complexity are nowadays a problem that has never occurred before. The Intergovernmental Panel on Climate Change (IPCC) has pointed out that human activity is responsible for climate change, rapid warming of the planet and related environmental changes on Earth (www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf).

Many interesting studies have been carried out on this subject, and therefore it is worth quoting some of them. An interesting study is the research entitled “Społeczna odpowiedzialność konsumenta w dobie pandemii w Polsce i wybranych krajach UE. Implikacje dla biznesu (Social responsibility of the consumer in the era of the pandemic in Poland and

selected countries of the European Union. Implications for business)”, which was carried out by ARC Rynek and Opinia dla Szkoły Głównej Handlowej, Katedry Badań Zachowań Konsumentów in October 2020. An important piece of information from the study is the perception of excessive consumerism by 58% of the surveyed Poles. Reducing the need to purchase new products and responsible management of water, gas and energy consumption is conscious behavior of modern consumers (Bushell et al., 2017, p. 45).

This study also includes information on the declarations of representatives of selected EU countries on the purchase of products from the production of their own country. Such an action also contributes to reducing the harmful impact on the environment, especially of transport (Poiani, Van Acker, Poiani, 2018, p. 218). Buying fewer imported products has a much better impact on the economy and the respondents' own financial resources (Fig. 3).

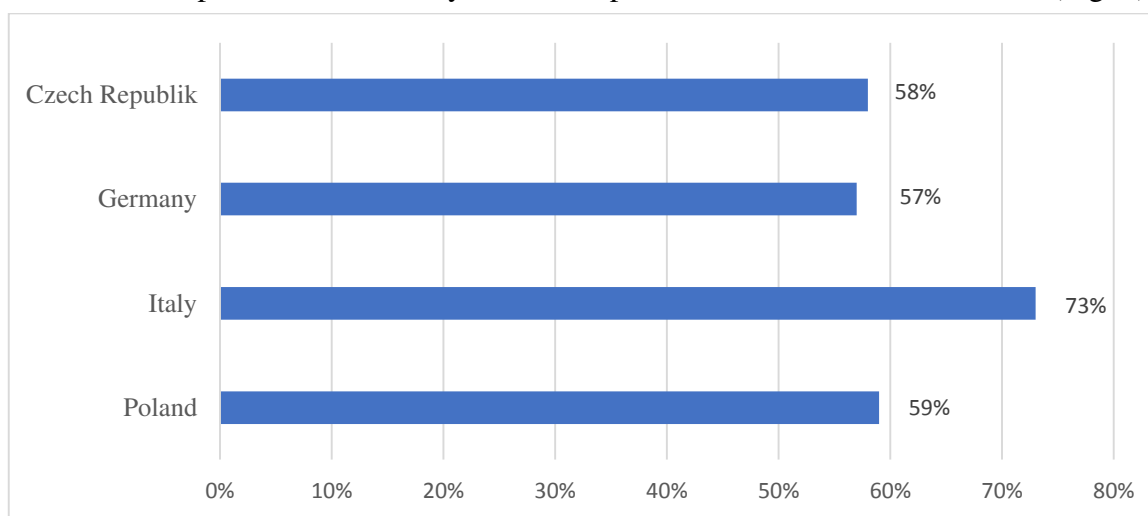


Figure 3. Consumer responsibility regarding the purchase of own products.

Source: Study on “Społeczna odpowiedzialność konsumenta w dobie pandemii w Polsce i wybranych krajach UE. Implikacje dla biznesu”, conducted by ARC Rynek and Opinia dla Szkoły Głównej Handlowej, Katedry Badań Zachowań Konsumentów, October 2020. <https://arc.com.pl/rosnie-swiadomosc-polskich-konsumentow/>.

As shown in Figure 3, the most responsible consumers who care about their own production are Italians. Representatives of other countries are at a similar level, which proves that they pay attention to their own products but are not afraid to import the necessary goods.

In the study (www.arc.com.pl/rosnie-swiadomosc-polskich-konsumentow/, 23.03.2023), the awareness of Poles in terms of recycling (Chaturvedi, Kulshreshtha, Tripathi, 2020, p. 413) of products harmful to the environment was also indicated. Every third Pole (35%) admits that they pay more attention to whether cosmetic products have been tested on animals than before (Figure 4).

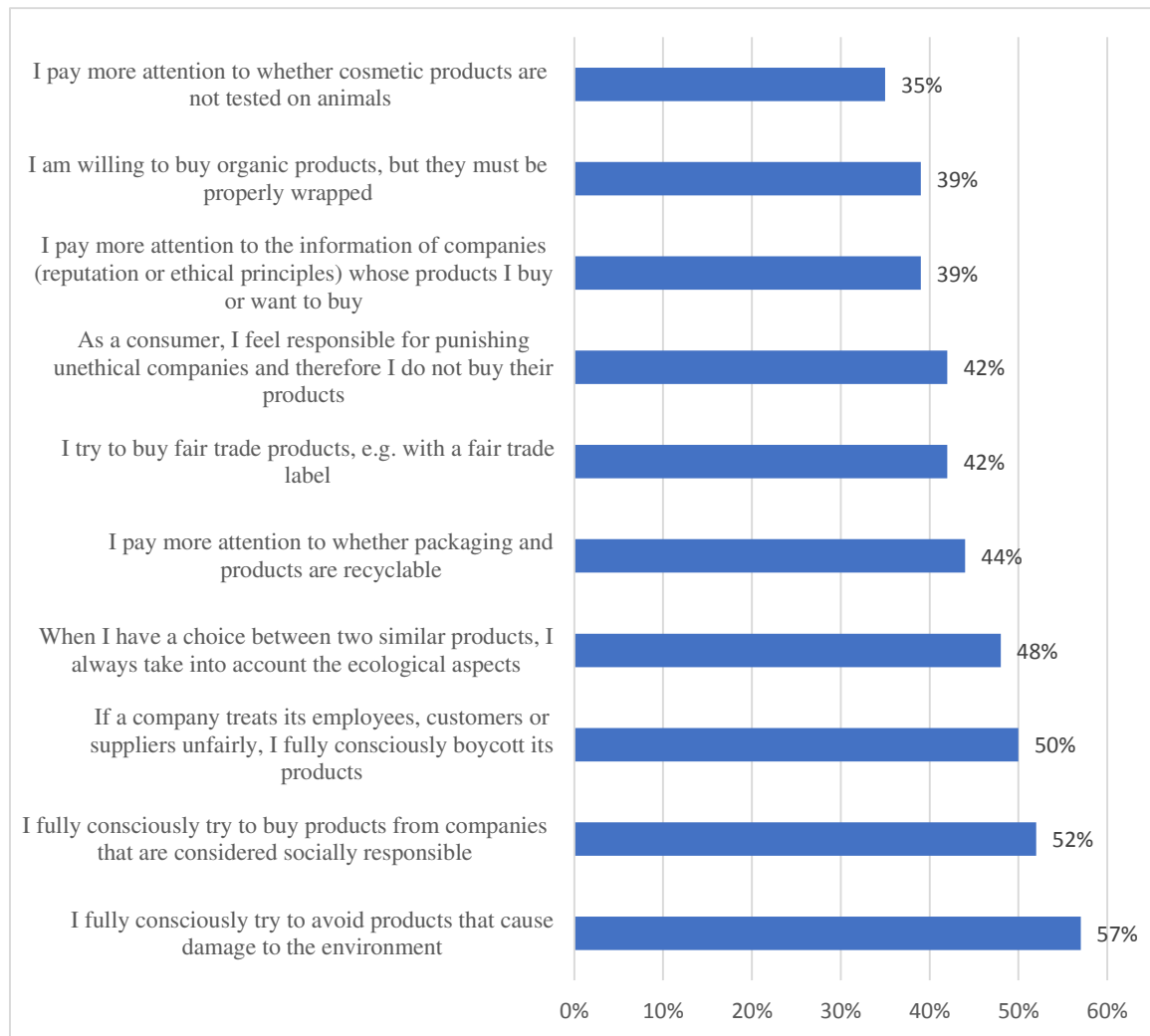


Figure 4. The topic of Poles as far as it concerns.

Source: Study on “Społeczna odpowiedzialność konsumenta w dobie pandemii w Polsce i wybranych krajach UE. Implikacje dla biznesu”, conducted by ARC Rynek and Opinia dla Szkoły Głównej Handlowej, Katedry Badań Zachowań Konsumentów, October 2020.

Another interesting approach to analyze is the sequential model, which defines the psychological and socio-demographic variables predicting the risk of climate change. The model is tested and refined using data from large national surveys conducted among the residents of the countries such as Australia and France (more: Bradley et al., 2020, p. 101410).

The study conducted in 2000 by P. Crutzen and E. Stoermer suggested that the whole world is changing due to irresponsible human activity affecting the climate and ecosystem (Crutzen, Stoermer, 2017). People born in 2020 are predicted to experience 6.8 times more heatwaves in their lifetime (Luten, Ryan, Wakefield, 2021).

Conducting continuous analyzes and investigating this topic allows for constant monitoring of the situation in terms of awareness of consumer behavior in the world. Changing consumer behavior is a long-term process and requiring high social and economic awareness (Shams et al., 2020, p. 9). Only the joint action of all people in the world will make it possible to stop some unfavorable environmental and economic changes.

4. Research methods

Based on the review of the literature, the hypotheses were formulated, which were supported by quantitative research. The main objective of the article was to analyze the awareness of various groups of consumer generations in terms of sustainable natural environment. The basis for the accomplishment of the objective was the main hypothesis: ecological and economic awareness is related to the age difference. To justify the main hypothesis, two sub-hypotheses were developed.

H1. There is a relationship between pro-ecological activities and age.

H2. Representatives of Generation X show greater economic awareness and less consumerism.

362 representatives of each characterized generational group took part in the study. The respondents were both women and men, working in the private and public sectors. For the purposes of the article, it was assumed that representatives of Generation X are people over 43 years of age, Generation Y are people between 23 and 42 years of age, while Generation Z are people under 22 years of age. The article presents only some of the respondents' answers, which significantly allow for determining their priorities and characteristics in the topic under consideration.

The measurement tool was the compiled paper questionnaire, which included closed, single and multiple-choice questions. The survey was divided into a main part and a list containing the following information: gender, age, education, and basic sources of income. In the study, the intensity of the respondents' attitudes was measured on a five-point ordinal scale. A Likert scale was used, in which the answers were classified in numerical and verbal values following the principle that the assigned values should increase in accordance with the nature and direction of the defined feature. A five-point scale was used to measure the significance of the statements, and the values were described in words and numbers: 5 – definitely significant; 4 – significant; 3 – insignificant; 2 – definitely insignificant; 1 – I have no opinion.

5. Analysis and conclusions from the research

The results of own research presented in this study are based on a quantitative study conducted using a questionnaire and partly an interview in a group of 362 respondents from the Częstochowa. The surveyed population was dominated by people from Generation X who constituted 52% of the respondents. The remaining part is representatives of Generation Y – 42%, and representatives of Generation Z, who accounted for 6% of the respondents (Figure 5).

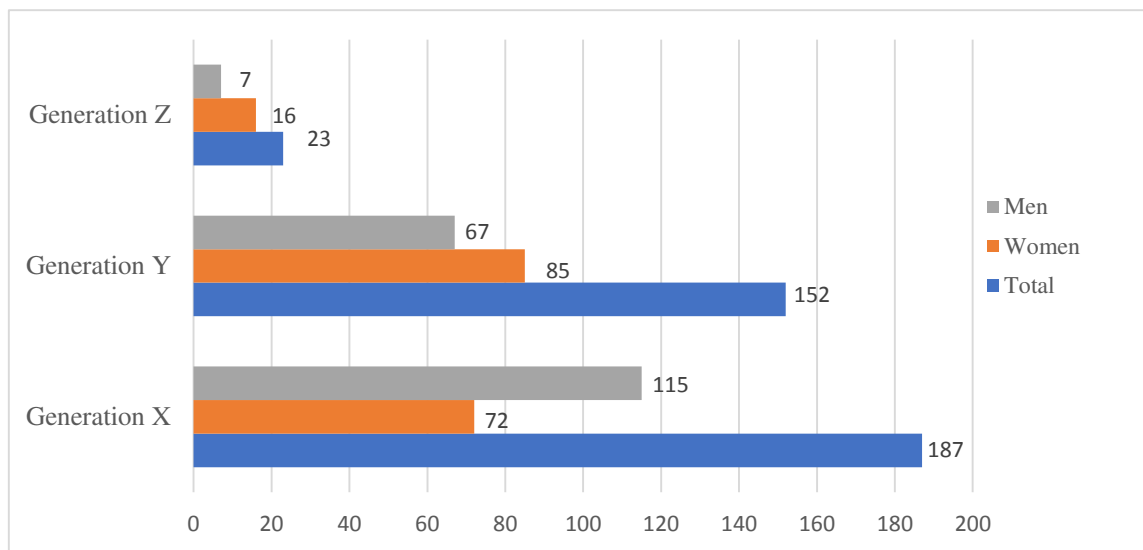


Figure 5. Structure of the sample broken down by the gender of the respondents.

Source: Own study, N = 362.

The largest groups of respondents were representatives of Generations X and Y, they constituted 97%, while 6% of the respondents were representatives of Generation Z. Nevertheless, the results of the research indicate the attitudes of all generation groups.

Among the survey questions regarding the elements of social responsibility in the activities of ZGM TBS, the respondents considered raising the ecological awareness of residents as the most important (Fig. 6).

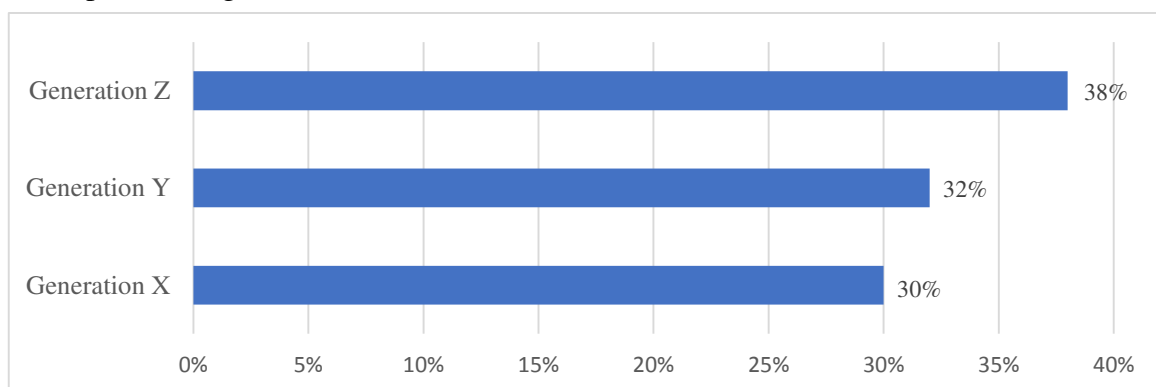


Figure 6. Structure of the sample broken down by belonging to a generational group.

Source: Own study, N = 362.

The data presented above indicate that the respondents from all generational groups equally considered it important to raise the ecological awareness of residents. This is very good news, because this proves the willingness of residents to expand their knowledge and the importance of implementing appropriate actions by ZGM TBS for its residents.

The following pro-ecological activities were specified in the study:

- placing bird feeders, nesting boxes, insect houses in the space of the cooperative,
- creating flower meadows, ponds, rain gardens, gardens with ecological education, green walls, green roofs, waste bin shelters,
- planting new trees and shrubs,
- creating leisure routes,
- installing rainwater tanks, photovoltaic panels on roofs, heat pumps for buildings, anti-smog ventilators, LED lighting,
- creating white roofs.

Among the above-mentioned activities, the division was made according to two criteria, the first being the construction of facilities affecting contact with nature, the second referring to ecological activities affecting savings. The breakdown is shown below. Among representatives of Generation X, the most important activities in the first criterion relating to contact with nature were as follows (Figure 7):

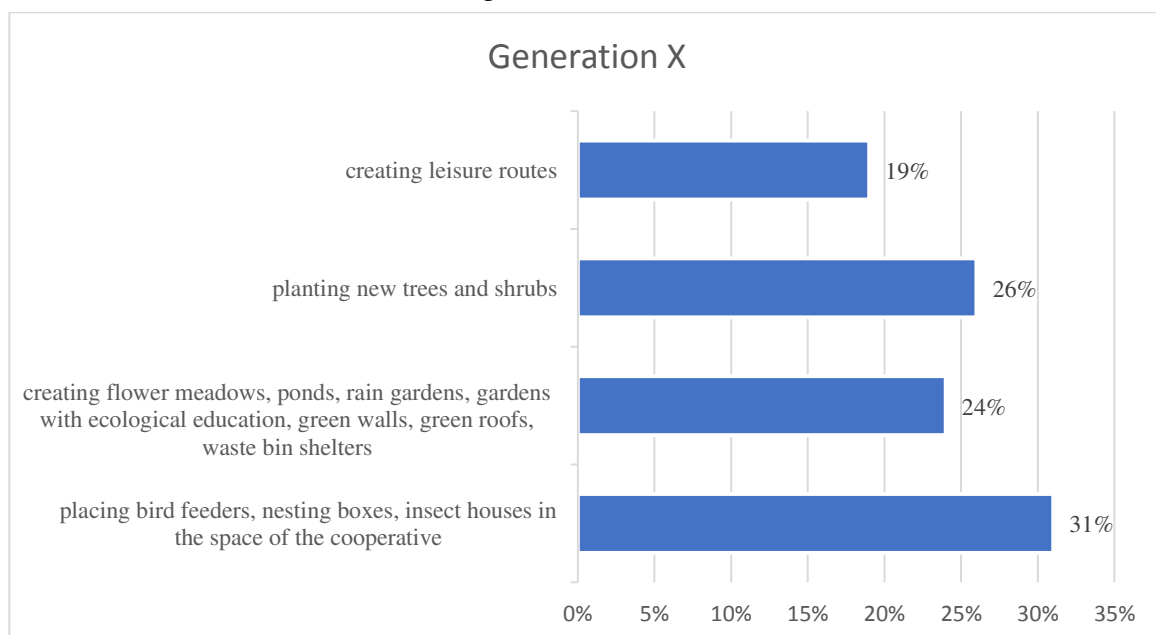


Figure 7. Structure of responses given by representatives of Generation X in terms of pro-ecological activities.

Source: Own study, N = 362.

The most important activity for representatives of Generation X is to place bird feeders, nesting boxes, and insect houses in the space of the cooperative.

Among representatives of Generation Y, the most important activities in the first criterion relating to contact with nature were as follows (Figure 8):

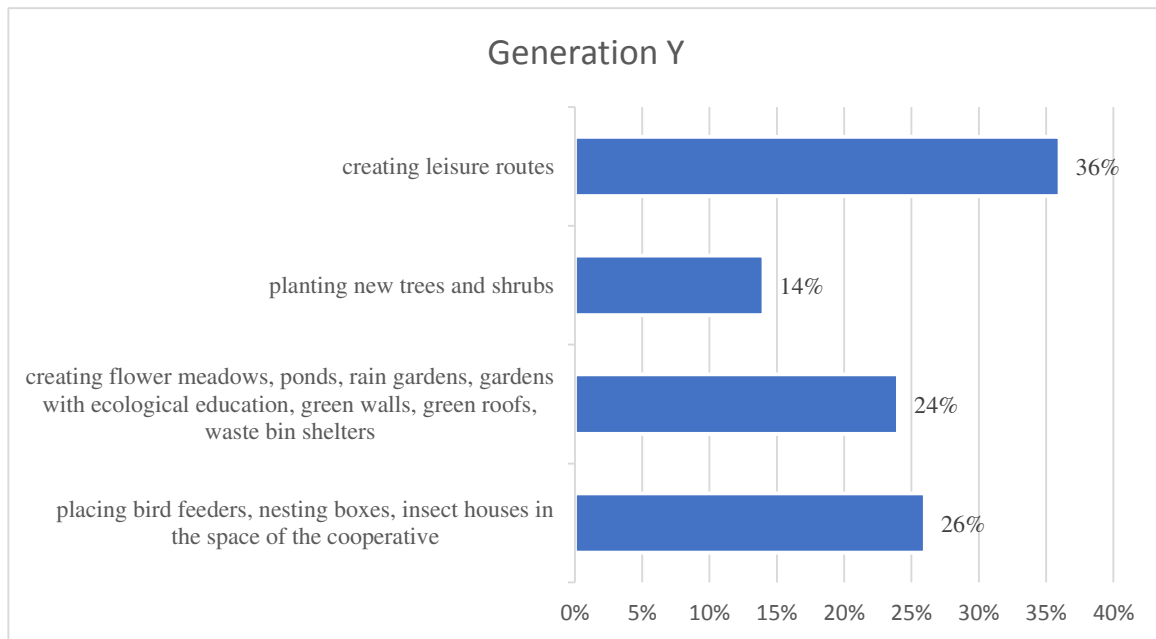


Figure 8. Structure of responses given by representatives of Generation Y in terms of pro-ecological activities.

Source: Own study, N = 362.

For representatives of Generation Y, the most important is to create leisure routes – 36% that allow contact with nature.

On the other hand, among representatives of Generation Z, the most important activities in the first criterion are (Figure 9):

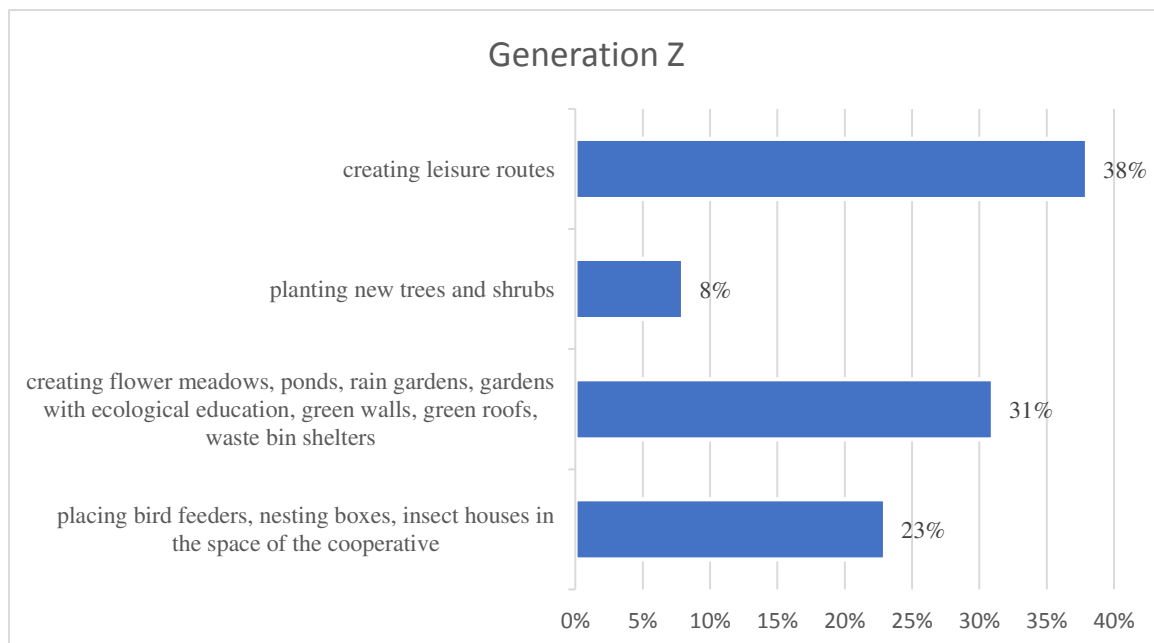


Figure 9. Structure of responses given by representatives of Generation Z in terms of pro-ecological activities.

Source: Own study, N = 362.

Also, for Generation Z, leisure routes account for the largest percentage of responses. The research indicates that representatives of all generational groups are very aware of the need to adapt urban space to closer contact with the natural environment. Therefore, many changes should be made to care for the environment as much as possible and not to lead to its degradation.

Obviously, not less important, the second criterion of activities relating to saving focuses on installing rainwater tanks, photovoltaic panels on roofs, heat pumps for buildings, anti-smog ventilators, LED lighting and creating white roofs. All groups of respondents consider these activities to be very important. Representatives of Generation X considered photovoltaic panels to be the most important, which will significantly allow for saving electricity. Representatives of the youngest generation decided that the installation of heat pumps will be the most important. According to the research, all respondents consciously approach saving available resources. When comparing the conducted surveys to the international studies indicated in the article, a significant relationship between the implementation of pro-ecological and economic activities and the awareness of consumer behavior can be seen. Nowadays, more and more attention is paid to the topic of sustainable use of available resources and minimizing the adverse socio-economic impact on the natural environment. All conducted studies clearly indicate the need to introduce changes in the ecological awareness of societies around the world. Global opportunities to influence the natural environment can help to slow down climate change. It is predicted that the increasing ecological and economic awareness may bring only positive effects in many areas of life.

6. Conclusions

Summing up the perception of the behavior of consumers representing different generations, one can notice the significant awareness in pro-ecological activities. The hypotheses put forward in the article have been proven by analyzing the obtained research results. The conclusions drawn from the analysis are:

The financial possibilities of various social groups may indicate the image of consumerism in the era of commonly required pro-ecological behavior. Numerous examples of such behavior analyzed for the purposes of the article.

Indicate that the development of urban space through the creation of ecosystems meets the approval of the community. The emergence of new ecological leisure places, taking into account small financial outlays, affects both consumerism and ecological and economic social behavior.

Following a few simple rules reducing excessive consumerism is also required today and serves the entire society. Pro-ecological solutions contributing to the improvement in residents' lives were indicated during the analyzes of the surveys.

Summing up the information presented in the article, it can be said that initiatives for the benefit of implementation of pro-ecological and economic solutions have been subject to discussions for many years and this is a very useful action that significantly affects the change in consumer behavior. These activities should be used as often as possible to ensure the reduction in costs of economic and social life, while increasing environmental awareness. The implementation of such solutions is very important socially and ecologically due to the improvement in the quality of life, especially in urban areas.

References

1. Bradley, G.L., Babutsidze, Z., Chai, A., Reser, J.P. (2020). The role of climate change risk perception, response efficacy, and psychological adaptation in pro-environmental behavior: A two nation study. *Journal of Environmental Psychology*, 68.
2. Bushell, S., Buisson, G.S., Workman, M., Colley, T. (2017). Strategic narratives in climate change: Towards a unifying narrative to address the action gap on climate change. *Energy Research Social Science*.
3. Chaney, D., Touzani, M., Ben Slimane, K. (2017). Marketing to the (new) generations: Summary and perspectives. *Journal of Strategic Marketing*, 25(3).
4. Chaturvedi, P., Kulshreshtha, K., Tripathi, V. (2020). *Investigating the determinants of behavioral intentions of generation Z for recycled clothing: An evidence from a developing economy*. Young Consumer.
5. Cranfield, J.A.L. (2020). Framing consumer food demand responses in a viral pandemic. *Can. J. Agric. Econ. Can. Agroekon*, Vol. 68.
6. Crutzen, P., Stoermer, E. (2017). The Anthropocene (2000). In: *The Future of Nature*. Yale University Press, <https://doi.org/10.12987/9780300188479-041>.
7. Fazlagić, J. (2010). Szczególne zjawisko. Pokolenie Y wyzwaniem dla pracodawców. *Personel i Zarządzanie*.
8. Fernandes, T., Moreira, M. (2019). Consumer brand engagement, satisfaction and brand loyalty: a comparative study between functional and emotional brand relationships. *Journal of Product & Brand Management*, Vol. 28, No. 2.
9. Gharzai, L.A., Beeler, W.H., Jagsi, R., (2020). Playing into stereotypes: engaging millennials and generation Z in the COVID-19 pandemic response. *Advances in Radiation Oncology*, Vol. 5, No. 4.

10. Heinonen, K., Strandvik, T. (2021). Reframing service innovation: COVID-19 as a catalyst for imposed service innovation. *Journal of Service Management, Vol. 32, No. 1.*
11. Hopkins, D. (2016). Can environmental awareness explain declining preference for car-based mobility amongst generation Y? A qualitative examination of learn to drive behaviours. *Transportation Research Part A: Policy and Practice.*
12. Hopkins, D. (2017). Destabilising automobility? The emergent mobilities of generation Y. *Ambio, 46(3).*
13. <https://noizz.pl/eko-generacja-z/xdjgl7t>, 3.03.2023.
14. Hultman, M., Yeboah-Banin, A.A., Boso, N. (2019). Linking improvisational behaviour to customer satisfaction: The relational dynamics. *Journal of Business and Industrial Marketing, 34(6).*
15. IPCC (2021). *Climate Change 2021: The Physical Science Basis*, https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf, 7 June 2022.
16. Kroenke, A. (2015). Pokolenie X, Y, Z w organizacji. *Zeszyty Naukowe Politechniki Łódzkiej. Organizacja i Zarządzanie, no. 1202.*
17. Kureshi, S., Thomas, S. (2020). Testing the influence of message framing, donation magnitude, and product category in a cause-related marketing context. *Journal of Marketing Communications, Vol. 26, No. 3.*
18. Kurz, C.J., Li, G., Vine, D.J. (2019). *Are millennials different?* Handbook of US Consumer Economics. Academic Press Cambridge.
19. Lissitsa, S., Kol, O. (2016). *Generation X vs. Generation Y – A decade of online shopping.* Journal Retailer Consumer Service.
20. Luten, S., Ryan, E., Wakefield, J. (2021). *Born into the Climate Crisis: Why we must act now to secure children's rights.*
21. Nolan, L.S. (2015). The Roar of Millennials: Retaining Top Talent in the Workplace. *Journal of Leadership, Accountability and Ethics, vol. 12(5).*
22. Ormerod, K. (2021). New season, old clothes. *Harper's Bazaar, Vol. 3689.*
23. Parment, A. (2013). Generation Y vs. Baby Boomers: Shopping behavior, buyer involvement and implications for retailing. *Journal of Retailing and Consumer Services, 20(2).*
24. Pencarelli, T., Ali Taha, V., Škerháková, V., Valentiny, T., Fedorko, R. (2020). Luxury Products and Sustainability Issues from the Perspective of Young Italian Consumers. *Sustainability.*
25. Pojani, E., Van Acker, V., Pojani, D. (2018). Cars as a status symbol: Youth attitudes toward sustainable transport in a post-socialist city. *Transp. Res. Part F, Traffic Psychology Behaviour.*
26. Reisenwitz, T.H., Iyer, R. (2009). Differences in Generation X and Generation Y: implications for the organization and marketers. *Marketing Management Journal.*

27. Sarraf, A.R.A. (2019). Generational Groups in Different Countries. *International Journal of Social Sciences & Humanities, Vol. 4, No. 1.*
28. Shams, G., Rehman, M., Samad, S., Oikarinen, E. (2020). Exploring customer's mobile banking experiences and expectations among generations X, Y and Z. *Journal of Financial Services Marketing, 25(1-2).*
29. Tevšić D., Nanić A. (2020). Research of gender-based behavioural differences in the purchasing decision-making process. *Economic Review – Journal of Economics and Business, Vol. 18, No. 1.*
30. www.arc.com.pl/rosnie-swiadomosc-polskich-konsumentow/, 23.03.2023.
31. Zalega, T. (2012). *Konsumpcja, Determinanty, Teorie, Modele.* Warszawa: PWE.

THE ROLE OF TRAINING IN MOTIVATING EMPLOYEES IN PUBLIC ADMINISTRATION

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Purpose: The subject of this article is training and its impact on the motivation of public administration employees in tax offices.

Design/methodology/approach: both secondary and primary research were conducted. Secondary research includes literature on the subjects of motivation, motivating, human resources management and employee training. However, the primary study includes a survey conducted in tax offices; in this case, the method was a survey, the technique was an online survey, and the research tool was a survey questionnaire.

Findings: respondents almost unanimously answered that they mainly participate in training because the acquired knowledge will allow them to improve the performance of their duties. Training also motivates them to continue their professional development. The answer regarding job change is noteworthy: respondents do not connect the knowledge acquired during training with the possibility of changing jobs. The research shows that the most important form of motivation is material motivation. Next are the atmosphere and satisfaction with the duties performed.

Originality/value: indicating how important it is to align employees' personal goals with the goals of the organization. In such a case, the system should take into account the individual needs of employees, but employees should also recognize the opportunities for their own development and the benefits that may accrue to the institution. In this way, professional goals can also become personal goals. The author drew attention to an important issue - respondents are aware of their needs, and employers should notice and meet their expectations. This will undoubtedly improve the functioning of many offices. In the era of artificial intelligence, employees' soft skills should be particularly valued because interpersonal skills, flexibility, the ability to cooperate, and creativity are becoming the key factors that distinguish people in the context of technological progress.

Keywords: administration, motivation, motivating, training.

Category of paper: Research paper.

1. Introduction

The article is devoted to the issue of developing the potential of public administration employees through staff training. The author, while analyzing the literature on the subject, noticed a gap regarding the role of training in motivating public administration employees, which is one of the most important motivational tools for this professional group. There have been many publications on the role of public administration employees' competencies e.g. (Cichoń, 2018; Karabela, 2022), motivation systems (Hysa, Grabowska, 2014; Drozdowski, 2013), and motivation factors combined with organizational culture (Bera, 2020; Jabłonko, Dziedzic, 2020). However, there is a lack of current studies on the issue of training and its role not only related to improving the qualifications of employees. The topic discussed is very current and important, especially in such changing conditions related to technological transformation.

The subject of this article is training and its impact on the motivation of public administration employees in tax offices. Goals:

- Development of a theoretical analysis in the field of motivation, motivating employees and training needs.
- Characteristics of the research environment - employees of selected tax offices.
- Conducting research - analysis and interpretation of results.
- Verification of the validity of research hypotheses.
- Developing recommendations for public administration regarding training needs for employees.

To achieve the above objectives, the main hypothesis and detailed hypotheses were formulated.

Main hypothesis: The training system should be a basic component of the human resources system, and the expenditure for this purpose should be treated as an investment in human resources. This structure will strengthen motivation to work and will be part of the organization's culture.

Detailed hypotheses include the following assumptions:

- H1. Employees of tax offices see the need to improve their professional competence through training and other forms of further education.
- H2. The knowledge acquired during training improves the performance of duties.
- H3. Training motivates employees for personal development.
- H4. Employees are motivated by the opportunity to improve their qualifications through individual selection of forms of further education.
- H5. Training in public administration should be a permanent tool supporting the development of employee competencies.
- H6. Basic salary is an important factor motivating tax office employees to work.

The above-mentioned hypotheses were formulated based on the literature and the author's state of knowledge.

The research was conducted among two tax offices located in Tarnów and Bochnia, with the participation of 17 employees. The research method used was an online survey, and the research tool was a questionnaire

There is therefore a need to determine key factors regarding the role of training and their impact on motivating employees, especially in public administration, to which the research part of this work is devoted. Decisions made by management directly affect employee motivation because they are closely related to the methods, tools and methods of achieving goals (Pietroń-Pyszczyk, 2015).

2. The motivation system and factors influencing its shape

A motivational system can be defined "as a set of purposefully selected and logically interrelated motivators, creating a coherent whole, which serves the implementation of the mission, vision, strategy and achievement of the goals of a given organization and takes into account the purposeful and achievable needs and expectations of managers and employees" (Oleksyn, 2014, p. 316).

The motivational system is an element of the motivational process. The motivational system is addressed to employees of a given organization. It should be shaped after a good understanding of their needs and expectations. It should serve the mission and goals of the organization (Oleksyn, 2014).

The success of every organization is influenced by the actions of the entire group of people, i.e. employees must cooperate with each other. Whether employees work only to the minimum of their capabilities or give their all depends largely on the motivation possessed by individuals and by the entire group of employees. The motivation system is created to increase employee efficiency and maximize their potential (System motywacyjny..., 2021).

Table 1. presents the motivating measures that constitute the company's motivation system.

The motivation process is closely related to the principles of human resources management (HRM): therefore, areas such as the remuneration system, evaluation system, promotion system and training system, which are the subject of this work, should be taken into account.

Table 1.*Types of measures creating the motivation system in the enterprises*

Motivation system		
Coercive measures	Incentives	Means of persuasion
Company status, regulations, instructions.	Salary, awards, bonuses, housing, trips abroad.	Coaching, suport.
Resolutions and regulations.	Recognition, praise, distinctions, feedback.	Advice, requests, agitations, negotiations.
Responsibilities.	Career paths, training , evaluation system, job evaluation.	Quality circles, group forms of work organization.
Penalties, threats, discipline system.	Content and working conditions, standards, work organization.	Employee opinion surveys, information systems. Management style, management methods, quality system.

Source: Kozłowski, 2020, p. 29.

When describing and qualifying motivation factors, Roman Karaś uses the following typology: in the process of designing, functioning and assessing the motivation system, each organization must also take into account universal and specific factors. The following can be distinguished (Karaś, 2004):

- factors determined by the employee's characteristics,
- factors determined by the characteristics of the organization,
- factors determined by the characteristics of the environment.

These factors are presented in Table 2.

Table 2.*Selected motivation factors determining the motivation system*

Employee characteristics	Features of the organization	Features of the environment
<ul style="list-style-type: none"> - work experience in the company and industry; - experience; - sex; - education; - employee's age; - family situation; - employee's value system; - responsibility; - qualifications and skills; - location in the organizational structure; - required knowledge and competence; - scope of external contacts; - work results; - potential; - position held. 	<ul style="list-style-type: none"> - size measured by: <ul style="list-style-type: none"> • profit • number of employees • assets - profitability; - industry; - organization development phase; - organizational culture; - influence of employees and trade unions; - production technology; - form of the property; - ownership structure; - management system; - organizational structure; - remuneration philosophy; - the company's position on the labour market; - organizational strategy; - scale of operations. 	<ul style="list-style-type: none"> - political system; - the tax system; - social security system - the degree and scope of legal regulations in the area of remuneration; - the role of trade unions; - level of income in the national economy; - level of economic development; - society's value system; - situation of the labour market; - degree of integration with the world economy.

Source: Michalik, p. 381, <https://zn.mwse.edu.pl/index.php/zn/article/view/487/456>, 9.02.2021.

The factors of motivational impact can be divided, depending on the adopted criterion, into motivators (Oleksyn, 2014):

- a) Material and intangible.
- b) Positive and negative.
- c) Short-term and deferred.

None of these divisions is precise, but each of them has advantages that will prove useful.

The motivational system in every organization is the basis for its smooth functioning. It can be turned into an asset when looking for new employees, and is also an important tool when retaining employees with longer experience. The employee motivation system consists of various tools. The most noticeable motivation that you can read and hear about the most is financial motivation. However, the view that this is the best method of increasing employee efficiency is now being abandoned. A sense of security, stability, a tool for development, expanding knowledge and scope of responsibilities may produce similar results.

3. Training – process characteristics

Training is one of the elements of the employment and staff development strategy. Organizational management also means knowledge management, change management and development. Looking from the perspective of a company that trains its employees, training is a staff development tool intended to provide the organization with people who will perform their work effectively. The training will fulfill its tasks if it results from the organization's personnel strategy. It should also be integrated with the appraisal system and meet the development needs of employees (Sidor, 2004).

Table 3 presents selected definitions of training according to Polish and foreign authors.

Table 3.
Selected definitions of training

Author	Training definition
A. Poczowski [1998]	"Training as a set of purposeful and systematic activities occurring in a given organization and aimed at deepening and expanding specific elements of work potential, as well as equipping it with new elements necessary from the point of view of the current and future needs of the organization."
M. Kostera [1999]	"Training - training evaporators to improve efficiency at the workplace."
T. Listwan [1999]	"The process of improving qualifications related to work requirements in order to increase operational efficiency."
T. Oleksyn [2017]	"Systematic implementation of the model (formal processes) and transmission of specific content to help employees acquire skills that allow them to perform their work effectively."
K. Aswathappa [2000]	"Training means improving the aptitudes, skills and abilities of employees to perform specific tasks."

Cont. table 3.

A. Mayo [2002]	"Training is related to know-how and should be determined by a clearly defined need to improve some element of professional qualifications."
<i>Business Dictionary</i> [2018]	"An organized activity that imparts information and/or instruction to improve a trainee's performance or to achieve a required level of knowledge or skill."

Source: Winnicka-Wejs, 2018, pp. 32-35.

In 1988, the Ashridge Management Research Group identified three basic models of human resources development management, which differ in their level of advancement (Mayo, 2020):

1. fragmented approach - emphasis on independent and formalized training programs, unrelated to business priorities,
2. formalized approach - more professional systematization of training activities, also covering activities preceding training activities and the following,
3. focused approach - training and development are a tool that the organization uses to achieve success, and activities are clearly aimed at achieving it.

In every organization, the human resources development department should be based on its own internal strategies - this department is very important for many reasons: firstly, it is responsible for designing and maintaining processes aimed at analyzing training needs, secondly, setting educational goals or defining solutions and assessing results (indicators performance of tasks, work results and effectiveness) on the basis of which progress will be assessed.

4. The role of training in public administration in the light of the analysis of own research results

"Anyone who stops learning is old,
regardless of whether he is 20 or 80 years old.

Whoever continues learning stays young.

The greatest thing in life is
keeping your mind young"

Henry Ford

This part of the article is devoted to the analysis of the results of the author's own research conducted among public administration employees. They concerned the role of training in motivating employees. The challenge of every organization in the 21st century is not only to acquire, but also to retain employees who have competences and are focused on professional and personal development, and thus become an asset to the organization or company. P. Drucker referred to such employees as "knowledge workers". The topic of the work undertaken by the author is very important not only because of the issue related to knowledge management, but above all because of the answer to the question: *how to make training one of the driving forces behind employee motivation?* Training should be an integral part of achieving

the employee's personal goals with the development goals of the organization. This combination will make the company successful and ensure employee satisfaction, but it is quite a challenge.

For the efficient functioning of public administration, it should have appropriate human resources - an official should professionally perform the entrusted tasks. The tax administration covered by this article is responsible for the collection of levies for the State Treasury and the financial security of the state. That is why it is so important to properly prepare tax administration employees who will serve society.

4.1. Research methodology

The study used both secondary and primary research. For secondary research, the literature on the subject was used on issues in the field of human resources management, motivation, motivating and issues related to employee training. However, primary research was carried out in order to thoroughly understand the subject matter, which was based on surveys conducted among employees of the Tax Office in Tarnów and Brzesko. The method was a survey, the technique was an online survey and the survey questionnaire was used as a research tool. The survey consisted of 17 questions, some of which constitute the respondent's details.

4.2. Analysis of the survey conducted among employees of Tax Offices

The theory described above regarding motivation as well as the role of employee training shows the wide scope and complexity of the issues discussed in this article. In order to better present the issue of training, the author of the work conducted a survey among 17 employees of the Tax Office in Tarnów and the Tax Office in Brzesko. The survey was conducted on May 20 and 21, 2021. The author asked 10 heads of tax offices in the Lesser Poland Voivodeship, but only two of them received the results.

The respondents included 16 women (10 US Tarnów, 6 US Brzesko) and 1 man (US Tarnów). The characteristics of the study group are presented in table 4.

Table 4.

Characteristics of the study group

	Sex	Age				Education			
		16-26	27-41	42-56	57-75	Secondary education	Higher education - bachelor's degree, engineer	Higher - Master's degree	Higher education with at least a PhD degree
Woman	16	0	4	10	2	1	1	14	0
Man	1	0	0	1	0	0	0	1	0

Source: own study based on respondents' answers.

The largest group of respondents turned out to be women, who constitute 94.1%. This result is not surprising, as there is still a trend of more women working in tax offices. The dominant age group is between 42 and 56, which constitutes 64.7% of respondents. If we analyze their

education, 88.2% have master's degrees, such a high rate indicates a qualified staff of employees and people who know how important education and knowledge are - this result may suggest that these people will also be more willing to participate in additional training.

Regarding the position held, the respondents indicated: 7 people - administrative employee, 1 - clerk, 2 - manager, 7 - specialist.

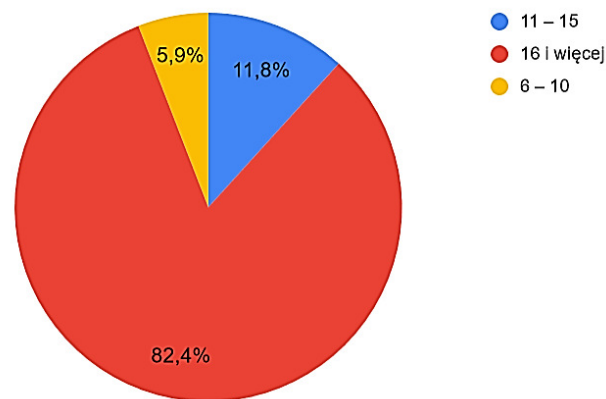


Figure 1. Respondents' work experience.

Source: own study based on respondents' answers.

As shown in Chart 1, respondents with work experience of over 16 years constitute 82.4%, from 11 to 15 years to 11.8%, from 6 to 10 years to 5.9%. This distribution suggests that the respondents are committed to their work and, secondly, it also indicates a low employee turnover rate, which is commendable. However, some level of turnover in an organization is always desirable. It opens the company to new people who can bring new knowledge and skills to the organization.

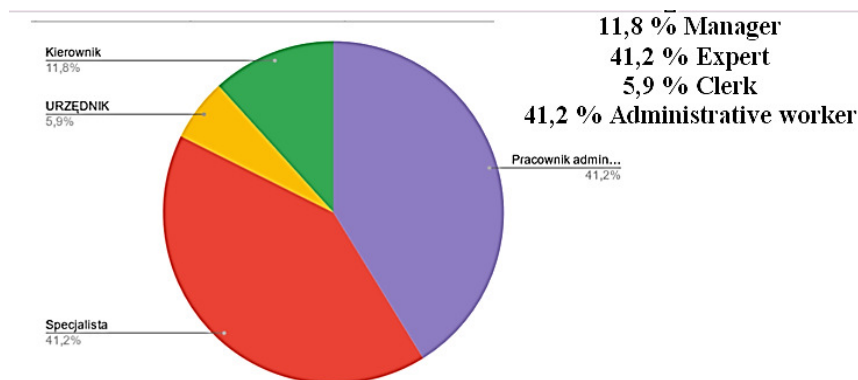


Figure 2. Position taken by respondents.

Source: own study based on respondents' answers.

In this question, respondents were given four suggestions, but they could also add "other" and here there was only one answer added as - official. The specialist and the administrative employee achieved the same percentage result of 41.2.

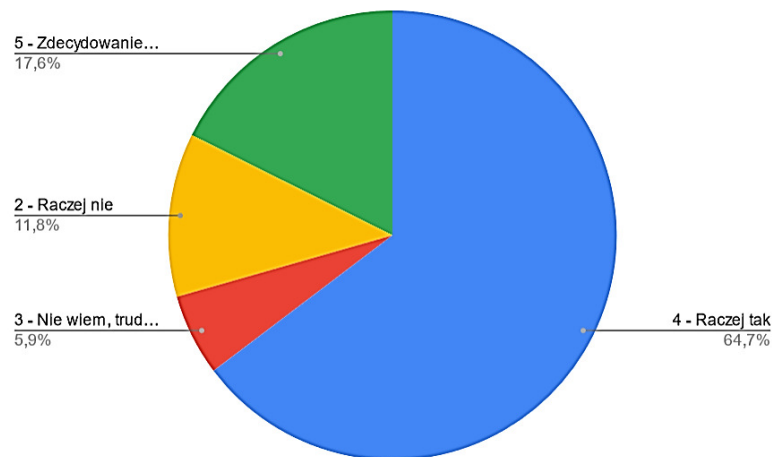
To the next question: *Do you think that training of employees in public administration is necessary?* All respondents answered unanimously, stating that training is needed for public administration employees. It should be noted here that the research hypothesis formulated by the author was confirmed.

H5. Training in public administration should be a permanent tool supporting the development of employee competences.

Respondents see the need to organize and thus participate in training.

The substantive preparation of tax administration employees enables them to perform tasks and duties that result in revenues to the budget from which the needs of all citizens are met (Kaliński, 2011).

The next question concerned job satisfaction (figure 3). The answers show that the respondents are satisfied with their work - this answer was marked by 14 people.



Question: Please rate your overall job satisfaction.

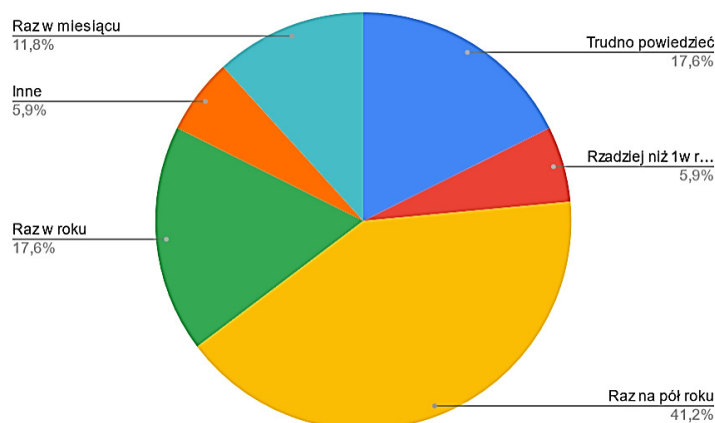
Figure 3. Degree of job satisfaction.

Source: own study based on respondents' answers.

Job satisfaction results from various reasons, one of them may be a reference to the previous question about work experience - where long-term work experience was visible, which suggests the possibility of satisfaction through job security.

As for the frequency of training organized by the employer, the respondents' answers here were different, as shown in Chart 4. However, almost half of the respondents indicated (41.2%) that the employer organizes training once every six months, the second leading result was the answer once a year (17.6%) - whether the answer "difficult to say" was the same.

An employee's awareness that his or her development is important to the employer increases loyalty and motivation to work. Well-trained staff is the key to the success of the entire organization and also improves its image.

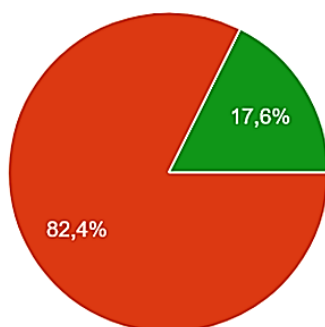


Question: How often do you take part in training organized by your employer?

Figure 4. Frequency of training organized by the employer.

Source: own study based on respondents' answers.

The most important issue, however, is the appropriate selection of training topics for the employee to suit his or her needs and position. In public administration, special attention should be paid to the selection of training topics - because they are also financed from the state budget.



Question: Are the training courses tailored to your needs and the position you hold?

Figure 5. Selection of training to the needs and position of employees.

Source: own study based on respondents' answers.

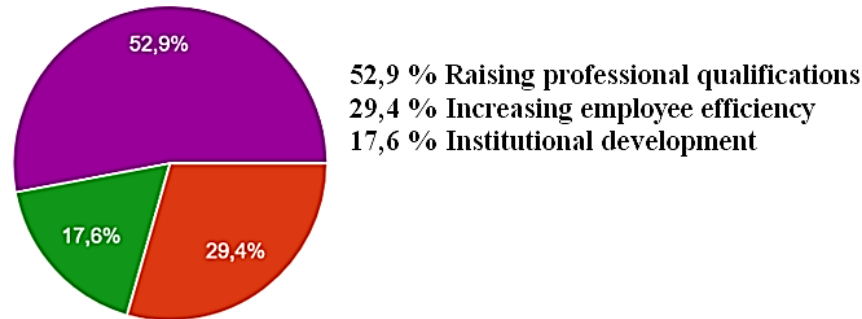
According to the collected data presented in Chart 5, the majority of respondents, as many as 82.4%, confirm that training is tailored to their needs and the position they hold. However, 17.6% gave a negative answer - this result suggests that people responsible for selecting training do not properly diagnose employees' needs.

In the answers to the above question, the hypothesis was verified:

H4. Employees are motivated by the opportunity to improve their qualifications through individual selection of forms of further education.

Identification of training needs is the first stage in the training process and it is safe to say that it is the most important. It is used to determine the level of knowledge, skills and attitudes of employees necessary to achieve the goals and implement the tasks and mission of a given organization (Kossowska et al., 2002).

In the next question, respondents were asked to answer what impact the organized training has (figure 6). The results are impressive and should be an indication for superiors in taking further steps when organizing training and, above all, refer to these results when in doubt whether to organize them.



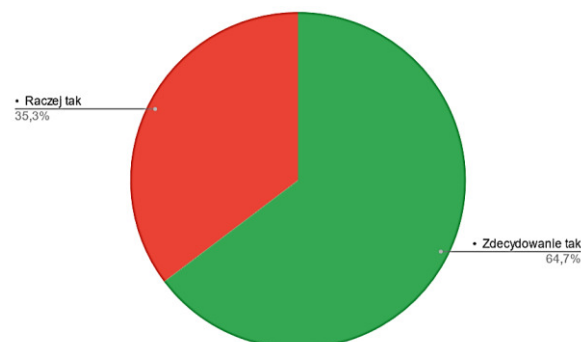
Question: What do you think the trainings have the greatest impact on?

Figure 6. Impact of organized training.

Source: own study based on respondents' answers.

The respondents divided their answers into three criteria: the first one, which received the largest number of votes and accounted for 52.9%, stated that training primarily improves their qualifications, and 29.4% indicated an increase in employee efficiency and the third group marked the development of the institution 17.6%, the latter proves the high maturity of employees as well as the knowledge that their skills are the key to the development of the institution in which they are employed.

Respondents believed that training should be a permanent element of acquiring knowledge and skills, as indicated by the results presented in figure 7. People are a special resource of the organization because their competences in the form of knowledge, experience, skills and abilities become a strategic resource that allows the organization to gain a competitive advantage and, in the case of public administration, also the trust of citizens.



Question: Do you use the knowledge acquired during training in your daily duties?

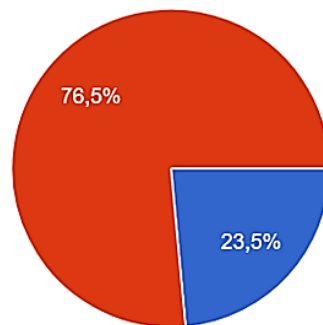
Figure 7. Training as a permanent element of supplementing and acquiring knowledge and skills.

Source: own study based on respondents' answers.

The hypothesis was confirmed in this question:

H1. Employees of Tax Offices see the need to improve their professional competences through training and other forms of further education.

Staff development should include all activities in the organization whose task is to support and implement the process of improving the qualifications and motivation of employees. This process aims to equip their professional potential with the properties necessary to perform current and future tasks.



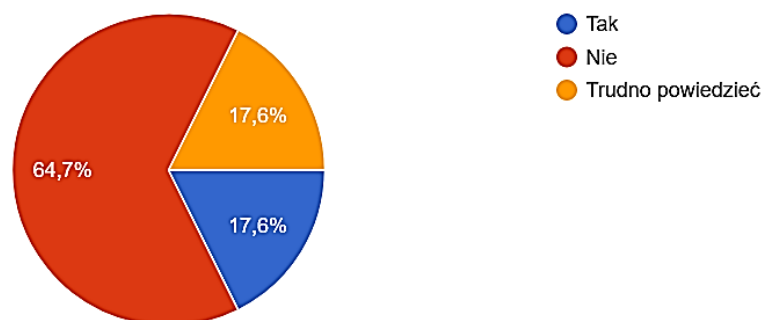
Question: Do you use the knowledge acquired during training in your daily duties?

Figure 8. Degree of use of knowledge acquired during training.

Source: own study based on respondents' answers.

76.5% of the employees surveyed stated that they try to use the acquired knowledge to some extent, while the rest stated that they fully use the acquired knowledge (See figure 8).

Respondents stated that they do not encounter any major difficulties that prevent them from participating in training - 64.7%. However, 17.6% encountered such. The difficulties are presented in figure 9, and the reasons are illustrated in figure 10.

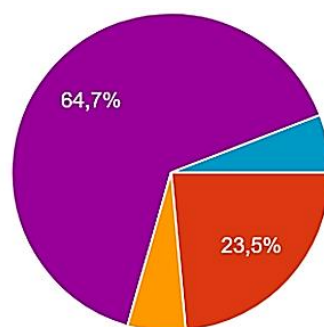


Question: Have you ever experienced difficulties in taking advantage of training? (Regardless of the type of reason – e.g. personal, professional, etc.).

Figure 9. Difficulties preventing participation in training.

Source: own study based on respondents' answers.

The most common difficulties encountered by the respondents were primarily inconvenient training dates or personal problems related to the duties of caring for children. However, the majority, as many as 64.7%, did not experience any difficulties.



Question: What were the difficulties you experienced?

Figure 10. Reasons preventing participation in training.

Source: own study based on respondents' answers.

The basis for the employer will be to discover what motivates each employee and what is important enough for him to make the work he performs a path to satisfaction. Every employer should develop a list of factors that motivate their employees. Of course, it is impossible to meet all expectations because each of us is different and has different needs, but it is possible to develop a set of the most frequently expected factors motivating work. Table 5 presents the respondents' answers.

Table 5.

Selected forms of work motivation by respondents

A form of motivation	Definitely yes	Probably yes	I don't think so	Definitely no	Hard to say
Base salary	17		0	0	0
Atmosphere at work - team	14	3	0	0	0
Satisfaction with performed duties	10	7	0	0	0
Availability of training - offered by the employer	1	11	3	0	2
The prestige of working in an office	0	8	4	3	2
A promotion opportunity	6	5	5		1
Possibility to improve your qualifications by individually choosing the form of further education	4	8	1	0	4

Question: Which form of work motivation do you consider the most important?

Source: own study based on respondents' answers.

From the data presented, all respondents chose the form of material motivation. Salary is the most important thing for them. Next, the atmosphere and satisfaction with the duties performed.

The hypothesis was confirmed for this question:

H6. Basic salary is an important factor motivating tax office employees to work.

As the presented research review shows, pay is a very important element motivating work. Money in the form of wages is a source of employee income, it is a determinant of the standard of living, social security, a determinant of the sense of value and recognition of one's talents, skills and qualifications (Leśniewski, 2021).

In the last question, respondents were asked to express their opinion on the reasons for participating in training. The distribution of results is presented in table 6.

Table 6.
Respondents' reasons for participating in training

Reasons for participating in training	Definitely yes	Rather yes	Rather no	Definitely no
I was referred by the employer - a refusal could have negative consequences	4	5	3	5
The acquired knowledge will improve my duties	11	5	1	0
This will bring me closer to promotion		4	10	3
I'm thinking about changing my job and the knowledge gained during the training may make it easier for me	1	1	6	9
The training motivates me to continue my professional development	4	8	5	0

Question: Why do you participate in training?

Source: own study based on respondents' answers.

The respondents almost unanimously answered that they mainly participate in training because the acquired knowledge will allow them to improve the performance of their duties. Training also motivates them to continue their professional development. The answer regarding job change is noteworthy - respondents do not connect the knowledge acquired during training with the possibility of changing job.

This question enabled the verification and simultaneous confirmation of hypothesis H2, where as many as 16 people marked an answer confirming that the knowledge acquired through training improves the performance of their professional duties.

H2. The knowledge acquired during training improves the performance of duties.

Acquired knowledge – acquired competences in relation to public administration officials play a fundamental role. The official performs many tasks, including making substantive decisions in accordance with the acquired knowledge and skills and preparing materials necessary to make such decisions. It is also a link between those in power and society, it should provide objective advice and assess the situation in accordance with the regulations.

Hypothesis H3 was further verified and confirmed by the author, where it was confirmed by 12 respondents.

H3. Training motivates employees for personal development.

Trainings motivate officials for personal development because they see the benefits of participating in them by improving their work or improving their competences. It should also be taken into account that the knowledge acquired can be used not only in the current workplace but is acquired capital for life.

To sum up, all the hypotheses were verified and confirmed. They were proven as a result of the study.

5. Conclusions

An important issue for the proper development of the personal potential of every institution and enterprise is to create optimal opportunities for employee development in relation to the short and long-term goals of the institution. It would be appropriate to combine personal goals with those of the organization. In such a case, the system should take into account the individual needs of employees - but the employee should also see the opportunities for his or her development and the benefits that may flow to the institution. In this case, professional goals may simultaneously become personal goals.

Participating in training brings benefits to the employee and the employer - the employee has the opportunity to develop, and the employer uses the skills he has acquired. Investment in human resources will bear fruit in the future, and well-qualified staff is the capital of the organization. Modern public organizations must be able to adapt to a complex and changing environment, and their role should be greater flexibility in action, which will translate into a more effective use of officials' competences and their knowledge as well as awareness of the needs for learning and self-development.

According to the author, the topic discussed is necessary to develop certain principles regarding knowledge management in public administration. That is why it is so important that training is a permanent element supporting the development of employees of every organization, not only public administration.

The training process aims to improve the qualifications and knowledge of its participants. Training is a complex process that consists of several stages. Each of them should be adapted to the needs and specific work of the training participants and must be compatible with the goals, mission and tasks of the organization.

As the study shows, respondents are aware of the benefits of participating in training and are willing to participate in it, but they know how important it is to select it appropriately to their needs and expectations and this should be given special attention.

The most valuable asset in an organization is people. Motivating is important at every stage of an organization's activity. The improvement process can be treated as part of the motivation system in the organization. Employees often treat training as a reward or an opportunity for professional development. Continuous improvement of qualifications is also a task for the employee, who is to support the functioning of the organization through his own development.

The topic is certainly not exhaustive and encourages further research, but it introduced the role of training and showed how important it should be in the development of the organization and in motivating employees. The author is aware of the major limitations of the material presented, one of the reasons is the low number of returned surveys, but the results are only a seed and a perspective for further research. The author intends to expand her research in the future and develop recommendations that could contribute to the development of training policy in public administration.

Acknowledgements

I would like to thank the officials who took part in the study from the Tax Office in Tarnów and the Tax Office in Brzesko. The research was also helpful in writing a diploma thesis in postgraduate studies in Psychology in Business.

References

1. Bera, A. (2020). Znaczenie kultury organizacyjnej dla motywacji pracowników Państwowej Straży Pożarnej. *Przedsiębiorczość i Zarządzanie*, 21(1), 31-46.
2. Cichoń, S. (2018). Rola kompetencji pracowniczych w administracji publicznej. *Studia i Prace WNEiZ US*, 51/2, 21-31.
3. Drozdowski, G. (2013). Motywowanie pracowników w organizacjach publicznych. *Studia Lubuskie: Prace IPiA PWSZ w Sulechowie*, 9.
4. Hysa, B., Grabowska, B. (2014). System motywacji pracowników administracji publicznej na podstawie wybranej jednostki ZUS. *Zeszyty Naukowe. Organizacja i Zarządzanie*, 74. Politechnika Śląska, 325-342.
5. Jabłonko, O., Dziedzic, K. (2020). Kultura organizacyjna a etyczne funkcjonowanie administracji publicznej. *Wyższej Szkoły Zarządzania i Przedsiębiorczości z siedzibą w Wałbrzychu*, 181.
6. Kaliński, M. (2011). Rozwój zasobów ludzkich w administracji podatkowej. *Zarządzanie Zasobami Ludzkimi*, no. 5(82).
7. Karabela, P. (2022). *Kształtowanie i rozwój kompetencji kierowniczych w Policji w ramach systemu szkolnictwa policyjnego*, 04karabela.pdf (ceon.pl), <https://depot.ceon.pl/handle/123456789/22185>
8. Karaś, R. (2004). *Teorie motywacji w zarządzaniu*. Poznań: Wydawnictwo Akademii Ekonomicznej w Poznaniu.
9. Kossowska, M., Sołtysińska, I. (2002). *Szkolenia pracowników a rozwój organizacji*. Kraków: Oficyna Ekonomiczna.
10. Kozłowski, W. (2020). *Zarządzanie motywacją pracowników*. Warszawa: CeDeWu.
11. Leśniewski, M., Berny, J. *Wynagrodzenia w procesie motywowania pracowników*, https://repozytorium.uph.edu.pl/bitstream/handle/11331/1031/Lesniewski_Berny_Wynagrodzenia_w_procesie.pdf?sequence=1, 10.06.2021.
12. Mayo, A. (2020). *Kształtowanie strategii szkoleń i rozwoju pracowników*. Kraków: Oficyna Ekonomiczna.

13. Michalik, K. *Typologia czynników motywacji*, <https://zn.mwse.edu.pl/index.php/zn/article/view/487/456>, 9.02.2021.
14. *Motivational system - factors, techniques, tools*, https://www.praca.pl/poradniki/rynek-pracy/system-motywacyjny-czynniki,techniki,narzedzia_pr-2014.html, 27.06.2021.
15. Oleksyn, T. (2014). *Zarządzanie zasobami ludzkimi*. Warszawa: Wolters Kluwer SA,.
16. Pietroń-Pyszczek, A. (2015). *Motywowanie pracowników wskazówki dla menedżerów*. Wrocław: Wydawnictwo Marina.
17. Sidor-Rządkowska, M. (2004). *Zarządzanie personelem w małej firmie*. Kraków: Oficyna Ekonomiczna.
18. Winnicka-Wejs, A. (2018). *Rynek usług szkoleniowych w Polsce. Uwarunkowania – modele – implementacje*. Katowice: Wyd. Uniwersytet Ekonomiczny w Katowicach.

NEW RULES OF REMOTE WORK – AMENDMENT TO THE LABOUR CODE

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Purpose: The impulse to write the article was the coming into force on 7 April 2023 of the amendment to the Labour Code, which introduced regulations regarding remote work. The possibility of an employee working remotely was provided for in Art. 3 of the Act of 2 March 2020, the act on special solutions related to the prevention, counteracting and combating of COVID-19, other infectious diseases, and crisis situations caused by them (The Act, 2020, Item 1842). Due to the temporary nature of the above-mentioned regulation, it became necessary to statutorily regulate the principles of remote work. The new regulations undoubtedly constitute a challenge for employers and make the issue of remote work in labour law important and topical. Author presents the definition and types of remote work, as well critically evaluates new regulations.

Design/methodology/approach: The deliberations are based on the related literature on the subject and an analysis of the legal provisions applicable in the area under discussion.

Findings: The current structure of remote working is less restrictive. The amendment does not specify any conditions enabling the introduction of remote work. The current regulation allows for more flexibility than with teleworking, because remote work does not always have to be only work the effects of which can be sent via electronic communication. There are also some criticisms of the above, though. The new regulation is extensive, and numerous references to other articles make the provisions relatively illegible. The procedure for agreeing on remote work has been significantly formalised, and part of the risk associated with its performance has been transferred to the employee.

Practical implications: Adjusting their business to the new legal requirements, entrepreneurs will need to implement far-reaching organisational changes. For this reason, knowledge about the remote work regulations has become increasingly important.

Originality/value: The article raises the issue of remote work, which is important not only from the point of view of the employee but also from the entrepreneur's perspective. The issues arising from this are the subject of only a few publications.

Keywords: labour law, remote work, entrepreneurs' obligations, employee.

Category of the paper: viewpoint, literature review.

1. Introduction

For the first time, regulations regarding remote work were introduced into the Polish legal system by way of the Anti-Crisis Shield (The Act, 2020, Item 1842). It had already been possible for an employee to work remotely. Since 2007, it had been possible to employ employees via teleworking (i.e., performing work regularly in a place other than the workplace using electronic means of communication (The Act, 2007, No. 181, Item 1288), or a home office). The adoption of these solutions required the unanimous intention of the employee and the employer. In the case of remote work, the greatest concerns arise regarding the possibility of the employer unilaterally imposing it on the employee. Pursuant to Art. 3 of the Anti-Crisis Shield, in order to counteract COVID-19, the employer could instruct the employee to perform work specified in the employment contract, for a fixed period of time, outside their place of permanent performance (The Act, 2020, Item 1842). The above regulation is detailed in the provisions of the Act of 19 June 2020 (The Act, 2020, Item 1082). At that time, a requirement was introduced for the employee to have the skills, the technical capabilities, and a location to perform remote work, and the possibility of performing remote work was limited to the type of work that allows for its remote organisation. Remote work could be recommended to the employee in order to counteract COVID-19, which in particular should be understood as limiting the direct threat resulting from COVID-19 (protection of employees' health and life) (Baran, Książek, 2020, p. 44).

Due to the temporary nature of the above-mentioned regulation, it became necessary to statutorily regulate the principles of remote work (Baumann, Marcum, 2023). The introduction of appropriate changes to the provisions of the Act of 26 June 1974 – Labour Code was argued in terms of the necessity to meet the justified needs of employees and employers in two important areas: enabling employers (in justified cases) to introduce preventive control of employees regarding the presence of alcohol or substances acting similarly to alcohol in their organism, and introducing regulations regarding remote work as a permanent solution (Justification..., 2022).

The Act of 1 December 2022 amending the Labour Code and certain acts, which introduced remote work to the Code, at the same time repealed the existing provisions regulating teleworking.

It could be said that the new institution of remote working is a combination of the three forms of remote working that have existed so far (as such a combination was envisaged in all projects published to date):

- Telework regulated for in the Labour Code (Art. 67(5)-67(17) of the Labour Code).
- Home office work, unregulated, but widely used in corporations.
- Remote work in force during the pandemic pursuant to Art. 3 of the Anti-Crisis Shield (Mędrala, 2023).

The new solution is based on the existing idea: the permissibility of working outside the place of permanent work. It is worth emphasising that the current structure of remote work is less restrictive than the regulation of the Anti-Crisis Shield, which granted the employer the right to issue an order to perform remote work (as performing work in this form was not based on the mutual intent of the parties to the employment relationship), and more flexible than telework (because remote work does not have to be restricted to work the effects of which can be sent via electronic communication) (Kryczka, 2023).

The amendment to the Code, which introduced the statutory regulation of remote working, made it a point of interest not only to representatives of legal doctrine, but also to entrepreneurs. The aim of the article is to present this new legal solution and the challenges faced by employers as a consequence of this modification.

2. Definition of remote work

The new regulation introduced a definition of remote work. Pursuant to Art. 67(18) of the Labour Code, “Work may be performed entirely or partially at a place indicated by the employee, including at the employee’s home address, and each time agreed with the employer, in particular with the use of means of direct remote communication (remote work)” (The Act, 2023, Item 1465).

The newly introduced definition of remote work is a combination of the existing, although significantly expanded, definition of telework, and remote work modelled on COVID regulations and *ad hoc* work from home (home office). This definition includes the following elements: complete or partial performance of work remotely (with the possibility of working in a hybrid model, part-time); performance of work at a place indicated by the employee, but each time agreed with the employer; and performance of work in particular (but not solely) using means of direct remote communication.

Importantly, the first two elements are obligatory, while the third is optional (Mędrala, 2023b).

Since remote work is allowed to be performed entirely or partially at a place indicated by the employee, a remote employee will be either an employee who exclusively performs their duties outside the workplace or one who alternately performs work outside the workplace only on certain days. Therefore, the exclusive performance of work outside the premises of the workplace cannot be accepted as a necessary condition for recognising a given job as remote work (Kryczka, 2023). Remote work may be permanent (where the only way of performing work by a given employee is remote work) or hybrid (where in parallel with remote work, the employee performs on-premises work when it is performed for a period not exceeding 24 days in a calendar year (Łuczak-Tarka, 2023)).

According to Art. 67(18) of the Labour Code, remote work may be performed “at a place indicated by the employee and each time agreed with the employer” (The Act, 2023, Item 1465). The Act excludes the possibility of imposing on an employee the place of remote work. The justification for the draft act reads as follows:

This part of the definition is crucial for distinguishing remote work from work performed in a traditional way. This means that an employee who performs all or part of their professional duties outside the workplace will not be an employee performing remote work if their place of work has been indicated by the employer and agreed with the employee (in the employment contract) or has been indicated *ad hoc* pursuant to employer’s instructions (e.g., instructing an employee to travel on a business trip) (Justification, 2022).

Pursuant to Art. 67(31) §7 of the Labour Code, allowing an employee to work remotely is contingent on the employee submitting a declaration, in paper or electronically, confirming that safe and hygienic working conditions are ensured at the remote workstation in the place indicated by the employee and agreed with the employer (The Act, 2023, Item 1456). It can be concluded that the burden and risk resulting from the obligation to ensure safety at work has been partially transferred to the employee. This is a beneficial situation for the employer, but for it to arise, it is necessary for the employer to know where the remote work will be performed, provide employees with the information required in this regard, and agree to allow the performance of remote work there (Prusik, 2023). It follows from this that mobile work or work performed as part of a business trip cannot be considered remote work, due to the fact that in such cases the employee does not make an independent decision as to where to perform their duties (Sobczyk, 2023). Making the recognition of a given job as remote dependent on the employee’s designation of the workplace has perhaps rightly been criticised. If the employer indicates the place of work to the employee (e.g., their place of residence), the employee will not then be performing remote work but rather “home working” (Walczak, 2023).

The new regulations introduced a new concept of “address of residence”, previously unknown to the law, without introducing its legal definition. Art. 25 of the Act of 23 April 1964 – Civil Code defines the place of residence as the place where a person resides with the intention of permanent residence, and Art. 28 of the Civil Code states that one can only have one place of residence (The Act, 2023, Item 1610). In turn, the provisions of administrative law include the term “address of registration”, referred to in Art. 89 of the Act of 6 August 2010 on identity cards (The Act, 2022, Item 671). The basis for the introduction of this new legal concept may be the fact that most often the address of registration is not also the place of permanent residence (Tomaszewska, 2023). “The intention to reside permanently occurs when there are circumstances that allow an average observer to conclude that a specific locality is the main centre of activity of an adult natural person” (Resolution, 2022). This address may, but does not have to, coincide with the employee’s place of residence or registered office. There are no obstacles to it being any other place where the employee lives at the time; e.g., a hotel or their

parents' house. Labour law provisions also do not prohibit remote work from being designated in a publicly accessible place.

According to Art. 67(18) of the Labour Code, the provision of remote work means performing work "in particular" using means of direct remote communication. The Act does not constitute a catalogue of technical means through which remote work can be performed, and "thus, the subject of remote work may be various activities and different scope of duties – as long as they do not fall into the catalogue of exclusions resulting from the provisions on remote work" (Kryczka, 2023). The use of the phrase "in particular" by the legislator allows one to assume that these may be "not only means of electronic communication, but also, for example, telephone, fax, instant messengers, and even no use of such means (e.g., document analysis)" (Justification, 2022). It is obvious that remote work can be provided via various means of direct remote communication, but can also involve the provision of manufacturing parts or material services (working on documents, preparing documents and analyses, verifying information, contact with clients and colleagues, etc.) (Marciniak, 2023).

The Act did not introduce subjective or objective prerequisites for the possibility of introducing remote work, which results in the highly flexible nature of its application (Matyjas-Łysakowska, Maroń, 2022). However, certain exceptions have been introduced to this rule: Remote work cannot apply to the work specified in Art. 67(31) §4 of the Labour Code (including particularly hazardous work involving the use of harmful substances). It is worth emphasising that the type of work or its organisation may also constitute an obstacle to the introduction of remote work at the employee's request (The Act, 2023, Item 1465, Article 67(19) §5).

With regard to the employer's obligation to create and provide a job, the amendment introduced a solution similar to the general principles of labour law. Pursuant to Art. 104(1) §1 of the Labour Code, the tools and materials necessary to perform the work are provided by the employer (The Act, 2023, Item 1465). The newly added article 67(24) §1 Point 1 of the Labour Code stipulates that the employer is obligated to provide an employee performing remote work with the work materials and tools, including technical devices, necessary for them to perform remote work (The Act, 2023, Item 1465). The concept of work tools should be understood in particular as "devices enabling the performance of activities constituting the work process, which the employer considers necessary to perform duties at a given job in the remote work formula" (Kuczkowski, 2022). These include a computer, software, access to workplace resources, and other things necessary to remotely perform employee duties, and may be specific to the nature of such duties (e.g., a mobile phone or a printer). Materials should be understood as the consumables most often necessary when using the tools; e.g., printer paper.

Since the employee declares that they have the premises and technical conditions to perform such work, it seems that the employer is not obligated to provide permanent office equipment, such as file cabinets, a desk, or a chair. The justification for the draft act states that "preparing the employee's place of remote work to perform work in the form of remote work may require

various adaptations, e.g. the need to rearrange the room in order to obtain better access to natural lighting. The employer's obligation in this case will be to prepare the employee for what an optimal (healthy and safe) workplace should look like" (Justification, 2022). It should be emphasised that the purchase of office furniture at the employer's expense is permissible under internal company regulations or individual agreement with the employee (Mędrala, 2023).

3. Types of remote work

Remote work may therefore be recommended to any person who meets the conditions specified in Art. 2 of the Labour Code: i.e., is employed on the basis of an employment contract (regardless of its type), appointment, election, nomination, or cooperative employment contract. Statutory regulations regarding remote work do not apply to persons employed under civil law contracts. However, it should be emphasised that nothing prevents the parties from contractually determining the place of work outside the workplace and the method of performing it based on the principle of freedom to conclude contracts (Jaśkowski, 2023). Remote work, like telework before it, is not a separate type of contract or basis for employment, but only a different way of performing work.

The Act provides for four remote work modes:

- Basic mode – as part of the arrangements between the employer and the employee (Art. 67(19) §1-2 of the Labour Code).
- Extraordinary mode – by order of the employer (Art. 67(19) §3-5 of the Labour Code).
- Privileged mode – at the request of certain specific groups of employees (Art. 67(19) §6-7 of the Labour Code).
- Occasional home office work up to 24 days a year – applied at the employee's request (Art. 67(33) of the Labour Code).

This division results from the very definition of remote work in Art. 67(18) of the Labour Code, according to which work may be performed entirely or partially in a place other than that specified in the employment contract (The Act, 2023, Item 1465). In addition, remote work, pursuant to Art. 67(33) § 1 of the Labour Code, may be occasional. Another division is related to the mode of remote work (voluntary, forced, or on request). It is worth emphasising that agreeing to remote work based on the employee's request is voluntary and requires mutual agreement between the parties to the employment relationship (Głądoch, 2023).

Importantly, the basis for introducing remote work does not affect how it is performed, which is always the same. However, this may affect the very arising or termination of the obligation to perform work in this way (Jaśkowiak, Maniewska, 2023).

The basic mode of remote work regulated for in Art. 67(18) of the Labour Code, as emphasised earlier, is based on the principle of voluntariness. However, a number of exceptions have been introduced to the above rule. The employer cannot refuse the possibility of providing remote work to, among others, parents who are raising a child under the age of 4, parents and guardians taking care of a person with a disability in the family, and pregnant women, as well as employees listed in Art. 142 §1 Points 2 and 3 of the Labour Code, as follows:

- Employees who are parents of a child who has the certificate referred to in Art. 4 Section 3 of the Act on supporting pregnant women and families “For life”: i.e., a certificate of severe and irreversible disability or incurable life-threatening disease that occurred in the prenatal period of the child’s development or during childbirth.
- Employees who are parents of a child with a certificate of moderate or severe disability specified in the provisions on vocational and social rehabilitation and employment of disabled persons.
- Employees who are parents of a child about whom an opinion has been expressed on the need for early support for the child’s development, a decision on the need for special education, or a decision on the need for revalidation and educational classes, as referred to in the provisions of education law (The Act, 2020, Item 1329).
- Remote work can be provided entirely or partially (hybrid model).

Choosing to work in the hybrid model requires specifying the amount of work performed remotely (i.e., the number of days a week on which work will be performed remotely) and indicating on which days the work will be performed remotely (e.g., on Mondays and Tuesdays). The possibility of changing the above arrangements becomes problematic due to the needs of the employer. Pursuant to Art. 22 §1 of the Labour Code, by establishing an employment relationship, the employee undertakes to perform work of a specific type for the employer and under their direction and at the place and time designated by the employer, and the employer undertakes to employ the employee in exchange for remuneration (The Act, 2023, Item 1465). Therefore, from the very definition of the employment relationship, it should be concluded that the employer is entitled to unilaterally determine the method of performing remote work provided partially. It should be emphasised, however, that there are no solutions in the statutory provisions regulating remote work that would directly indicate such a possibility, and the introduction of hybrid work itself requires a mutual agreement of the parties, which precludes imposing remote work on the employee, and thus, it seems, a change in the number of days of on-site work (Tomaszewska, 2023).

Remote work may be recommended to an employee only in the situations specified in Art. 67(19) §3 of the Labour Code, provided that the employee submits a declaration that they have appropriate working conditions in terms of health and safety at the remote workplace. “In practice, this means that the employer is obligated to obtain – before issuing an order to work remotely – information whether the employee has the above-mentioned skills and

capabilities” (Justification, 2022). The employee has the right to refuse to work remotely if there are no appropriate conditions to do so.

In the light of Art. 67(19) §3 of the Labour Code, remote work may be performed at the employer’s request during a state of emergency, a state of epidemic threat, or a state of epidemic, and within 3 months after their cancellation or during the period in which ensuring safe and hygienic working conditions at the current workplace by the employer for the employee is temporarily not possible due to *force majeure* (The Act, 2023, Item 1465). The decision to introduce and cancel remote work can be considered a managerial competence of the employer, but it should still be remembered that the employee’s declaration of having appropriate premises and technical conditions is necessary, and the provision of work in this mode is time-limited and depends on the existence of the conditions listed in Art. 67(19) §3 of the Labour Code (Mitrus, 2023).

Pursuant to Art. 67(33) §1 of the Labour Code, remote work may also be performed occasionally at the employee’s request submitted on paper or electronically, for a period not exceeding 24 days in a calendar year, and may be established only at the employee’s request (although the employer is, of course, not bound by this request). In relation to occasional remote work, the application of Art. 67(19)-67(24) of the Labour Code (including initiating and resigning from remote work, providing tools and covering costs by the employer) and Art. 67(31) §3, it was mandated to regulate, in consultation with the employee, the control principles regarding remote work, occupational health and safety, or compliance with information security and protection requirements, including personal data protection procedures (The Act, 2023, Item 1465). The Act does not specify whether the limit of 24 days in a calendar year applies to every employee regardless of whether they are employed full-time or part-time, which will undoubtedly result in practical problems (Moras-Olaś, 2022). It seems reasonable to adopt the position that, similarly to the calculation of leave, the number of days of occasional remote work should depend on the time worked (Kosut, 2020).

4. Conclusion

Regulation of remote work in the Labour Code and its permanent introduction into the Polish legal system was positively received by both employees and employers. An undoubted advantage is the possibility of initiating this type of work not only by the employer but also by the employee. Providing remote work means performing work “in particular” using means of direct remote communication, but the Act does not exhaustively list the technical means by which remote work can be performed, which may be beneficial for the employee.

Art. 67(29) of the Labour Code should be considered equally beneficial; according to it, an employee performing remote work in terms of establishing and terminating an employment relationship, terms of employment, promotion, and access to training in order to improve professional qualifications cannot be treated less favourably than other employees employed in the same or similar work, taking into account differences related to the conditions for remote work (The Act, 2023, Item 1465). Importantly, the employee will not be able to be discriminated against in any way due to remote working or their refusal to do so. This amounts to a prohibition of discrimination against an employee performing remote work as well as against an employee who refuses to perform remote work. This will constitute an additional protective regulation for employees working remotely.

There are also some criticisms of the above, though. The new regulation is extensive, and numerous references to other articles make the provisions relatively illegible. The procedure for agreeing on remote work has been significantly formalised, and part of the risk associated with its performance has been transferred to the employee. This is in particular the result of burdening the employee with the majority of organisational responsibilities regarding the introduction of remote work, with the simultaneous lack of systematisation of some issues; e.g., incurring costs for the means used to perform remote work. The issue of protecting personal data when working remotely, including that of the employee's closest relatives, also seems problematic.

All of this means that the application of the provisions on remote work may pose considerable difficulties in practice. Only time will tell whether and to what extent they require further amendments and improvement.

References

1. Baumann, H.M., Markum, T.M. (2023). Human capital and legal perspectives on remote work: recommendations for organizations. *Management Research Review*, Vol. 46, No. 12, pp. 1711-1726.
2. Gładoch, M. (2023). *Praca zdalna. Kontrola trzeźwości. Nowelizacja Kodeksu pracy. Komentarz*. C.H. Beck.
3. Jaśkowski, K. (2023). Art. 67(18). In: E. Maniewska, K. Jaśkowski, *Kodeks pracy. Komentarz aktualizowany*, LEX/el. <https://sip.lex.pl/#/commentary/587922291/746224?keyword=kodeks%20pracy%20komentarz&toHit=1&cm=SFIRST>, 27.12.2023.
4. Kosut, A. (2020). In: K.W. Baran (ed.), *Kodeks pracy. Komentarz*. Wolters Kluwers.
5. Kryczka, S. (2023). *Bezpieczna praca osób świadczących pracę w formie pracy zdalnej - krok po kroku*, LEX/el. <https://sip.lex.pl/#/publication/470046519/kryczka-sebastian->

- bezpieczna-praca-osob-swiadczyacych-prace-w-formie-pracy-zdalnej-krok-po-kroku?keyword=kryczka%20praca%20zdalna&cm=SFIRST, 20.12.2023.
6. Kuczkowski, Ł. (2022). *Koszty pracy zdalnej*, LEX/el. <https://sip.lex.pl/#/publication/151424733/kuczkowski-lukasz-koszty-pracy-zdalnej?keyword=praca%20zdalna%20koszty&cm=STOP>, 19.12.2023.
 7. Łuczak-Tarka, J. (2023). *Wybrane zagadnienia pracy zdalnej z perspektywy ochrony danych osobowych*, LEX/el. <https://sip.lex.pl/#/publication/470208490/luczak-tarka-joanna-wybrane-zagadnienia-pracy-zdalnej-z-perspektywy-ochrony-danych-osobowych?keyword=praca%20zdalna&cm=SREST>, 20.12.2023.
 8. Marciniak, J. (2023). Nowe przepisy Kodeksu pracy. In: *Praca zdalna i hybrydowa. Aspekty organizacyjne i prawne*, Warszawa. <https://sip.lex.pl/#/monograph/369541221/9/marciniak-jaroslaw-praca-zdalna-i-hybrydowa-aspekty-organizacyjne-i-prawne?keyword=POJ%C4%98CIE%20I%20RODZAJE%20PRACY%20ZDALNEJ%20W%20%C5%9AWIETLE%20NOWELIZACJI%20KODEKSU%20PRACY%20Z%20DNIA%2001%20GRUDNIA%202022%20R.&cm=STOP>, 10.12.2023.
 9. Matyjas-Łysakowska, P., Maroń, A. (2022). Praca zdalna w administracji samorządu terytorialnego – rozwiązanie na czas kryzysu czy nowy standard? *Roczniki Administracji i Prawa*, 3(XXII), pp. 375-389.
 10. Mędrala, M. (2023b). *Praca zdalna. Komentarz do nowelizacji Kodeksu pracy, art. 67(18)*. Warszawa, <https://sip.lex.pl/#/commentary/587936107/733547?keyword=POJ%C4%98CIE%20I%20RODZAJE%20PRACY%20ZDALNEJ%20W%20%C5%9AWIETLE%20NOWELIZACJI%20KODEKSU%20PRACY%20Z%20DNIA%2001%20GRUDNIA%202022%20R.&toHit=1&cm=SFIRST>, 21.12.2023.
 11. Mędrala, M. (2023a). *Praca zdalna Kontrola trzeźwości pracowników Wzory Przewodnik po nowych przepisach Kodeksu pracy*. Wolters Kluwer.
 12. Mitrus, L. (2023). Pojęcie i rodzaje pracy zdalnej w świetle nowelizacji kodeksu pracy z dnia 1 grudnia 2022 r. *Praca i Zabezpieczenie Społeczne*, 11, pp. 40-48.
 13. Moras-Olaś, K. (2022). Okazjonalna praca zdalna - problemy z liczeniem okresu okazjonalnej pracy zdalnej pracowników zatrudnionych w niepełnym wymiarze i w trakcie roku kalendarzowego na tle projektu nowelizacji kodeksu pracy. *Praca i Zabezpieczenia Społeczne*, 8, pp. 26-31.
 14. Postanowienie NSA z 5.04.2022 r., I OW 197/21, LEX nr 3338645. <https://sip.lex.pl/#/jurisprudence/523432341/1/i-ow-197-21-pojecie-sporu-kompetencyjnego-pojecie-zamiaru-stalego-pobytu-postanowienie-naczelnego...?keyword=Postanowienie%20Naczelnego%20S%C4%85du%20Administracyjnego%20z%20dnia%2005%20kwietnia%202022%20r.,%20I%20OW%20197%2F21&cm=SFIRST>, 27.12.2023.
 15. Prusik, A. (2023). *Praca zdalna. Praktyczny przewodnik po nowych przepisach*. Wolters Kluwer.

16. Sobczyk, A. (ed.) (2023). *Kodeks pracy. Komentarz*. C.H. Beck.
17. Tomaszewska, M. (2023). Element konstytutywne pracy zdalnej. *Studia z Zakresu Prawa Pracy i Polityki Społecznej*, No. 3, pp. 211-219.
18. Ustawa z 19 czerwca 2020 r. o dopłatach do oprocentowania kredytów bankowych udzielanych przedsiębiorcom dotkniętym skutkami COVID-19 oraz o uproszczonym postępowaniu o zatwierdzenie układu w związku z wystąpieniem COVID-19. Dz.U. 2020 poz. 1086 (2020).
19. Ustawa z dnia 2 marca 2020 r. o szczególnych rozwiązaniach związanych z zapobieganiem, przeciwdziałaniem i zwalczaniem COVID-19, innych chorób zakaźnych oraz wywołanych nimi sytuacji kryzysowych. Dz.U. 2020 poz. 1842 (2020).
20. Ustawa z dnia 23 kwietnia 1964 roku – Kodeks cywilny. Dz.U. 2023, poz. 1610 t.j. (2023).
21. Ustawa z dnia 24 sierpnia 2007 r. o zmianie ustawy — Kodeks pracy oraz niektórych innych ustaw. Dz.U. 2007 nr 181, poz. 1288 (2007).
22. Ustawa z dnia 26 czerwca 1974 r. Kodeks pracy. Dz.U. 2023 poz. 1465 t.j. (2023).
23. Ustawa z dnia 6 sierpnia 2010 roku o dowodach osobistych. Dz.U. 2022, poz. 671 t.j. (2022).
24. Ustawa z dnia 4 listopada 2016 r. o wsparciu kobiet w ciąży i rodzin “Za życiem”. Dz.U. z 2020 r., poz. 1329 z późn. zm. (2020).
25. *Uzasadnienie do rządowego projektu ustawy o zmianie ustawy - Kodeks pracy oraz niektórych innych ustaw* (2022). <https://www.sejm.gov.pl/sejm9.nsf/druk.xsp?nr=2335>, 20.12.2023.
26. Walczak, K. (ed.) (2023). *Kodeks pracy. Komentarz*. C.H. Beck.
27. Ziółkowska, K. (2023). Praca zdalna po zmianach w Kodeksie pracy. *Radca Prawny*, No. 2, pp. 55-72.

SUSTAINABLE MARKETING IN THEORY AND PRACTICE. RESEARCH RESULTS

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Purpose: Obtaining information (as a result of reviewing available studies and qualitative own research) on sustainable marketing in Poland, with an emphasis on specified research issues, practices in different economic sectors under the brands' emblems, and taking into account the developed tool kit of activities in this area.

Methodology: Research of secondary information sources, online studies, multiple case studies of brands from selected economic sectors focused on the tool kit of methodological actions for sustainable marketing, and participant observation in their chosen initiatives with an analysis and diagnosis of the multifaceted benefits for all involved parties, the environment, land resources and the economy.

Findings: A tool kit dedicated to sustainable marketing. Diagnosis of the state of sustainable marketing development in Poland. Presentation of identified examples of tool applications by brands from various economic sectors.

Research limitations: The article is based on literature research and qualitative studies using multiple case studies, participant observation and online research. It is worth analyzing the research problem on a larger number of brands. A survey of the opinions of brand community representatives is planned to obtain information on the reception of individual campaigns.

Practical implications: The original author's list of sustainable marketing instruments expands knowledge in the field of management and quality sciences and has practical applications. Diagnosing the state of sustainable marketing in Poland provides a basis for improving activities in this area and has enabled the formulation of recommendations for those interested in this marketing concept.

Social implications: The research has shown that sustainable marketing activities have an impact on customer behaviours, their experiences, attitudes, engagement and changes in the methods of acquisition and consumption of products, market behaviours, practices of marketers, and as a result, on the entire society and the natural environment.

Value: This is the first study of its kind (at least in the Polish market) that addresses the state of sustainable marketing, including examples of the application of its tools, considering the established set of instruments, as well as recommendations for marketers and the resulting practical implications (social, economic, environmental, business and managerial).

Keywords: sustainable marketing, sustainable brand strategy, tool kit of sustainable marketing actions, sustainable practices in selected sectors in Poland, recommendations for marketers.

Category of the paper: research paper.

1. Introduction

In professional literature and business practice, new marketing concepts continuously emerge, such as partnership marketing, value marketing, internet marketing, sustainable marketing, etc. This reflects the activity of entrepreneurs seeking optimal marketing actions tailored to the specifics of modern organisations and the conditions (Wolniak, Grebski, 2023; Robertson, 2021) under which they operate.

Respecting specific conditions plays an important role in effective management in the current market environment (McPhee, Dias, 2020; Lubin, 2022; Brzustkiewicz, 2023; Chojan, 2023; Florczak, 2023): strong competition among players; specific customer expectations; progress in technology and technical advancements, the development of resources and internet network functionalities; strong trends related to sustainable development and management, social responsibility, and concern for social issues. Finally, in managing modern organisations, modern management paradigms must be taken into account, such as (Tarczydło, 2010; Tarczydło, 2016b): the personalised brand paradigm with which the customer engages; actions considering stakeholders and their participation; the perspective of the organisation's broad objectives (economic and non-economic), methods of their realisation and result metrics; process approach; continuous improvement and resource optimization.

This raises the question of what role sustainable marketing plays in management practices, how it fits into current conditions, trends, and the respect for paradigms. Therefore, it is necessary to explore its essence and place in contemporary marketing activities and in the management of market entities. The objective of this study is to bring closer the position and role of sustainable marketing in the management of modern organisations. Starting with the definition, its assumptions and forms of application (tool kit) will be discussed. Taking into account the conditions for managing modern organisations, a procedure for designing and implementing effective sustainable marketing initiatives/strategies will be indicated. The Polish market will be examined from the perspective of interest in and utilisation of sustainable marketing by market players (whether, since when and to what extent it is used, the reasons behind it, who employs it, how it is presented in theory, how information about the studied phenomenon is disseminated, what industry events actually take place, who is affected, what results can be expected, and whether research on the effectiveness of the considered actions is conducted). The publication will present the findings of qualitative research on the status and applications of sustainable marketing in the Polish market.

This study represents the first of its kind conducted in the Polish market, focusing on the analysis of sustainable marketing practices. Moreover, this is the first comprehensive analysis that not only allowed us to propose a list of tools dedicated to sustainable marketing, but also presents examples of their practical use. Furthermore, the study includes recommendations for marketers regarding the effective utilization of these tools and discusses practical implications,

such as potential social, economic, environmental, commercial, and managerial consequences. This distinctive perspective sets this study apart from other analyses of sustainable marketing in the Polish market.

2. Literature review

The beginnings of sustainable marketing worldwide trace back to the 1970s (Tkocz, 2016). Several decades of practice mean many applications, but also interpretations of the concept under consideration. Many authors (Pabian, 2012; Keller, 2013; Rudawska, 2013; Niedzielska, 2014; Zajkowska, 2015; Ind, Horlings, 2016; Ostrowska, 2016; Tkocz, 2016; Zaremba-Warnke, 2016; Foroudi, Palazzo, 2021; Hansen, 2021; Larsen, 2023; Tarczydło et al., 2023) consider that we are dealing with sustainable marketing when entrepreneurs and societal actors implement marketing techniques wanting to achieve desirable sustainable goals. On the other hand, authors emphasise that sustainable marketing should be associated with at least changing behaviour for the good of the (Schmitt, 2011; Tarczydło, 2014; Clatworthy, 2022; Marczak, 2022; Ghaffar et al., 2023; Gong et al., 2023) individual, society, the environment and the economy.

Sustainable marketing involves marketing tools, methods and procedures that respect the principles of sustainable development, the 2030 Agenda (United Nations, 2023) and ESG (Egorova et al., 2022; Kamiński, 2022; Chojan, 2023) relating to the development of products, pricing, sales methods and marketing communication in such a way that satisfies and meets the needs of customers and other stakeholders, enables the realisation of company goals, and ensures the compatibility of these processes with the ecosystem (Zajkowska, 2015; Randle, Eyre, 2023). Within this concept, companies strive to achieve objectives centred around three aspects: ecological, social and economic. Sustainable marketing calls for more balanced actions from both entrepreneurs and other market participants (Zaremba-Warnke, 2016; Brzustewicz, 2023). It is a multi-dimensional concept and, in Polish social and economic reality, it is still little known but widely used in business practice, including marketing activities (Rudawska, 2013).

Current sustainable marketing initiatives fit very well into the concept of holistic marketing, which includes (Kotler et al., 2021): internal marketing (marketing department, management, other units); performance marketing (sales revenue, brand equity and customer capital, ethical aspect, environment, law, community); relationship marketing (customers, channels, partners); and integrated marketing (communication, goods and services, channels). This is because systematic sustainable marketing projects of organisations should involve employees and other stakeholders, be focused on achieving set goals (often related to health protection, safety, the natural environment, social issues; optimally goals of the 2030 Agenda and EU ESG

directives) and specific results, thanks to the application of integrated marketing activities towards a 360-degree strategy. Furthermore, in the process of holistic marketing management encompassing social, environmental, economic and business activities, a comprehensive set of activities addressed to the soul, mind and body of the recipient/stakeholder should be considered. This is associated with a holistic approach to human beings, who react simultaneously on all levels: psychological, physical and spiritual.

In summary, the essence of sustainable marketing is changing people's behaviours, which is achieved through thoughtful actions, most often in the form of sustainable campaigns under the brand's emblem.

Sustainable brand projects create changes in the way stakeholders think and act, and are necessary to bring positive effects on the environment and climate, in line with the principles of the circular economy, sustainable resource management, the goals of the 2030 Agenda (United Nations, 2023) and the directive ESG of the Council of the European Union, which is an important assumption of the authors' qualitative research.

The forms of sustainable marketing applications result from the use of marketing (Kotler et al., 2021) philosophy, its tools, methods and procedures, but with consideration for achieving sustainable goals. In essence, the spectrum of tools or forms of applications is unlimited and depends on the creativity (Kushwaha, 2020; Kerzner, 2022; Wolniak, 2023) of the creators, although it is likely determined by the amount of resources available. The basic form of sustainable marketing is the so-called sustainable campaign (Zajkowska, 2015; Tarczydło, 2016; Tarczydło, Miłoś, 2019; Foroudi, Palazzo, 2021; Robertson, 2021; Dziadkiewicz et al., 2022). It is assumed that this is a campaign prepared in accordance with a marketing approach, which usually aims to induce changes in social behaviours and attitudes towards a certain idea or problem, as well as to achieve environmental, resource and economic effects.

The selection of activities depends on the scale of the campaign, the target audience, the stakeholders involved, the budget and the adopted communication (Chaffey, 2017; Troian, 2023) strategy in line with current trends (e.g., when conducting campaign events, actions are typically taken on the Internet, but also meetings, events, leaflets and informational brochures, or billboards, press and radio advertisements, and others depending on the available resources and creativity), generally, integrated (Kotler et al., 2021; Tarczydło et al., 2023) marketing activities are undertaken.

The authors, through the literature review and exploration of the offerings by specialised agencies, as well as through observations of sustainable marketing practice, propose the following taxonomy of tools dedicated to marketers:

- sustainable marketing campaign;
- internet presence – information and campaigns on the website and in social media (content concerning environmental protection and sustainable programmes – engagement and education);

- cooperation and partnership with local environmental organisations, non-profit organisations or enterprises engaged in sustainable development;
- special corporate publications containing sustainable development strategies, e.g., integrated reports, materials related to campaigns being implemented;
- green certificates and labels, quality marks;
- ecological events and meetings (promote opportunities and specialist knowledge in the field of organising sustainable events and meetings, e.g., event calculator, a tool for measuring the environmental impact of events);
- involving relevant influencers and sustainable direct marketing practices;
- volunteering;
- education and engagement: workshops, training sessions, webinars, and competitions focused on sustainable behaviours and attitudes;
- thematic (pro-sustainable): advertisements, blogs, podcasts...;
- sustainable loyalty programmes (a loyalty programme that rewards guests for choosing sustainable options and participating in environmentally friendly actions);
- press releases and media coverage (press releases sent to local and industry media to announce significant milestones, initiatives or achievements in the field of sustainable development);
- diverse marketing activities focused on respecting a sustainable approach (for example, in terms of: product, distribution strategy, pricing policy, market research...).

Finally, it is worth referring to the concept of the 8Ps (marketing mix) (Kotler et al., 2021), which should be taken into account for a balanced product, properly calculated price, care for a sustainable approach throughout the supply chain and distribution strategy used, marketing communications, for example, focused on sustainable content, participations, physical evidence, process and partnership (Szytyczek, 2024).

In line with the marketing approach, the process of building a sustainable campaign should include: preliminary analysis, market segmentation and target market selection, research of target audiences (Gong et al., 2023), setting objectives, planning a sustainable marketing mix, formulating a creative strategy and campaign elements, and communication policy.

The designed programme of marketing activities within the campaign contributes to changing the behaviours of individuals, groups and the whole society through informing, addressing difficult or embarrassing topics, educating, raising awareness, explaining, engaging and publicising.

The proposed approach to developing a sustainable campaign is presented in Table 1.

Table 1.
Stages of designing a sustainable campaign

Stage	Description
Concept, idea	All actions should concern significant matters that are consistent with the goals of Agenda 2030 and the European Union's ESG Directives. It is worth defining the idea for which actions are taken, which often relate to the 5P principle (People, Planet, Prosperity, Peace, Partnership). In detail, these actions may involve changing community behaviours, enhancing safety levels, raising awareness of the consequences of reckless behaviour and negative impact on the ecosystem, protecting Earth's resources, restoring sustainable terrestrial ecosystems, promoting peace and inclusive societies, and ensuring access to justice for all people.
Potential allies/ stakeholders involved	The more partners/allies there are, the greater the possibilities (commercial companies respecting a sustainable approach, our so-called prosumer clients who want and are worth engaging, public administration offices, market entities whose activities are related to the campaign issues, celebrities, non-profit organisations, media representatives, PR agencies, local community, volunteers...).
Convincing partners to collaborate	In a specific problem situation, establishing collaboration with appropriate stakeholders (e.g., for a local issue: local media, companies operating in that market, non-profit organisations).
Message	What idea the actions will revolve around, what is to be communicated (verbally and visually), defining the so-called higher purpose (something more than making money, giving consumers a reason to choose the brand).
Refinement of campaign objectives	Depending on the scale of the initiative, the general goal must be translated into specific objectives.
Facts	Data, evidence and research findings supporting the validity of the idea should be collected.
Development of the scope of activities	The selection of actions depends on the scale of the campaign, the target audience (Smilansky, 2009; Schmitt, 2011; Tarczydło, 2014; Clatworthy, 2022; Marczak, 2022; Ghaffar et al., 2023; Gong et al., 2023), the stakeholders involved, the budget and the adopted communication strategy in line with current market trends. Integrated sustainable marketing actions are typically launched using a variety of tools and through appropriate communication channels.
Implementation and measurement of results	Schedule of implementation and methods of measuring results, checking whether sustainable objectives have been achieved. Plans for future actions, as sustainable campaigns often have a cyclical nature.

Source: Author's own compilation based on observations of sustainable campaigns 2020–2023 and Encyklopedia Zarządzania (2023). *Kampania społeczna*, https://mfiles.pl/pl/index.php/Kampania_spo%C5%82eczna, 10.12.2023.

Considering the issues outlined in the table, such an approach to developing the assumptions of a sustainable marketing campaign increases the likelihood of success.

In the available literature, one can also encounter the viewpoint that the procedure for sustainable marketing strategy should encompass (Quoquab et al., 2020; Randle, Eyre, 2023): 1) situation analysis (studying the market environment, competition, trends, legal regulations, company's resources and capabilities, identifying the target group and preferences, needs, motivations and barriers related to sustainable consumption) (Wilk, 2015); 2) defining objectives and assumptions of the strategy (formulating clear and measurable goals of sustainable marketing that align with the company's mission and vision, as well as the principles of sustainable development; ideas on how to implement them); 3) selection and development of marketing tools (choosing and designing the appropriate marketing-mix elements, considering the ecological, social and economic aspects of the company's offering,

as well as methods of presentation and communication; designing campaigns, actions and marketing communication initiatives) (Wilk, 2014) and 4) implementation, control and conclusions for the future (carrying out planned sustainable marketing activities, monitoring their progress and outcomes, and making necessary corrections and adjustments; evaluating the degree of sustainable objectives achievement, as well as the impact of marketing activities on customer satisfaction and loyalty, company reputation and image (Keller, 2013; Tarczydło, 2018; Brand projects, 2023; Goodson et al., 2023), and the natural and social environment and expectations of other stakeholders).

Summarising the above considerations, it can be stated that the range of forms of sustainable marketing, or its conceptual tools, is very rich. It should be emphasised that the effectiveness of sustainable marketing initiatives, including sustainable campaigns, is determined not only by the spectrum of activities but also by a methodical approach to their design and implementation; the described marketing approach seems to be optimal.

3. Methodology of own research and its scope

The identified research gap concerns the scope and methodological conditions of sustainable marketing activities, its tools and examples of applications in various economic sectors in the Polish market. The research problem addressed: how an entrepreneur can and should use the tools, methods and procedures of sustainable marketing to generate multifaceted benefits for all stakeholders.

Seeking answers to the question of the role sustainable marketing play in managing modern organisations in Poland, a review of the literature was conducted, as well as an analysis of secondary sources of information (both traditional and online), available research reports, case studies (Yin, 2012; Budzanowska-Drzewiecka, 2022) from the portfolios of agencies providing such services, materials from Effie Awards and Spinacze competitions, reports from industry events, and available video materials and webinars. These efforts were aimed at gathering information and addressing research issues regarding the state of sustainable marketing in the Polish market.

Multiple case studies of selected brands (Brand project, 2023; Tarczydło et al., 2023) from different economic sectors (table 3) were also conducted, focused on the implementation of sustainable marketing strategies under their emblem, including the utilisation of tools considering the tool kit for sustainable marketing actions developed by the authors. It has enabled the identification of the advantages and disadvantages of this marketing concept, the social and economic impact of methodological sustainable marketing activities, and the development of recommendations for interested marketers.

Substantive scope – selected brands and members of their communities, experts responsible for such practices, representatives of specialised agencies; objective scope – sustainable marketing activities in various economic sectors; temporal scope – from October 2023 to January 2024; spatial scope – online and offline.

4. Sustainable marketing in the management of modern organisations – research findings from the Polish market

The research (Kuciński, 2014; Wolniak, Grebski, 2023; Czakon, 2024) assumed that various concepts, methods and management models (including sustainable marketing) may be useful for contemporary managers, provided that before the person managing the organisation reaches for them, the contextual situation of the organisation's functioning, its specificity, and market conditions are taken into account. The authors define effective management of a contemporary organisation as a management approach that should allow for sustainability and development, creativity, responding to market signals, and creating appropriate value for staff, customers and all involved entities (stakeholders).

The identified research problems and the generalised research findings are compiled in Table 2.

Table 2.
Sustainable marketing in Poland

Research problems related to sustainable marketing	Explanatory description and obtained results
Is sustainable marketing practised in Poland and since when?	There is no clear stance on this issue, but it is certain that for at least several years, systematic sustainable campaigns that stem from corporate social responsibility (Tarczydło, 2010; Kamiński, 2022; Chojan, 2023; Florczak, 2023) initiatives have been carried out in Poland. The development of these practices has intensified recently and is driven by climate changes, social issues, management trends and legal regulations resulting from state policies as well as the need to respect the 2030 Agenda and the EU ESG Directives.
To what extent and scope?	The most common manifestation of sustainable marketing includes sustainable campaigns using integrated marketing communication, in line with trends, and also having strategies for sustainable operations, special sections on website services, informing in a thoughtful manner about such practices e.g., in integrated reports, using various tools dedicated to this marketing concept.
What explains this trend?	Current market trends, increasing awareness of market players, needs to care for sustainable goals (economic, social, environmental, educational, etc.) focused on measurable outcomes and changing business practices, including marketing practices and the behaviours of market players.
Who is practising it?	Commercial enterprises, brands, non-profit organisations, foundations, associations, specialist agencies, experts in sustainable marketing, all market players, special partner groups, etc.

Cont. table 2.

How is sustainable marketing presented in Polish literature?	The presentation is ambiguous. On one hand, there is an increasing number of studies (Pabian, 2012; Rudawska, 2013; Niedzielska, 2014; Zajkowska, 2015; Ostrowska, 2016; Tkocz, 2016; Zaremba-Warnke, 2016), while on the other, there is considerable confusion regarding the essence, tools and implementation strategies. As a result of the conducted literature review, the authors believe that there is a significant need to systematise knowledge in this field, which is of scientific importance and has high empirical values.
How is information disseminated?	In line with market trends, there is growing interest among market players [practically every decent brand has a sustainable brand strategy (Keller, 2013; Ind, Horlings, 2016; Wan et al., 2016; Foroudi, Palazzo, 2021; Hansen, 2021; Larsen, 2023; Tarczydło et al., 2023)], more implementation projects are on the rise, and during sustainable marketing campaigns, information is spread through industry portals, available media, by interested offerors, through deliberate amplification, and 360-degree communication in favour of the implemented campaign.
What industry events actually take place?	Activity for sustainable purposes is such an important issue that various industry organisations have been established and operate on the Polish market – such as Fundacja Wspierania Zrównoważonego Rozwoju (Foundation for Supporting Sustainable Development), the Polish ESG Association or individual agencies providing services in this area, such as: Fabryka Komunikacji Społecznej (Social Communication Factory), or public relations agencies taking appropriate measures within a wide range of projects. An increasing number of industry events focus on sustainable marketing activities, including the “Sustainable Economy Summit” and the “Green Industry Summit” organised by the Executive Club.
Who is impacted by sustainable marketing efforts?	Depending on the scope of the actions, the recipients of the initiatives, brand stakeholders (Hillebrand et al., 2015; Kotarbiński, 2021; Freeman, 2022; Targiel, 2022) for whom sustainable marketing activities are conducted and all stakeholders.
What results can be expected?	Changes in behaviours, attitudes, and broad environmental, social, economic, business and management benefits. Improved living conditions for future generations. Greater responsibility and commitment from market players.
Is research on the effectiveness of sustainable marketing initiatives conducted?	Yes, though it is limited due to the difficulty of its unequivocal verification. More and more often, research is conducted after the implementation of a programme or campaign (what they have yielded, the effect they have caused, how they are perceived and assessed, who and how they have engaged, what specifically was achieved, e.g., how much used clothing was collected, how much less plastic was used for packaging...). For example, during industry competitions for the best campaign, such as the Effie Awards Special Categories: ESG Influence [https://awards.effie.pl/kategorie/ , 2022] or Positive Change: Environmental, Governance, Social [https://awards.effie.pl/kategorie/#cat-4859 , 2024], the best campaigns in various thematic areas are selected by experts. Finally, in line with technological progress, if for instance an online platform dedicated to sustainable marketing is launched, it is possible to measure various quantitative and qualitative results, e.g., concerning communities, the number of engaged individuals, types of comments, content sharing, ways of engaging, frequency of use, preferred content formats, and other characteristics derived from so-called online user traces.

Source: Own development based on conducted research.

Approximate characteristics of sustainable marketing from the Polish market inspire the presentation of selected results from a multiple case study of brands representing diversified sectors of the economy and the sustainable marketing activities carried out under their emblems.

Table 3.*Examples of sustainable marketing activities of studied brands*

Tool kit of sustainable marketing actions	Research objects/ sector/product	Characteristics of selected sustainable marketing practices of the brand
<p>Online presence, special tabs and/or platforms dedicated to the sustainability strategy and communication on social media. Reliable information about ongoing sustainable campaigns, the brand's sustainable strategy, a multitude of content focused on the goals of Agenda 2030 and the EU ESG directives, known as branded content (specialised information, reports, video materials, commentaries, research results, campaigns, projects, achievements...) as well as social media communication appropriate to current conditions (including content on environmental protection and sustainable programmes, stakeholder engagement, education, creating sustainable behaviours and attitudes)</p>	<p>Unilever Polska (an international conglomerate managing a portfolio of approx. 400 brands; food products, cleaning and hygiene products; repeatedly recognised by experts (GlobeScan SustainAbility Leaders Survey) for showing the greatest commitment to integrating sustainable development into their business strategies. Brands that are particularly present and active in Poland: Amino, Algida, Knorr, Lipton, Rama and Slim Fast; among cleaning products: Cif, Coccolino, Domestos, Surf; body care cosmetics: Axe, Dove, Clear, Signal, Timotei, Vaseline</p>	<p>On the website, there is a special tab "planet and society," which leads to content about the sustainable Kompas campaign. Unilever focuses on improving the condition of our planet and people, particularly in terms of health, confidence and well-being, as well as on creating a fairer and more socially integrated world.</p> <p>Both for the corporation and individual brands, methodical actions of sustainable marketing are professionally promoted online. For example, campaigns like Dove Detox Feed, Dove Self-Esteem, Algida "Odpowiedzialnie z myślą o dzieciach" (Responsibly for children), Cif "Cif, Witaj Piękno!" (Welcome Beauty!) and "Cif. Witaj, piękna Polsko!" (Welcome, beautiful Poland!), Domestos "Czysty spokój" (Clean Peace).</p>
<p>Collaboration and partnership with local environmental protection organisations, non-profits or companies involved in sustainable development</p>	<p>Carrefour Polska and Caritas Polska Trade and third sector organisations – non-profit</p>	<p>Carrefour Polska is committed to the implementation of numerous projects, which include charitable food, medical and school supply collections, as well as expanding cooperation in the fight against food waste and the opportunity for Caritas Polska to collect it nationwide.</p>
<p>Special corporate publications containing sustainable development strategies, such as integrated reports, materials related to implemented campaigns</p>	<p>ING Bank Śląski Banking and loans</p>	<p>The Culture Book 2022 "siła harmonii" (The Power of Harmony) is dedicated to the theme of ESG, providing numerous examples of sustainable actions that ING is undertaking along with its employees.</p>
<p>Green certifications and labels, quality marks</p>	<p>Nivea product line by Beiersdorf AG Cleaning and hygiene products</p>	<p>Nivea ensures that the palm oil it uses in the production of its cosmetics comes from responsible farming practices that do not contribute to deforestation. As such, it is a member of the Roundtable on Sustainable Palm Oil (RSPO) organisation, sourcing raw materials that have the appropriate certifications.</p>
<p>Ecological events and meetings (promoting opportunities and specialist knowledge in the field of organising sustainable events and meetings, e.g., event calculator, a tool for measuring the environmental impact of events)</p>	<p>BNP Paribas Bank Polska S.A. Banking and loans</p>	<p>The BNP Paribas Green Film Festival is an 8-day showcase of competition films in several open-air cinemas in Krakow. On the Vistula Boulevards, there is what is known as Festival Town, where discussion panels with creators and experts are organised, as well as ecological and film workshops. The event supports filmmakers and is a combination of art and ecological education.</p>

Cont. table 3.

Involving relevant influencers and sustainable direct marketing practices	Rossmann Cleaning and hygiene products	The “Czujesz Klimat?” (Do You Feel the Climate?) campaign, in collaboration with Natalia Szroeder – a Polish vocalist, promotes her eco-friendly actions and values through a commercial spot and posts on her Instagram profile, encouraging her audience to adopt them as well.
Volunteering	Santander Banking and loans	Employee volunteerism benefits both the workers and society at large. Volunteer efforts are focused on supporting education and scientific development, advocating equal opportunities, and building a civic society.
Education and engagement: workshops, training sessions, webinars, and competitions focused on sustainable behaviours and attitudes	Zalando Clothing textiles	Zalando offers multiple tips on their website to care for clothes and footwear, to minimise frequent wardrobe changes that contribute to environmental pollution – a series of tips "W jaki sposób..." (How to...), e.g. "W jaki sposób... Przedłużyć trwałość ubrań planując pranie" (How to... Extend the durability of clothes by planning washing).
	Ferrero Rocher Food products	Ferrero Rocher has undertaken the education of farmers, as well as supporting local communities in the areas where it sources ingredients for its products.
	Dekra Supervision, advisory services and business support	Dekra conducts training for entrepreneurs and companies that want to learn how to grow their business with respect for the natural environment, communities and standards.
Thematic (pro-sustainable) blogs	InPost Courier services/ Transportation	Publishing educational and informational sustainable blog posts related to environmental protection ("InPost dla środowiska") (InPost for the environment), as well as about athletes' achievements – values that are promoted by the brand ("InPost Sport Team").
Thematic (pro-sustainable) podcasts	Selena FM S.A Building material prefabricates	Creating a series of podcasts on Spotify dedicated to sustainable development ("Zrównoważony rozwój w Grupie Selena") (Sustainable development in the Selena Group), discussing topics significant to the industry the service operates in ("Selena Experience. Budowanie przyszłości") (Selena Experience. Building the future).
Sustainable loyalty programmes (a loyalty programme that rewards guests for choosing sustainable options and participating in environmentally friendly actions)	Delikatesy Centrum oraz Kasztelan Trade and food products	The “Naturze się należy” (Nature Deserves It) programme encouraged customers to support glass container recycling by returning them to the Delikatesy Centrum store network. During the campaign, consumers received gifts.
Press releases and media coverage (press releases sent to local and industry media to announce significant milestones, initiatives or achievements in the field of sustainable development)	CCC S.A. Clothing textiles	The “Komunikaty prasowe” (Press Releases) tab on the website is used for distributing press releases, including those concerning sustainable development, e.g. "Grupa CCC z oceną „AA” w ratingu MSCI ESG" ("CCC Group with an 'AA' rating in the MSCI ESG rating).

Source: Own development based on conducted research.

The branded sustainable marketing projects indicated in the table seem to be a good example to follow by other market players, with emphasis on their social and business significance. This includes building the brand capital in the current market conditions, in line with the principles of sustainability and the 2030 Agenda, which describes a vision of the world respecting the 5P principle (People, Planet, Prosperity, Peace, Partnership) and 17 Sustainable Development Goals. The indicated examples of the use of various sustainable marketing tools expand the reader's knowledge, skills and competences. They can be used to determine how to adapt particular tools in different sectors and how many benefits can be achieved (environmental, social, economic and managerial).

The research conducted leads to the conclusion that sustainable marketing is gaining increasing popularity in Poland and is being appreciated by both commercial and non-commercial organisations' management. Initiatives from the analysed area fit very well into the current market conditions. Significant practices of sustainable marketing include: sustainable social responsibility, including support for charitable organisations, educational initiatives, human rights, equality and diversity (e.g., ING Bank Śląski); pro-ecological offerings of products and services that are environmentally friendly; reusable packaging, recycled products, energy-efficient appliances, car-sharing services, or support for initiatives aimed at reducing the carbon footprint (e.g., CCC S.A.) and protecting the personal data of consumers (e.g., InPost).

The research has confirmed that modern organisations should engage in sustainable initiatives for the benefit of involved stakeholders and the community at large, Earth's resources and their rational use, combating the effects of climate change, and in all areas outlined by the Agenda 2030 and the EU ESG directives.

5. Conclusions and recommendations

As a result of the deliberations and research, the main determinants of managing modern organisations and the need for sustainable marketing have been identified as: intensifying climate change, a multitude of global-scale problems – social inequalities, wars, epidemics, hunger, crime, but also the development of information technology, digitisation, trends related to social responsibility, sustainable development and resource management, as well as the expectations of consumers who are increasingly willing to use sustainable products and are interested in projects and initiatives in sustainable marketing.

The need to adapt managerial actions, including marketing, to current market conditions means that sustainable marketing initiatives, including sustainable campaigns, play an increasingly important role in the effective management of modern organisations.

This also leads to the promotion, under the brands' emblems and with the commitment of its stakeholders, of a sustainable approach to resource management and the undertaking of projects that are consistent with the goals of the 2030 Agenda and the recommendations of the ESG directive.

Sustainable marketing is increasingly used by both commercial and non-commercial organisations. Many sustainable projects and campaigns are implemented in various areas stemming from the Agenda 2030 and the ESG European Union Directives.

In summary, sustainable marketing plays a particular role in managing modern organisations in relation to the concept of a sustainable organisation, which assumes the organisation's commitment to achieving a competitive advantage through strategic adaptation and development of ecological and social processes, supporting the production of ecological and social products and services, and innovative practices in human resource management.

Implementing a sustainable marketing strategy may appear easy in theory. In practice, it requires the work and commitment of many people, both from the agency and the interested party, dedicating countless hours to the creation of its principles and the development of an implementation programme.

It is essential to remember that sustainable marketing campaigns should not only stem from the objectives of the 2030 Agenda and the EU ESG Directives but should primarily consider strategic insights, the brand's concept, keep up with trends, surprise positively and consistently engage stakeholders in the cause. Measuring the effectiveness of actions in environmental, social, economic and commercial aspects is crucial.

In light of our research, the main advantages of sustainable marketing and its resulting benefits include: changing behaviours and attitudes towards managing the Earth's resources; contributing to environmental protection, countering the progression of climate change; achieving the goals of the 2030 Agenda and the EU ESG Directives; increasing brand recognition and improving its image; cutting costs and enhancing company efficiency; better compliance with legal requirements; increasing effectiveness in acquiring customers and partners who expect sustainable practices from marketers; investing in innovations (e.g., biodegradable packaging), quality and diversity of the offer, as well as in the communication and education of stakeholders.

On the other hand, the following can be considered drawbacks to the concept: higher financial, time and organisational investments, as the company must adapt its offerings, processes and communication to the demands of sustainable development (research and development, certification and quality control, education and stakeholder engagement); the risk of a disconnect between the company's declared actions and its actual ones in terms of environmental and social efforts (the company must be credible and transparent); greenwashing – a loss of customer trust and loyalty, exposure to criticism and a tarnished image due to excessive or false emphasis on the company's eco-friendliness or social responsibility; limited

demand from consumers, who are often not ready to change their habits and preferences in favour of sustainable consumption.

In summary, the authors believe that sustainable marketing in the academic dimension is a particularly important field within management and quality sciences, and in the practical dimension, it constitutes a set of comprehensive tools (as proposed in their approach), methodical actions taking into account the specifics of selected economic sectors, and recommendations for marketers. Sustainable marketing campaigns are particularly desirable in current market conditions, offering numerous environmental, social, economic and management benefits, and generating value for the stakeholders involved.

The authors wish to emphasise that in sustainable marketing projects, new technologies such as the use of AI, chatbots, AR and VR, are particularly useful. It is also essential to involve stakeholders in projects under the emblem of brands. It seems essential to personalise actions and skilfully link them to the brand's values and history, its sustainable strategy, as well as keeping up with trends and seizing emerging opportunities. Success may be determined by skilfully managed marketing communication campaigns involving influencers, the use of video formats, leveraging online communication, and surprising and creative initiatives.

For marketers interested in implementing sustainable marketing, the authors propose the following recommendations:

All projects in this area should address significant issues consistent with the goals of the 2030 Agenda, EU ESG Directives, and the brand values under which they are implemented.

Marketers should start by researching their target market to understand who their customers are – what is important to them, what they are interested in, and how to engage them. Those responsible for designing sustainable strategy/campaigns should consider defining a brand purpose that goes beyond traditional financial metrics. This is a fundamental step that enables a company to understand the context of its operations and determine the values it wants to convey to stakeholders.

When designing sustainable marketing strategies for brands, it is worth considering the following stages: analysis of the initial situation, defining objectives and assumptions, selection and development of marketing tools and their implementation, control, and conclusions for the future.

The optimal solution is integrated activities in this area using a systematized and extended range of activities. The key ones include campaigns, actions, and projects of sustainable marketing, along with supporting online communication considering the progress and development of social media functionalities and special platforms dedicated to campaigns/projects.

The authors consider the sustainable marketing actions of the Unilever group and its affiliated brands exemplary and worth emulating, regardless of the sector in which one wishes to conduct sustainable marketing. It is also valuable to observe award-winning campaigns from

competitions such as Spinners and Effie Awards (especially special categories: ESG Influence or Positive change: Environmental, Governance, Social).

Marketers should pay particular attention to marketing communication supporting their sustainable marketing projects, including involvement of industry journalists.

Sustainable marketing projects are worth implementing with partners (they are more credible and result in synergy), with the participation of appropriately selected influencers, and with the involvement of customers, internet users, and other interested stakeholders.

It is worthwhile to use technological advancements and apply AI, chatbots, AR, VR, and personalized actions in projects undertaken.

The authors recommend measuring the effectiveness of implemented sustainable marketing campaigns, including the growth of the brand's community, environmental effects, shaping behaviors and attitudes of participants, achieving goals, and increasing brand recognition and improving its image, which contributes to innovation for future actions.

The research issue undertaken is worth analysing across a larger number of brands representing the considered economic sectors, and perhaps even increasing the number of sectors taken into account. Furthermore, the upcoming project also plans to conduct opinion research among representatives of the communities of the analysed brands and its key stakeholders in order to obtain information on the perception of sustainable marketing practices and individual campaigns.

Systematized sustainable marketing issues and particularly expanded action instruments broaden knowledge in the field of management and quality sciences. Meanwhile, specific brand projects in this area generate many benefits for the planet, its resources, people, and the conditions in which current generations and future generations will live.

References

1. Brand projects supporting circular economy on the base of clothing sector. A case study of 4F Change and other research results (2023). In: D. Lewicka, J. Zarębska, R. Batko, B. Tarczydło, M. Woźniak, D. Cichoń, M. Pec (2023). *Circular Economy in the European Union: Organisational Practice and Future Directions in Germany, Poland and Spain* (pp. 130-150). New York: Routledge.
2. Brzustewicz, P. (2023). Incorporating sustainable marketing in the new product development process: evidence from companies operating in Poland. *Qeios*, pp. 1-13, DOI:10.32388/51voi0.
3. Budzanowska-Drzewiecka, M. (2022). Studiowanie przypadków – metodyka postępowania badawczego. In: J.M. Bugaj, M. Budzanowska-Drzewiecka M. (Eds.), *Jakość kształcenia akademickiego* (pp. 63-84). Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.

4. Campbell, A. (2020). *Agile: Essentials of Team and Project Management*. Manifesto for Agile Software Development. London: Wiley.
5. Chaffey, D., Smith, P.R. (2017), *Digital marketing excellence: planning, optimizing and integrating online marketing*. New York: Routledge.
6. Chojan, A. (2023). Założenia polityki Unii Europejskiej wobec zrównoważonego rozwoju. In: E. Florczak (Ed.), *Zrównoważony rozwój jako trend kształtujący współczesną gospodarkę* (pp. 3-12). Warszawa: C.H. Beck.
7. Clatworthy, S. (2022). *Doświadczenia klientów: od idei firmy do zachwyty konsumenta*, Warszawa: ICAN Institute.
8. Czakon, W. (Ed.) (2024). *Podstawy metodologii badań w naukach o zarządzaniu*. Warszawa: Wydawnictwo Nieoczywiste.
9. Dziadkiewicz, A., Sokołowska, E., Jerzemowska, M. (2022). Stakeholders identification as a determinant of sustainable project management. *Scientific Paper of Silesian University of Technology, Organization and Management Series, Vol. 156, No. 10*, pp. 141-155, doi: 10.29119/1641-3466.2022.156.10.
10. Effie Awards (2024). *Positive change: Environmental, Governance, Social*, <https://awards.effie.pl/kategorie/#cat-4859>.
11. Egorova, A.A., Grishunin, S.V., Karminsky, A.M. (2022). The Impact of ESG factors on the performance of Information Technology Companies. *Procedia Computer Science, No. 199*, pp. 339–345.
12. Encyklopedia Zarządzania (2023). *Kampania społeczna*, https://mfiles.pl/pl/index.php/Kampania_spo%C5%82eczna, 10.12.2023.
13. Florczak, E. (Ed.) (2023). *Zrównoważony rozwój jako trend kształtujący współczesną gospodarkę*. Warszawa: CH Beck.
14. Foroudi, P., Palazzo, M. (2021). *Sustainable Branding: Ethical, Social and Environmental Cases and Perspectives*. New York: Routledge.
15. Freeman, R.E. (2022). My Own Book Review. Strategic Management: A Stakeholder Approach. *Journal Management, Vol. 25, No. 1*, pp. 67-69. Retrieved from: <https://www.cairn-int.info/journal-management-2022-1-page-67.htm>, 17.07.2023.
16. Ghaffar, A., Zaidi, S.S.Z., Islam, T. (2023). An investigation of sustainable consumption behavior: the influence of environmental concern and trust in sustainable producers on consumer xenocentrism. *Management of Environmental Quality: An International Journal, 34(3)*, 1–23. DOI 10.1108/MEQ-05-2022-0153.
17. Gong, Y., Xiao, J., Tang, X., Li, J. (2023). How sustainable marketing influences the customer engagement and sustainable purchase intention? The moderating role of corporate social responsibility. *Frontiers in Psychology, Vol. 14*, doi: 10.3389/fpsyg.2023.1128686.
18. Goodson, S., Walker, C. (2021). *Activate Brand Purpose: How to Harness the Power of Movements to Transform Your Company*. London: Kogan Page Publishers.

19. Hansen, H. (2021). *Brand Management in a Co-Creation Perspective: Communication as Constitutive of Brands*. New York: Routledge.
20. Hillebrand, B., Driessen, P.H., Koll, O. (2015). Stakeholder marketing: theoretical foundations and required capabilities. *Journal of the Academy of Marketing Science*, Vol. 43, Iss. 4, pp. 411–428, doi: 10.1007/s11747-015-0424-y.
21. Ind, N., Horlings, S. (2016), *Brands with a conscience: how to build a successful and responsible brand*. New York: Kogan Page Publishers.
22. Kamiński, R. (2022). *Zrównoważony rozwój przedsiębiorstw jako przedmiot raportowania niefinansowego*. Warszawa: PWE.
23. Keller, K.L. (2013). *Strategic brand management. Building, measuring and managing brand equity*. New York: Pearson Education Limited.
24. Kerzner, H. (2022). *Innovation Project Management: Methods, Case Studies and Tools for Managing Innovation Projects*. Toronto: Wiley.
25. Kotarbiński, J. (2021). *Marka 5.0. Człowiek i technologie: jak tworzą nowe wartości?* Warszawa: PWN.
26. Kotler, Ph., Kartajaya, H., Setiawan, I. (2021). *Marketing 5.0. Technology for Humanity*. Hoboken: Wiley.
27. Kuciński, K. (Ed.) (2014). *Naukowe badanie zjawisk gospodarczych. Perspektywa metodologiczna*. Warszawa: Oficyna a Wolters Kluwer business.
28. Kushwaha, B.P. (2020), Integrating employees, customers and technology to build an effective sustainable marketing strategy. *International Journal of Sustainable Society*, Vol. 14, No. 4, pp. 310-322, <https://doi.org/10.1504/IJSSOC.2022.127985>.
29. Larsen, F. (2023). *Sustainable Energy Branding: Helping to Save the Planet*. London: Routledge.
30. Lubin, L. (2022). *How to Build Your Brand: Implementing a Proven and Effective Process*. Toronto: Wiley.
31. Marczak, Ł. (2022). Storytelling i social selling jako metody grywalizacji andragogicznej podnoszącej wartość zrównoważonego rozwoju. *Przedsiębiorczość – Edukacja*, No. 18(2), pp. 119-131, DOI: 10.24917/20833296.182.7.
32. McPhee, W., Dias, S.M. (2020). *Integrating Sustainability In Major Projects: Best Practices and Tools for Project Teams*. New York: Routledge.
33. Niedzielska, A. (2014). Marketing w świetle zrównoważonego rozwoju przedsiębiorstw. *Marketing i Rynek*, No. 11(CD), pp. 213-219. <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.ekon-element-000171303527>.
34. Ostrowska, I. (2016). Koncepcja marketingu zrównoważonego. In: G. Rosa, J. Perenc, I. Ostrowska (Eds.), *Marketing przyszłości: od ujęcia tradycyjnego do nowoczesnego* (pp. 299-313). Warszawa: C.H. Beck.

35. Pabian, A. (2012). Zrównoważony marketing na rynku przedsiębiorstw. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Poznaniu*, No. 226, pp. 125-133. <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.ekon-element-000171214799>.
36. Papadoulou, M., Pappasolomou, J., Thrassou, A. (2021). Exploring the level of sustainability awareness among consumers within the fast-fashion clothing industry: a dual business and consumer perspective. *Competitiveness Review: An International Business Journal*, Vol. 32, No. 3, pp. 350–375, doi:10.1108/CR-04-2021-0061.
37. Quoquab, F., Mohamed Sodom, N.Z., Mohammad, J. (2020). Sustainable Marketing. In: D. Crowther, S. Seifi (Eds.), *The Palgrave Handbook of Corporate Social Responsibility* (pp. 1-24). London: Palgrave Macmillan.
38. Randle, P., Eyre, A. (2023). *Sustainable Marketing: The Industry's Role in a Sustainable Future*. New York: Kogan Page.
39. Robertson, M. (2021). *Sustainability Principles and Practices*. New York: Routledge.
40. Rudawska, E. (2013). Marketing zrównoważony – nowe oblicze kapitalizmu? *Ekonomia*, No. 3(24), pp. 75-88, <https://www.dbc.wroc.pl/publication/27066>.
41. Schmitt, B.H. (2011). *Experience marketing: concepts, frameworks and consumer insights*, Boston/Delft: NOW The essence of knowledge.
42. Scoffham, S., Rawlinson, S. (2022). *Sustainability Education. A Classroom Guide*. London: Bloomsbury Publishing Plc.
43. Smilansky, S. (2009). *Experiential marketing. A practical guide to interactive brand experiences*. London/Philadelphia: Kogan Page Limited.
44. Syrytczyk, K.W. (2024) In: A. Kuźniarska, K. Mania, M. Jedyna (Eds.), *Organizing Sustainable Development* (pp. 146-158). New York: Routledge.
45. Tarczydło, B. (2010). Społeczna odpowiedzialność biznesu. Wybrane przykłady. In: J. Stańkiewicz (Ed.), *Społeczne wymiary zarządzania nowoczesnymi przedsiębiorstwami: ludzie, kultura organizacji i społeczna odpowiedzialność* (pp. 462-478). Zielona Góra: Wydawnictwo Uniwersytetu Zielonogórskiego.
46. Tarczydło, B. (2014). Wzbudzanie emocji i kreowanie doświadczeń w kampanii komunikacji marketingowej. *Marketing i Rynek*, No. 4, pp. 159–165.
47. Tarczydło, B. (2016). Marketing społeczny w zarządzaniu współczesnymi organizacjami. Wybrane aspekty. In: J. Ejdys (Ed.), *Społeczna odpowiedzialność i zrównoważony rozwój w naukach o zarządzaniu: aspekty teoretyczne i aplikacyjne* (pp. 252-261). Toruń: Towarzystwo Naukowe Organizacji i Kierownictwa „Dom Organizatora”.
48. Tarczydło, B. (2016). Paradygmat marki w dobie digitalizacji i technologii mobilnej. *Handel Wewnętrzny*, Vol. 62, No. 5, pp. 314-323.
49. Tarczydło, B. (2018). Actions of social responsibility in creating the brand image of a service organization. *European Journal of Service Management*, Vol. 26, No. 2, pp. 265–271, ISSN 2450-8535, doi: 10.18276/ejasm.2018.26-33.

50. Tarczydło, B., Miłoś, J. (2019b). Kreowanie doświadczeń interesariuszy powiązanych z marką. Wyniki badań. In: N. Iwaszczuk (Ed.), *Innowacyjność w działalności gospodarczej* (pp. 135-151). Kraków: IGSMiE PAN.
51. Tarczydło, B., Miłoś, J., Klimczak, J. (2023). Experience branding in theory and practice. Case study. *Scientific Papers of Silesian University of Technology Organization and Management Series, no. 178*, pp. 617-636, doi: 10.29119/1641-3466.2023.178.33.
52. Targiel, K.S. (2022). Project Success and Communication with Stakeholders. *Scientific Paper of Silesian University of Technology, Organization and Management Series, Vol. 155, No. 34*, pp. 527-534, doi: 10.29119/1641-3466.2022.155.34.
53. Tkocz, A. (2016). Marketing w koncepcji zrównoważonego rozwoju. *Współczesne wyzwania zrównoważonej produkcji i konsumpcji* (pp. 36-46). Opole: Wydział Ekonomiczny Uniwersytetu Opolskiego.
54. Troian, V. (2023). Marketing cyfrowy jako narzędzie promocji zrównoważonego rozwoju dla konsumentów oraz biznesu w internecie. In: J. Buzek, H.A. Kretek, M. Staniszewski (Eds.), *Zrównoważony rozwój i europejski zielony ład imperatywami doskonalenia warsztatu naukowca* (pp. 373-384). Gliwice: Wydawnictwo Politechniki Śląskiej.
55. United Nations (2023). *The 2030 Agenda for Sustainable Development – The 17 Goals*, <https://sdgs.un.org/goals>, 13 January 2024.
56. Wan, L.C., Poon, P.S., Yu, C. (2016). Consumer reactions to corporate social responsibility brands: the role of face concern. *Journal of Consumer Marketing, Vol. 33, No. 1*, pp. 52-60. ISSN: 0736-3761, doi: 10.1108/JCM-03-2013-0493.
57. Wilk, I. (2014). Komunikacja z rynkiem docelowym w ramach marketingu zrównoważonego. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Problemy Zarządzania, Finansów i Marketingu, No. 35*, pp. 199-207. <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.ekon-element-000171310403>.
58. Wilk, I. (2015). Konsument zrównoważony jako segment odniesienia dla działań marketingowych przedsiębiorstwa. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Problemy Zarządzania, Finansów i Marketingu, No. 38*, pp. 183-191, DOI: 10.18276/pzfm.2015.38-17.
59. Wolniak, R. (2022). Project management in engineering. *Scientific Papers of Silesian University of Technology, Organization and Management Series, No. 157*, pp. 685-698, doi: 10.29119/1641-3466.2022.157.44.
60. Wolniak, R. (2023). Design thinking and its use to boost innovativeness. *Scientific Papers of Silesian University of Technology, Organization and Management Series, No. 170*, pp. 647-662, doi: 10.29119/1641-3466.2023.170.39.
61. Wolniak, R., Gajdzik, B., Grebski, W. (2023). Environmental sustainability in business. *Scientific Papers of Silesian University of Technology Organization and Management Series, No. 175*, pp. 611-630, doi: 10.29119/1641-3466.2023.175.39.

62. Wolniak, R., Grebski, W. (2023). Comparison of traditional and sustainable business practices. *Scientific Papers of Silesian University of Technology Organization and Management Series, No. 177*, pp. 671-688, doi: 10.29119/1641-3466.2023.177.39.
63. Yin, R.K. (2012). *Applications of case study research*. London: SAGE Publications Ltd.
64. Zajkowska, M. (2015). Marketing zrównoważony – od tradycyjnego do innowacyjnego nurtu zarządzania marketingowego. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Problemy Zarządzania, Finansów i Marketingu, Vol. 41, No. 875, t. 2*, pp. 359-370, doi: 10.18276/pzfm.2015.41/2-29.
65. Zaremba-Warnke, S. (2016). Marketing zrównoważony vs. niezrównoważona konsumpcja, *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach, No. 255*, pp. 92-101. <http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.cejsh-b194959f-7fdb-4466-814e-c077d37fc722>.

EMPLOYEE ADAPTATION IN A SOCIALLY RESPONSIBLE ORGANIZATION

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Purpose: The beginning work in a new place for an employee means a lot of stress resulting from confrontation with unfamiliar surroundings and people. The process of introducing an employee to work should involve not only the employer, but also the entire team, emphasizing care, willingness to help and support at such an important initial stage. The main aim of the research is to examine whether the adaptation of new employees in a trade enterprise is effective. An attempt has been made to identify the conditions in the process of social and professional adaptation of a new employee through the prism of corporate social responsibility.

Design/methodology/approach: The paper is consisted with 2 parts. The first is about a theoretical context of CSR in small trade company level and personnel management issues and the adaptation of a new employee. The second part includes findings on research. The case study was used to develop research problem. The research questions included the issue of stress in the adaptation process and the role of the introducer. The study covered 100% of the study population. Data were analyzed using descriptive and non-parametric statistics methods (e.g. classification trees method to identify the importance of predictors).

Findings: The research results indicate that the adaptation of a new employee is an important element of his/her quality of professional life, and for the organization it is an important aspect of implementing the social responsibility strategy. Taking into account the needs of employees, as internal stakeholders of the company, is an expression of the implementation of socially responsible management. The implementation of the CSR strategy can be assessed by the degree of employee satisfaction with the quality of work life, which results from the effectiveness of fulfilling tasks in the adaptation process.

Research limitations/implications: Due to the fact that research is limited to the one chosen company results can not be uncritically generalized. This study covers only a narrow part from a wide range of problems in shaping social responsibility in business. It only applies to actions taken towards employees in the adaptation process. Due to this implication, research should be deepened and expanded to include additional aspects both in terms of responsibility towards employees and other stakeholder groups.

Practical implications: The research results can be a source of information for managers about factors important in shaping the personnel function of a socially responsible organization, primarily in the field of social and professional adaptation.

Social implications: The article contributes to the development of knowledge and dissemination of good practices in the field of corporate social responsibility.

Originality/value: The article presents a new approach to managing the personnel function in a business organization through the prism of the principles of social responsibility. Previous research does not directly or comprehensively take into account possible connections between corporate social responsibility and the adaptation process.

Keywords: corporate social responsibility, socio-professional adaptation, quality of professional life, trade enterprise.

Category of the paper: Research paper.

1. Introduction

The issue of corporate social responsibility, although not yet widely used in the practice of small and medium-sized enterprises, is permanently entering the canon of management sciences. The challenges that today's organizations face in terms of competition are increasingly associated with the need to expand the field of responsibility. This is done by including more stakeholder groups and pursuing a wider range of goals in various areas of social responsibility (Corporate Social Responsibility, CSR) (Borowska-Pietrzak, Stojan, 2023; Wolniak, Hąbek, 2016).

The first and most important resource of every organization are people and the capital they represent (Włodarczyk, 2022; Żychlewicz, 2015), hence, the first and priority group of stakeholders of every enterprise are its employees (Duda, 2022). A manager's responsibilities include acting as a leader. If he wants to maintain a team of qualified and committed employees, he should shape the elements of the quality of their professional life according to their needs.

The quality of professional life is an important element of the quality of life in general, because work itself is an unquestionably important part of life (Jakubczak, 2014). In this aspect, the problems of shaping work-life balance become the subject of theoretical, but also practical considerations among managers.

A socially responsible organization is a concept that is not sufficiently defined in the literature and practice. Corporate social responsibility has numerous definitions that are constantly evolving, but they are so broad that they do not allow for undisputed determination of whether an organization can be considered socially responsible or not. For example, Lemańczyk (2023) states, following Romanowski (2016), that the new business model that appeared in the second half of the 20th century is characterized by the inclusion of environmental and social aspects in business activities. Lemańczyk adds that responsible business activity is characterized by sharing the profits obtained with internal and external stakeholders (Lemańczyk, 2023). Romanowski, presenting the evolution of views on CSR,

mentions its aspects: the moral obligation of the enterprise, charity and fiduciary. It also presents, on the one hand, the occurrence of a conflict of economic and social goals when implementing this concept, and on the other hand, the possibility of a positive impact on the economic results of enterprises (Romanowski, 2016). Due to its specificity, the phenomenon of corporate social responsibility may take various forms of organizational activity in various spheres of its functioning. It includes influence and actions in the context of responsibility for the well-being of many diverse stakeholder groups, e.g. the local community, society as a whole, selected social groups, contractors, consumers, etc. The implementation of the CSR concept is very flexible and this flexibility refers to the diversity and scale of the organization's influence in the sphere of interests and influence (Kuropatwa, 2015). So far, there are no tools for objective assessment of this phenomenon for its unquestionable classification. Therefore, there is a risk of activities simulating CSR, e.g. in the form of greenwashing (Jakubczak, Gotowska, 2020). In this study, it is assumed that the main group and therefore the first group of stakeholders towards whom the company should act socially responsibly are employees. In terms of responsibility towards employees, one of the issues is the adaptation of a new employee.

The importance of the problem of socio-professional adaptation results from its direct impact on employees' work results, but despite this, many organizations do not pay due attention to this topic, and this process is spontaneous. Many managers underestimate the importance of the adaptation process, believing that it may take place unplanned, they do not want to spend available funds or they often implement it only partially. Most organizations do not even have basic programs for adapting new staff (Kolesnichenko et al., 2018; Stacho et al., 2017).

There are three important issues related to the recruitment process: expanding the pool of potential candidates, employing the best candidates and introducing them to work (Ulrich, 2008, p. 112). The process of introducing a new employee to work is aimed primarily at familiarizing him with the organization of work in the company, with the procedures, with the organizational culture, as well as with the values professed in an organization (Juchnowicz, 2003, p. 93). Regardless of the form of induction of a new employee, during the first few days it is the responsibility of the team, and above all the supervisor, to provide information about the specifics of the company, i.e. organizational culture, company history and prevailing customs (Ciekanowski, 2012, pp. 132-133).

The main aim of the research is to check whether the adaptation of new employees in a trading company is effective¹. The considerations are conducted in the context of the principles of social responsibility. The focus was on the subjective opinions of employees resulting from their experiences, because it was assumed that the degree of meeting the needs

¹ Effectiveness is the ability to set appropriate goals to "do the right thing". An effective action is one that, to some extent, leads to the intended result. The measure of effectiveness is the degree of achievement of the goal, after: Gilbert, Stoner, Freeman, 2011, p. 24.

of stakeholders in the adaptation process is also an indicator of the level of the company's social responsibility in the area of employees. Dialogue and participation of employees in management, i.e. taking into account their needs, is one of the elements of corporate social responsibility (Norm ISO 26000).

The following specific objectives have been formulated:

1. Determining the course of the adaptation process in a commercial enterprise: type of process - degree of formalization; occurrence of individual stages, their order, length; intensification of control.
2. Determining the employee's satisfaction with the adaptation process: stress level; assessing the degree of control; assessment of the level of responsibilities; assessment of the atmosphere in the first days of work; assessment of meeting the expectations and identifying the needs of the new employee; assessment of individual activities of the adaptation process; feeling of belonging to a team.

A case study have been chosen as the research method, which allows for a detailed exploration of the problem. The choice of the research entity have been purposeful, its main criterion was the possibility of obtaining the results of a direct interview from employees. A survey questionnaire have been used. 26 employees took part in the study, which constituted 100% of the study population (full study). The study was conducted on people employed in a trading enterprise located in the Kuyavian-Pomeranian Voivodeship. A trading enterprise is understood as an economic entity whose primary activity is the sale of goods.

Data were analyzed using descriptive and non-parametric statistics methods (e.g. classification trees method to obtain the importance of predictors).

The article consists of a theoretical part and an empirical part. Chapters 2 and 3 focused on locating the personnel function in the context of corporate social responsibility. Then, there are presenting the process and types of adaptation, as well as factors influencing employee adaptation. The second part presents the characteristics of the respondents and the organization and course of the study, as well as the study results in a graphical, tabular and descriptive manner. Then, the results obtained have been discussed in the context of other similar studies and the conclusions have been included in the summary.

2. Social responsibility of business and employees

The personnel function is one of the basic functions in an organization (Włodarczyk, 2022). Experience from practice shows that it is implemented with a different approach to employees' expectations and goals. The scope of employee management, in addition to the dimension of human resources administration, includes human capital management, which is closely related to leadership, management styles and motivation. Both human resources administration and

leadership is a difficult task for managers. It requires taking into account knowledge and experience in management, psychology and sociology. This issue is becoming more and more important in the light of the thesis that in today's organizations the only area of competitive advantage is the area related to human capital, because the remaining resources of the organization are relatively easier to imitate by competitors. Human capital makes the organization unique and is the carrier of its knowledge, which is accumulated in the organization's experience. It turns out that in the perspective of the development of ethical issues in management and their increase in importance gaining in a competitive advantage, human capital is also gaining importance as a carrier of the social responsibility of the organization. Ethics concerns people, not organizations. The norms and values shared by the members of an organization create its unique organizational culture (Gajowiak, 2023).

It should be noted that in the context of social responsibility, employees are treated in the organization not only as stakeholders, i.e. recipients of CSR activities, but also play an active role, as inspirators and implementers of the CSR strategy in all key areas for an organization.

Every manager who deal to personnel activities and followed the implementation of the overarching goals in the organization, should also plan its strategic dimension. Specialized strategies, also within the personal function, towards social responsibility, are the CSR strategy.

Employees are also stakeholders and implementers of the CSR strategy. In both of these roles, an essential condition for success is obtaining employee involvement in implementing this strategy. This effect can be achieved not only by carefully identifying the needs reported by stakeholders, but also by entering into a dialogue with them. Two-way exchange of information between employees and strategy managers begins already in the planning phase, i.e., primarily, in setting goals for implementation, and it is the recipients of the CSR strategy in the area of employees who are most reliably able to indicate their own needs that should be taken into account in the organization's goals. In accordance with the principles of management by objectives, employee participation in defining goals and then also programs for their implementation not only increases the effectiveness of undertaken actions, but also has a motivating effect. In this way, employee involvement is achieved not only as contractors, but also as stakeholders of the CSR strategy.

The guidelines on social responsibility included in the non-mandatory ISO 26000 standard include discussion and guidance for shaping CSR strategies in seven key areas. One of them contains practices directed employees. The standard divides and characterizes the scope of the organization's impact on personnel into several issues. Employment and labor relations practices were listed first. The overriding premise here is the need to shape employment security, including concluding permanent employment relationships, and counteracting all forms of discrimination. Another element is working conditions and social protection. The importance of shaping work-life balance is particularly strongly emphasized, which determines the quality of life not only of employees, but also of their families. In the sphere of social dialogue, the most important issues are creating a climate of understanding in employer-

employee relations and the application of democratic principles. Occupational health and safety are to be based on the highest standards, so it is recommended to continuously improve processes and identify sources of risk, as well as develop plans to prevent and minimize this risk. Another important issue in which the company should demonstrate actions responsible is training and development in the workplace. The expected effects of activities carried out in this aspect are not only the development of professional competences in the current job position, but also the personal development of the employee as a full member of society and a mobile employee in the perspective of shaping his or her own career (26000, 2010).

3. The concept and essence of employee adaptation

The concept of adaptation has been used in science for over 150 years. They can first be seen in the natural sciences. K. Darwin (year), describing the course of development of the living world, pointed to the role of adaptation. He documented that its mechanism consists in better adaptation of living organisms to living conditions by gaining greater ability to survive those of them that have significantly reorganized the properties corresponding to the requirements of the environment. A little later, the topic of adaptation entered the social sciences, especially sociology (Kowalik, 1998, pp. 13-15). Adaptation is an extremely broad concept closely related to education, economics, sociology and psychology. Its purpose is to orient employees to the environment in accordance with the planned process. Unfortunately, this process is underestimated by many organizations. Adaptation concerns not only the professional aspect, but also the social one, because the employee learns not only the duties and rules of the company, but also the people who function in it (Kałużny, 2018, p. 347).

One of the simplest definitions by Z. Janowska (2010) says that adaptation includes the introduction of new employees to the company and should take place after the employee selection phase. It begins when a new employee enters the organization (Janowska, 2010, p. 83).

In turn, J. Szczepański (1963) adds that adaptation aims to modify the characteristics of employees so that they meet the company's requirements, which, as stated by H. Olesiak (year), is measured by the employee's job satisfaction (Szczepański, 1963, p. 162).

During adaptation, the employee and his quality play the main role. Immediately followed by them is the company's value system communicated to employees located. The system consists of opinions, attitudes, interests and ways of behavior. Success is the adoption and acceptance of the system, or rather entry into the organizational culture. In accordance with an effective personnel policy, employees should adapt to new roles, positions, co-workers and working conditions (Szalkowski, 2006, p. 106).

Adaptation has a dual nature and depends largely on the industry, culture, norms and goals of the organization as well as the employee himself and how he absorbs the information he acquires. The essence of adaptation is to transmit expected behavior patterns and respond to changes (Kałużny, 2018, p. 349).

Focusing on the concept and essence of adaptation of new employees, it is also necessary to mention what the goals are. T. Oleksyn listed the following goals of employee adaptation (Oleksyn, 2017, pp. 271-274):

- introducing a new employee to the organization as quickly and effectively as possible, and more specifically, familiarizing him with:
 - about the mission,
 - about the history of the company,
 - about the strategy of action,
 - about health and safety regulations,
 - about the division of labor,
 - about the scope of duties,
- achieving independence at work as quickly as possible,
- training the employee in performing his duties, achieving the required quality and work efficiency,
- interest of the new employee in the organization and presenting him with opportunities for further personal development, in order to encourage him to stay in the organization,
- reducing stress related to a new job,
- familiarization with applicable internal and external regulations,
- learning how to behave and react in non-standard, crisis or dangerous situations.

Combining all the collected information, it can be concluded that adaptation is a concept closely related to sociology, pedagogy, psychology and economics, which aims to orient new employees in organizational structures. Adaptation has a two-fold nature: we are talking about professional and social aspects. Employee adaptation begins after the recruitment process and plays an important role in it. During the orientation process, information about duties and tasks is provided, co-workers, the position and the company's value system, including views, attitudes, interests and behavioral patterns, must be presented. In the adaptation process, the employee's characteristics are modified so that they meet the organization's requirements. Adaptation is effective when the employee is independent and able to work in a team (Kałużny, 2018, pp. 347-349).

3.1. Types of adaptation and providing necessary information

Sometimes a situation occurs when an employee is unable to adapt to the work environment. This is influenced by the personality traits of a individual, but also of his or her colleagues. The adaptation process begins with assigning the employee his position, and there are two types of it (Pawlak, 2011, p. 250; Woźniak, 2013, p. 294):

- spontaneous adaptation,
- guided adaptation.

The first type is the spontaneous adaptation of the employee himself, which forces him to obtain information from various sources in the organization, co-workers or self-observation of the environment. In this case, the organization does not incur any costs related to the acclimatization of employees, but full acclimatization takes much longer. The likelihood of process failures and employee resignations also increases. This may be due to incomplete and erroneous information obtained through spontaneous information and experience collection (Ludwiczynski, 2006, p. 216-217).

Guided adaptation includes precise activities preparing new employees to fulfill their role in the organization. The adaptation process carried out in this way gives the employee a sense of security and bond with the company, which increases his participation in the duties performed. This is a cost-intensive process, but because employees learn faster, the adaptation time is shortened. The risk of employees leaving is also reduced. The costs incurred by the company are related to the development, implementation and enforcement of employee adaptation plans. The program is especially effective when it is created with a specific employee in mind (Ludwiczynski, 2006, pp. 216-217).

Regardless of the type of introduction, the basic role of the supervisor is provided employee with the necessary information. They concern the specificity of the enterprise, i.e. the company's history, mission and goals, or prevailing customs (Ciekanowski, 2012, p. 133). The necessary information for the proper implementation of a new employee is presented in Table 1.

Table 1.

Necessary information for proper onboarding of a new employee

Area	Contents
Basic information about the company	the company's history products and services provided
Goals and organization of the enterprise	mission of the company organizational structure development strategy
Working conditions	working time health and safety at work
Development prospects	employee development program career development paths periodic evaluation system training
Terms of remuneration for work	salaries loans
Interpersonal relations	employee organizations sources of information buffets, dining rooms
Additional benefits	social benefits non-wage forms of remuneration forms of insurance

Source: Jamka, 2001, p. 162; Ciekanowski, 2012, p. 133.

The literature also divides information into three types. According to J. Stoner and Ch. Wankel, a newly hired employee should receive three types of information (Stoner, Wankel, 1992, p. 292):

- basic (general) – company history, goals, services provided,
- detailed – regulations, rules applicable in the company, benefits to which employees are entitled,
- fundamental – information regarding everyday, routine work.

Basic (general) information should be provided to the employee during the inaugural meeting. Issues regarding the elements that should contain basic and detailed information are presented in the table 2.

Table 2.

Elements of basic and detailed information provided to a new employee

Specification	Elements
Basic information	mission of the organization, goals and strategies, history, basic economic and organizational data, characteristics of the business, position on the market, products or services offered, main customers
Detailed information	organisation of working time, management system, remuneration rules, social security of the employee, evaluation of effectiveness

Source: Ziębicki, <http://studenci.pl/zarzadzanie/zasludzkie/sem29.html>; Jamróz-Ligęza, 2012, pp. 19-32.

Effective employee onboarding will facilitate the initial phase of employees' functioning in the new conditions and speed up the adaptation process, and the more time invested in the process of introducing a new employee to the team, the greater the chances of achieving the desired effect, i.e. gaining a new participant in the organization who is faithful, committed and aware of their responsibilities (Ciekanowski, 2012, p. 133).

3.2. Adaptation process

The adaptation process is important, but at the same time difficult when taking up a job for the first time in your career. This is a watershed moment in everyone's life, as work is associated with hopes and plans for the future, not only financially, but also with the possibility of professional or personal growth. The future employee is tailored not only to perform a specific job, but also to all future work experiences (Kałużny, 2018, pp. 349-350). To ensure correct adaptation, instrument kits are used. Such tools include (Jamróz-Ligęza, 2012, pp. 19-32):

- guides for supervisors,
- brochures.
- information available on the Internet,
- integration trips.

Socio-professional adaptation has a fixed structure and elements. They consist of recommendations aimed at correct implementation. An important element is getting to know your co-workers. A common mistake is introducing a new person to too many employees in

a short time. A new employee may feel uncomfortable and nervous due to not remembering all the names. In order to avoid such a situation, the adaptation phase should be spread over several days. First, introduce the new person to people directly related to the position held, and then to representatives of other departments in the company (Jamróz-Ligęza, 2012, pp. 19-32).

There is divisions of the adaptation process in the literature presented by P. Krzyszkowski. This process has four stages (Krzyszkowska, 2016, pp. 16-19):

- the first is to introduce employees to the workplace. This is an extremely important element because the effectiveness of subsequent stages depends on it. It should contain introduction of co-workers and provide all information related to responsibilities, tasks and applicable organizational rules and culture;
- the next stage is initial professional experience, which is closely related to the first stage. Here, the employee is monitored on how he or she copes with the tasks assigned to him or her. Questions are asked to confirm knowledge and dispel any misunderstandings and misunderstandings;
- the penultimate stage is the assessment of the employee's adaptability, usually performed by the immediate superior. The employee's knowledge is checked whether he has learned all his duties and whether he can handle them independently;
- the last stage of the process is drawing conclusions regarding further staff development.

A more detailed division was proposed by A. Żarczyńska-Dobiesz, who presents six stages of the adaptation process (Żarczyńska-Dobiesz, 2008, p. 41).

To sum up, the adaptation process includes all activities related to the new employee's orientation to co-workers and the new environment, as well as familiarization with the applicable rules, duties and tasks. Adaptation can be spontaneous or guided and can be divided into stages facilitating its implementation (Rutkowska, 2006, p. 119; Ludwiczynski, 2006, pp. 216-217; Pawlak, 2011, p. 250; Woźniak, 2013, p. 294). The figure of the supervisor or other person introducing the new employee to the organization plays an important role in this process.

4. Methodology and results

The main objective of the study was to check whether the adaptation of new employees in a commercial enterprise is effective in the context of social responsibility. In order to obtain the data, a research tool was used, i.e. an online survey questionnaire. The survey was conducted at a commercial enterprise in the Kuyavian-Pomeranian Voivodeship at the beginning of February 2023. All responses were anonymous. The survey questionnaire was created using Google Forms. Then, it was made available on-line in a joint group created especially for the

participants. The study group consisted of 26 people, which constituted 100% of the study population.

4.1. Characteristics of the study group

There were more women (57%) than men (43%) among the surveyed people. The study participants were divided into three age groups. Most respondents (68%) were between 18 and 25 years old. The second largest age group was 26 to 35 years old (24.6%). The least number of people were in the age group of 36 to 45 (7.4%). The respondents had various educational backgrounds, the vast majority of them (55.9%) had secondary or higher education (29.7%). A very small group of people had primary/lower secondary education (4.6%) or vocational education (9.8%). The respondents live in towns of various sizes. The largest group of respondents (33.9%) comes from cities with up to 50,000 inhabitants. Two further groups of respondents were people from cities with 51,000 to 150,000 inhabitants (27.4%) and people from rural areas (22.6%). The remaining study participants come from cities with 151,000 inhabitants or more (16.1%).

4.2. Research results

At the beginning of the study, respondents were asked whether they had been trained in occupational health and safety rules. All respondents (100%) responded positively. Then it was checked whether the respondents were familiar with the company's structure, mission, strategy and goals. Less than half were familiar with it (42.3%), the remaining respondents were familiar with only some of the above (30.8%) or not at all (26.9%).

Next, it was checked whether the respondents were provided with information about their first day of work. Most people answered yes (84.6%). This result is positive and suggests that the vast majority of respondents received information regarding their first day of work. This is important because the first day in a new job can be stressful, and providing the right information can help employees feel more confident and better prepared. Respondents who have not received information about their first day of work may feel uncertain and confused, which may affect their initial experience of work. Providing information about the first day of work allows you to better prepare for the new environment, procedures and responsibilities. Those responsible for onboarding new employees should continue the practice of providing this important information to help employees feel welcome and comfortable in their new workplace. The results are presented in the figure 1.

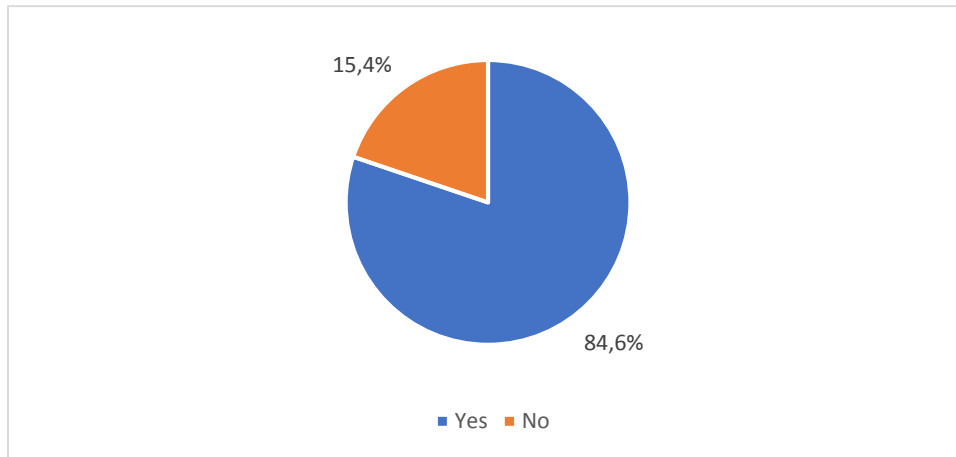


Figure 1. Providing information on the first day of work.

Source: Own research.

It was also checked whether the new employee was properly prepared for work, and more specifically whether he was provided with the necessary tools for work, and whether he knew where each department, room, kitchen and toilet were located in a new place of work. First, it was checked whether the employee was equipped with the tools needed for work. Most respondents answered affirmatively (80.8%), and few answered negatively (19.2%). Then, they were asked whether the respondents had been shown around the workplace. The majority confirmed this fact (76.9%), but it should be noted that some of the respondents (23.1%) were not shown around the workplace. They may be less familiar with the work environment, which may impact their initial impressions and comfort in the new environment. A tour can help them adapt more quickly to the new environment and increase their involvement. The results for the above two questions are shown in table 3.

Table 3.

Preparation for work of the surveyed persons

Question	Answer	
	Yes in %	No in %
Have you been equipped with all the tools you need to do your job?	80,8	19,2
Have you been given a tour of the workplace?	76,9	23,1

Source: Own research.

Assigning a person responsible for induction new worker to work is important in the employee adaptation process. Unfortunately, it can be seen that most new employees did not have a person assigned to help in the adaptation process (23.1%) or this person changed frequently (38.5%). Assigning a supervisor is necessary, among others: in defining work rules for a new employee. Thanks to the assignment of a trainer, the employee knows who to contact in case of problems. Therefore, the relationship between the assignment of a caregiver and the knowledge of whom to contact in the event of problems occurred was examined. It is worth continuing the practice of assigning a supervisor in the first days of work to ensure that they feel confident and comfortable in the workplace from the first day (Table 4).

Table 4.

The relationship between assigning a supervisor and knowing who to turn to in case of problems

Have you been assigned a person to carry out the adaptation process (supervisor)?	Do you know who to contact if you have problems?	
	Yes in %	No in %
I had one supervisor for the entire duration of the adaptation	61,1	0
I didn't have a specific supervisor, I worked with many people, depending on the needs	16,6	37,5
The supervisor has changed many times	15,3	62,5

Source: Own research.

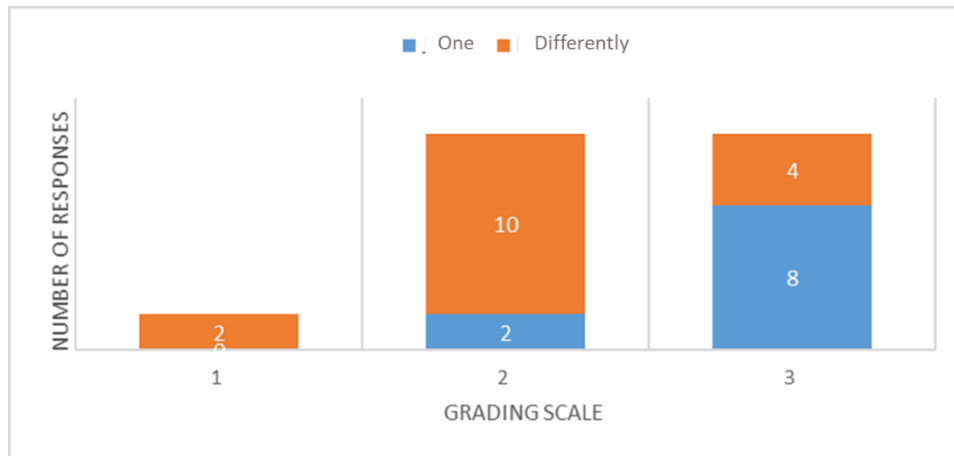


Figure 2. Supervisor stability and satisfaction with the recruitment process.

Source: Own research.

Assigning one permanent guardian to an employee was important for the respondents' assessment of the adaptation process. In this analysis, due to the relatively small size of the group, the 5-point scale was collapsed into a 3-point scale, grouping extreme answers from both sides of the scale. The highest positive ratings were given by people who were assigned one supervisor throughout the entire recruitment period (fig. 2).

About the atmosphere during the first days at work, almost half of the respondents (46.2%) answered that it was neutral. Every third respondent (26.9%) stated that their welcome was nice. The study participants also admitted that they were received very nicely in the company (145.4%). Some of the people who took part in the study were welcomed to the company in a negative or very negative way (fig. 3).

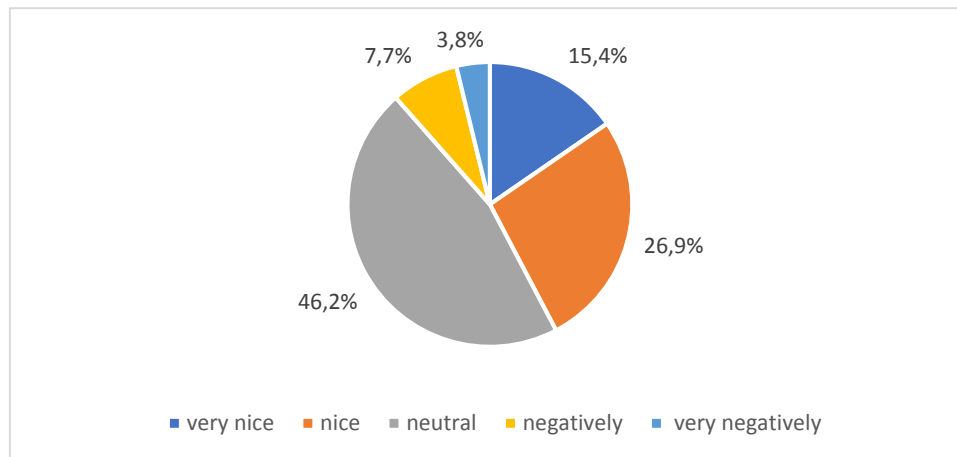


Figure 3. Welcome to the company.

Source: Own research.

Respondents were asked to indicate whether they received learning materials that they could use both at work and outside of work. There is a large difference between receiving the necessary learning materials during training (92.3%) and access to training materials outside of work (53.8%). More than half of respondents received training materials that were available off-site, which may mean that they accessed the materials outside standard working hours or outside the workplace. The materials may be useful, especially for training that requires independent study or practice. It should be noted that the company has materials that can be used at work as well as at home, so you should consider where the difference in answers to these questions comes from. Access to materials outside the workplace was not as common, which may be an area worth considering in the context of improving employee access to additional learning sources. The results are presented in table 5.

Table 5.

Classification of respondents according to access to learning materials during training and training materials outside of work

Question	Answer	
	Yes in %	No in %
Have you been given access to the learning materials necessary during the training?	92,3	7,7
Have you been provided with training materials that are available outside the workplace?	53,8	46,2

Source: Own research.

The opinion on the length of the adaptation process was also checked. The big division is noticed in the answers. The same number of respondents stated that the adaptation process was of appropriate length (42.3%) and too short (42.3%). A small group (15.4%) described the adaptation process carried out in the company as too long. However, the majority (80.8%) confirm that the adaptation process made it easier to start working independently. However, it was examined whether gender had a significant impact on the response. The results are presented in table 6.

Table 6.*The Process of adaptation and gender*

Characteristics of respondents		Has the adaptation process made it easier for you to start working independently?	
		Yes in %	Not in %
Sex	Woman	70,6	29,45
	Man	100	0

Source: Own research.

It was examined what actions had been taken to support the adaptation process. The most frequently mentioned were proposing to start to address each other by first names with colleagues (61.5%), initial training in knowledge about the structure and goals of the company (50.0%), a tour of the company (50.0%) and an integration meeting (46.2%). Respondents could indicate more than one answer. The results are presented in Table 7 in descending order.

Table 7.*Actions taken to support the adaptation process*

Actions taken	Contribution of responses to %
suggesting a switch to "you" with co-workers	61,5
initial training in knowledge of the company's structure and goals	50,0
guided tour of the company	50,0
integration meeting	46,2
training about the company's products	38,5
handing over educational materials	38,5
receiving a gift with the company's products at the beginning of work	34,6
assignment of a supervisor	30,8
access to the tools used at work	30,8
information about the possibility of making mistakes	30,8
information on who to contact in case of problems	26,9
assignment of low-responsibility tasks	19,2
feedback from the supervisor	15,4

Source: Own research.

The respondents were asked to assess the level of tasks in the first period of work. The majority indicated that the tasks were adequate to the competences (65.4%). This is a positive signal, suggesting that most respondents were faced with tasks that were in line with their skills and experience. This result may indicate an appropriate adjustment of duties to the level of employee competences, which affects their sense of comfort and effectiveness at work. Nearly one third of respondents (26.9%) believed that the tasks they were supposed to perform were too demanding or exceeded their current competences. This may be a signal that in some cases employees may have felt pressured or uncertain about their tasks, which could lead to stress and low job satisfaction. A small group of respondents (7.7%) believed that the duties in the first period of work were below their skills. It may be suggested that some employees may have felt a lack of challenge or a sense of not fulfilling their potential in the workplace. First of all, there is a need to pay attention to employees who believe that tasks are too demanding or exceed their competences. This may suggest that it is necessary to better adapt duties to the skill level of new employees or to provide them with appropriate

support and training. On the other hand, it is also worth taking an interest in employees who believe that their duties are below their competences. There may be untapped skills on the team that could be used more effectively.

Respondents were asked to indicate the answers they agreed with. They concerned the feelings of new employees. They could indicate more than one answer. The majority of respondents (53.8%) felt responsible for the decisions they made in their work, which may be related to the autonomy or level of trust they enjoyed in their role. The results suggest that there are positive aspects to the relationship between employees and their caregivers or supervisors. However, there is still room for improvement in areas where scores are lower. The answers are presented in figure 4, from the answer with the largest number of indications to the answer with the least number of indications.

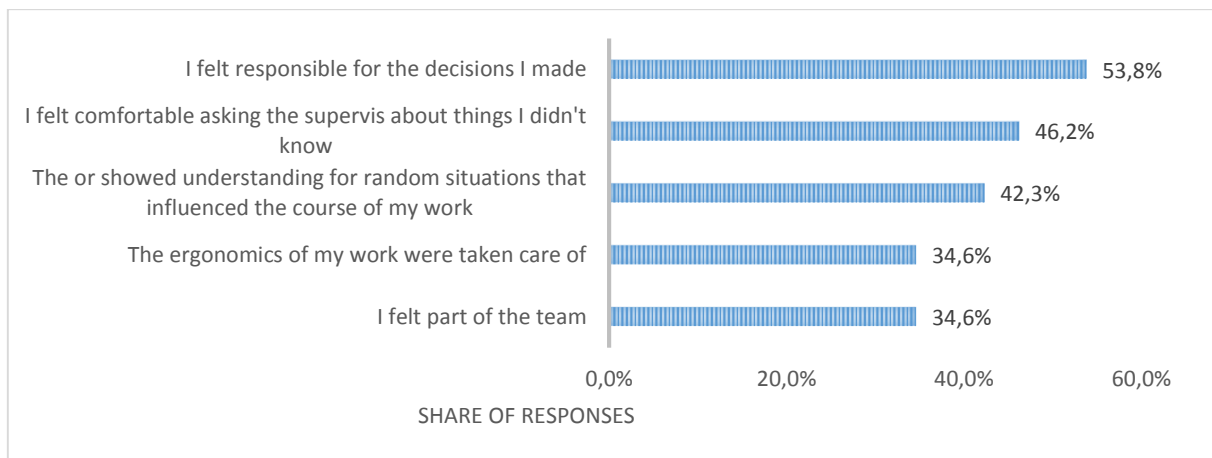


Figure 4. Employees' assessment of the elements of the adaptation process.

Source: Own research.

Employees rated the adaptation carried out in the company on a scale from 1 (the worst) to 5 (the best). The largest group of respondents (46.2%) rated adaptation at level 3, which may suggest that most employees have average or neutral impressions of the adaptation process. The survey results indicate a certain differentiated assessment of the adaptation process in the company. However, it is worth paying attention to the group of employees who rated adaptation at the lowest level (1) (Fig. 5).

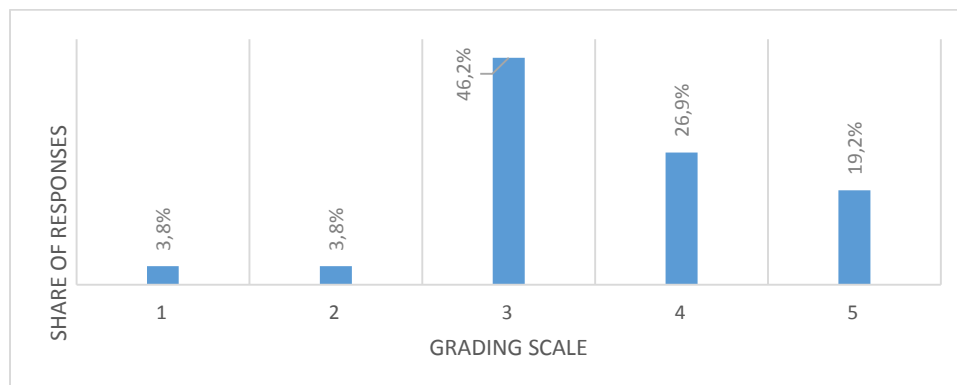


Figure 5. Evaluation of the entire adaptation process.

Source: Own research.

New employees rated their stress level in their first days of work. Opinion was measured on a scale from 1 (worst) to 5 (best). None of the respondents rated their stress level as the lowest, which may suggest that all respondents had some level of stress in the first days of work. The largest group of respondents, as many as 50%, rated the stress level at 4, which indicates a high level of stress in the first days of work. Most employees experienced moderate to high levels of stress in their first days on the job. This is understandable, because the first days in a new job can be difficult and full of uncertainty. It is important that employers offer appropriate support and assistance in the adaptation process to help new employees cope with stress and quickly adapt to the new work environment (figure 6). A more detailed analysis of the results revealed that most people who were satisfied with the adaptation process described their stress level as average (fig. 7).

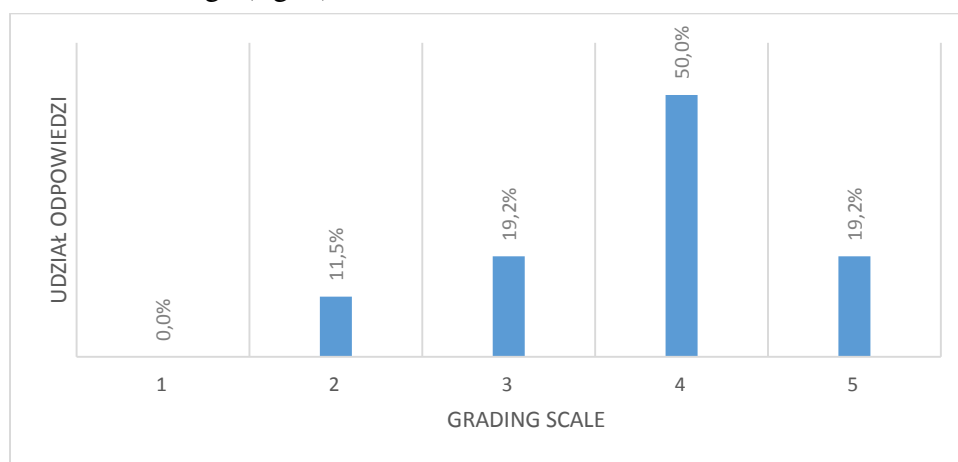


Figure 6. Stress levels in the first days of work.

Source: Own research.

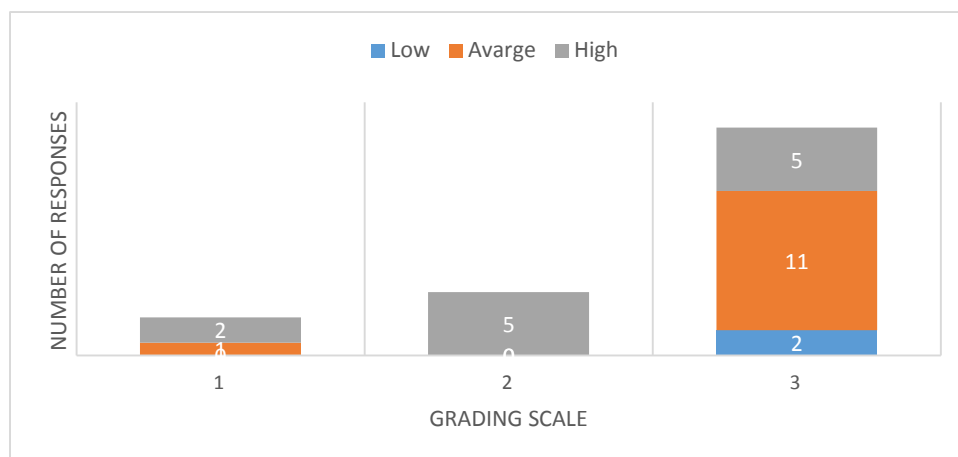


Figure 7. Assessment of the adaptation process and stress level.

Source: Own research.

Based on the survey results, it is possible to determine the level of satisfaction of employees' expectations and needs in the first days of work in the company on a scale from 1 (worst) to 5 (best). The largest group of respondents (34.6%) rated the level of satisfaction at level 3. The next group of respondents (26.95) rated the level of satisfaction at level 4. The low level

of satisfaction with the fulfillment of the needs of newly adopted children was most significantly influenced by the participation of many caregivers in the adaptation process. The results indicate that most employees had average or good satisfaction of their needs and expectations in their first days of work. This is positive information, suggesting that in most cases the adaptation process met the expectations of new employees. However, it is worth paying attention to the group of employees who assessed satisfaction at lower levels, which may require further analysis and actions aimed at improving the adaptation process (fig. 8).

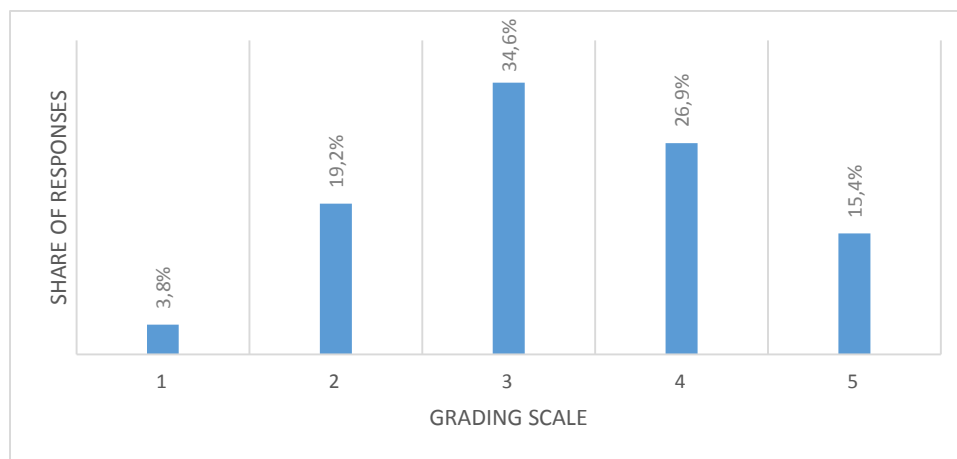


Figure 8. The level of satisfaction of expectations and needs in the first days of work.

Source: Own research.

The low level of satisfaction with meeting the needs of people newly admitted to the team was most significantly influenced by the participation of more than one guardian in the adaptation process.

Employees determined the level of control that was presented to employees in the first days of work in the company. Opinion was measured on a scale from 1 (worst) to 5 (best). The largest group of respondents, as many as 50%, rated the degree of control at level 4. Less than one sixth of respondents (11.5%) rated the degree of control at the highest level, which suggests that few had a very high level of control in the first days of work. A small percentage of respondents rated the degree of control as the lowest, probably they were very dissatisfied with the lack of control or excessive supervision in the first days of work. Most employees experienced a moderate to high level of control or supervision in their first days on the job. This may be due to an attempt to provide new employees with appropriate support and direction in their new work environment. However, it is worth paying attention to the group of employees who assessed the level of control at lower levels, which may require analysis and possible adaptation of the process to take into account the individual preferences and needs of employees (figure 9).

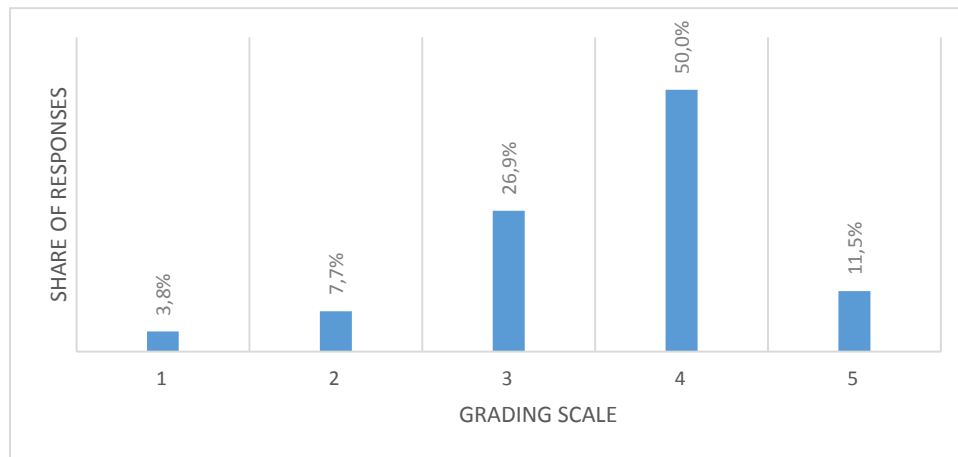


Figure 9. The degree of control that was shown to the employees.

Source: Own research.

The higher the level of control in the first days of adaptation, the more satisfactory the respondents rated it as. The degree of control was important for a positive assessment of the adaptation process (fig. 10).

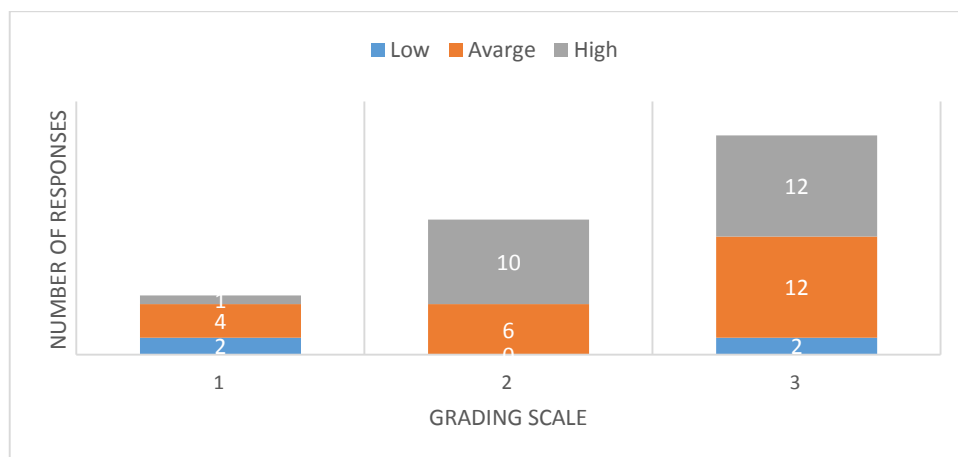


Figure 10. The degree of control and satisfaction with the adaptation process.

Source: Own research.

Based on the survey results, it can be determined whether the degree of control in the first days of work was appropriate from the employees' perspective. The majority of respondents (57.7%) assessed that the degree of control was appropriate for them. This indicates that most employees felt comfortable with the level of control or supervision. Less than half of respondents (42.3%) said the degree of control was not appropriate for them. The results are shown in figure 11.

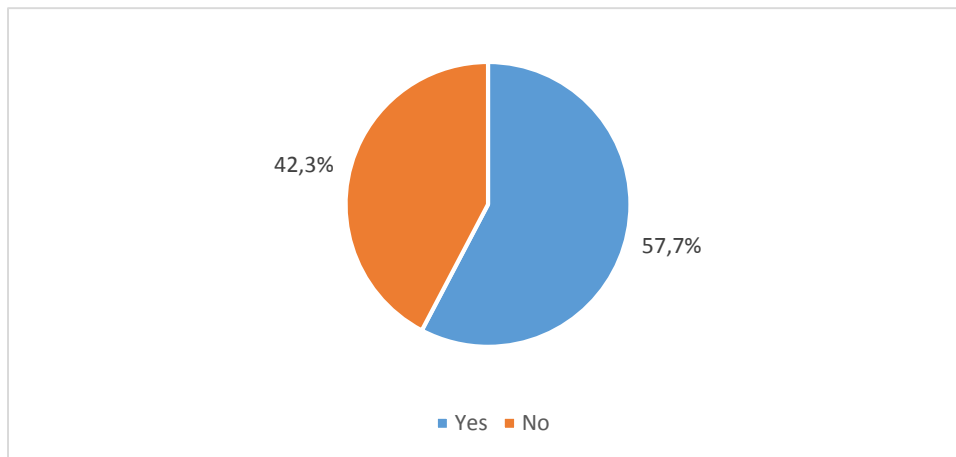


Figure 11. Degree of control.

Source: Own research.

It should be noted that the largest number of respondents had a high degree of control during adaptation (fig. 12).

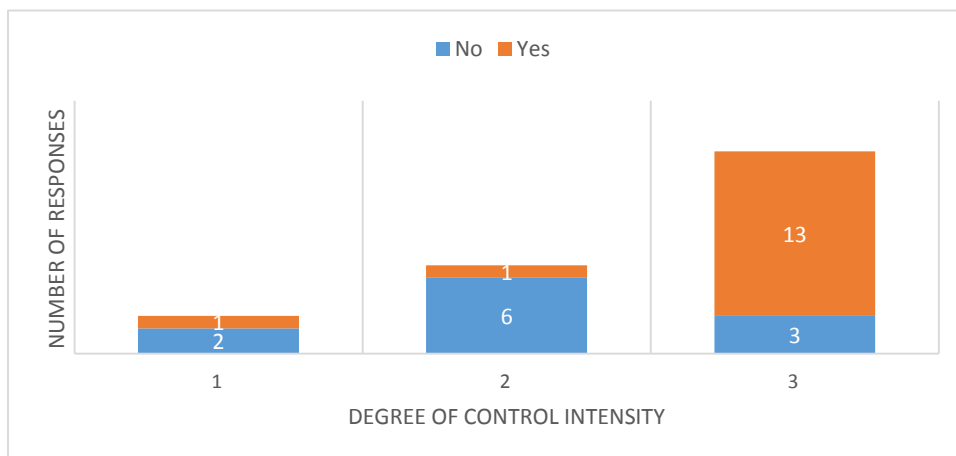


Figure 12. Degree of control and its acceptance.

Source: Own research.

5. Discussion

Research conducted among 350 Slovak organizations from various industries in 2017 revealed (Stacho et al., 2017) that the issue of employee adaptation is important and related to shaping organizational culture. Only approximately every fifth company presents a systematic and organized approach to this process. Important elements in an employee's adjustment to a new organization include learning about the system of tangible and intangible values, the organizational structure, including formal and informal rules, and recognizing his or her own status in the company.

The authors of the study (Chernysh, Kozyk, 2021), using the example of the adaptation process of managerial employees in the hotel industry, also note how important the role and responsibility of the person directly supervising the adaptation process is. These people, called mentors, not only supervise the employee, but also advise him, act as role models and support the new employee as his individual needs become apparent. Eliminating the stress of a newly accepted member of the organization by creating relationships in the new environment (Jiang et al., 2022) ensures his high productivity (Lapointe et al., 2014). The adaptation process should be systematized in organizational activities and maximally tailored to the individual needs of novices (Cai et al., 2023).

6. Summary and conclusion

Adaptation of a new employee is an important element of the functioning of every organization, it allows the new employee to quickly adapt to the environment and provide him with knowledge and skills to accurately and correctly perform his duties and tasks. To sum up, the survey results indicate that the process of adapting new employees to the company may be stressful, but most employees feel satisfied with the level of control and satisfaction of their needs. However, there is room for improvement, particularly in the provision of information and support activities, to ensure a more positive experience for new employees. The presented analysis of the collected data allowed for the following conclusions to be formulated:

1. Most of the surveyed people had received information enabling them to perform the assigned tasks.
2. Most respondents were assigned a person to supervise the adaptation process and in most cases this person was rated as helpful. It should be noted that not all new employees were assigned a guardian and it is important to remember to avoid such a situation in the future.
3. The majority of study participants described the adaptation process carried out in the company as sufficiently long, necessary and effective.
4. Most of the respondents received access to the materials necessary for learning during the training, but attention should be paid to the differences in the answers regarding the materials that can be used at work and the materials available for learning at home.
5. The company meets its obligations in terms of creating appropriate working conditions and training employees, providing instruction and instructions on safe behavior, because all new employees have undergone occupational health and safety training.
6. The largest group of employees assessed the adaptation process at an average level. It is worth noting that there is a group of employees who rated the process at lower levels, which may require further action to improve the process.

7. The results indicated that most employees experienced moderate to high levels of stress in their first days on the job. The first days at a new job are often stressful, which emphasizes the need for appropriate support and preparation of new employees for this period.
8. The majority of employees assessed that the degree of control in the first days of work was adequate. This indicates that most employees felt comfortable with the level of control or supervision presented during this period.
9. The main factors of effective adaptation include the assignment of a new employee's guardian, who ensures an appropriate level of control in the initial phase, which helps manage the new employee's stress level.

A socially responsible organization in the personnel sphere should ensure the highest standards, and this means meeting the needs of employees also from the first stage of their functioning in the organization.

The obtained results made possible to assess the effectiveness of the employee adaptation process in the selected trade enterprise. The main attention was paid to the elements of the process that the employer should consider careful so that new employees are in the result be fully prepared to perform their functions in the company. Further analyzes and adjustments to the adaptation process included in managing process may contribute to increasing employee satisfaction and commitment.

Due to assuming that the degree of meeting the needs of stakeholders in the adaptation process is also an indicator of the level of social responsibility of the company in the area of employees, the results obtained indicate a certain level of its implementation. Determining this level is a diagnosis and a starting point for taking management actions. In order to manage in a socially responsible manner, the company's management should consider whether the effects obtained in the current employee adaptation practices are sufficient, i.e. they contribute to increasing satisfaction with professional life and thus ensure an appropriate level of staff involvement for the company's needs. Then take corrective or preventive action.

References

1. 26000 (2010). *2010: ISO 26000. Guidance on Social Responsibility*. Geneva, Switzerland: International Standard Organization.
2. Armstrong, M. (1997). *Jak być lepszym menedżerem*. Warszawa: Dom Wydawniczy ABC.
3. Borowska-Pietrzak, A., Stojan, K. (2023). Changes in the structure of the CSR strategy of companies in the context of Russia's military invasion of Ukraine in 2022. *Scientific Papers of Silesian University of Technology, Organization and Management Series, Iss. 178*, 127-146.

4. Cai, D., Li, Z., Xu, L., Fan, L., Wen, S., Li, F., Guan, Z., Guan, Y. (2023). Sustaining newcomers' career adaptability: The roles of socialization tactics, job embeddedness and career variety. *Journal of Occupational and Organizational Psychology*, 96(2), 264-286.
5. Chernysh, I., Kozyk, M. (2021). Improving the process of employee adaptation in hospitality enterprises based on ISO 10018:2015 "Quality management, guidelines for employee management and competencies". *Baltic Journal of Economic Studies*, 7(5), 204-212.
6. Ciekanski, Z. (2012). Proces adaptacji społeczno-zawodowej nowego pracownika. *Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach*, No. 94.
7. Duda, A. (2022). Społeczna odpowiedzialność w strategii przedsiębiorstw sektora TSL notowanych na FWB i GPW. *Research Papers of Wrocław university of economics and Business*, vol. 66/4.
8. Gajowiak, M. (2023). Corporate social responsibility in the context of demographic crisis. Chosen results of the empirical study on the SME's *Scientific Papers of Silesian University of Technology, Organization and Management Series*, No. 177, pp. 191-205. Retrieved from: <http://dx.doi.org/10.29119/1641-3466.2023.177.11>, 3.11.2023.
9. Jakubczak, A. (2014). *Praca a jakość życia*. Bydgoszcz: Wydawnictwa Uczelniane Uniwersytetu Technologiczno-Przyrodniczego, 223-230.
10. Jakubczak, A., Gotowska, M. (2020). Green Consumerism vs. Greenwashing. *European Research Studies Journal*, 23(2), 161-181.
11. Jamka, B. (2010). *Dobór wewnętrzny i zewnętrzny pracowników*. Warszawa: Difin.
12. Janowska, Z. (2010). *Zarządzanie Zasobami Ludzkimi*. Warszawa: PWE.
13. Jiang, J.Y., Ashforth, B.E., Li, J. (2022). The long walk together: The role of institutionalized socialization in shaping newcomers' future expectations about their networks. *Journal of Vocational Behavior*, 137.
14. Juchnowicz, M. (2003). *Narzędzia i praktyka zarządzania zasobami ludzkimi*. Warszawa: Poltex.
15. Jurkowski, R. (2002). *Prawne i ekonomiczne aspekty zarządzania ludźmi w firmie*. Warszawa: Dom Wydawniczy ABC, Oddział Polskich Wydawnictw Profesjonalnych Sp. z o.o.
16. Kałużny, R. (2018). Adaptacja nowych pracowników w organizacji. *Edukacja dla bezpieczeństwa, Przegląd naukowo-metodyczny*, No. 1/201/(38).
17. Kolesnichenko, E., Radyukova, Y., Kolesnichenko, D. (2018). Improving the Management of Employees Adaptation in Regional Authorities. *Innovation Management and Education Excellence through Vision 2020, Vol. I-XI*, 1481-1487.
18. Kowalik S. (1998). Adaptacja. *Encyklopedia socjologii*. Warszawa: Oficyna Naukowa.
19. Krzyszkowska, P. (2016). Znaczenie, przebieg i narzędzia procesy adaptacji zawodowej w miejscu pracy. *Bezpieczeństwo Pracy*, No. 8.

20. Kuropatwa, A. (2015). Niewidzialna ręka społecznej odpowiedzialności biznesu. *Ekonomia – Wrocław. Economic Review*, 21/1. Retrieved from: https://repozytorium.uni.wroc.pl/Content/94443/05_Kuropatwa_A_Miscellanea_Niewidzialna_reka_spolecznej_odpowiedzialnosci_biznesu.pdf. 17.12.2023.
21. Lapointe, É., Vandenberghe, C., Boudrias, J.S. (2014). Organizational socialization tactics and newcomer adjustment: The mediating role of role clarity and affect-based trust relationships. *Journal of Occupational and Organizational Psychology*, 87(3), 599-624.
22. Lemańczyk, J. (2023). CSV Revolution of Evolution of the CSR Concept. *Scientific Papers of Silesian University of Technology, Organization and Management Series, No. 173*. Retrieved from: <http://dx.doi.org/10.29119/1641-3466.2022.173.27>, 16.12.2023.
23. Ludwicyński, A. (2006). Alokacja zasobów ludzkich organizacji. In: H. Król, A. Ludwicyński (Eds.), *Zarządzanie zasobami ludzkimi*. Warszawa: PWN.
24. Oleksyn, T. (2017). *Zarządzanie zasobami ludzkimi w organizacji*. Warszawa: Wolters Kluwer.
25. Pawlak, Z. (2011). *Zarządzanie zasobami ludzkimi w przedsiębiorstwie*. Warszawa: Poltext.
26. Romanowski, R. (2016). Możliwość zastosowania koncepcji CSR w terytorialnym partnerstwie wielosektorowym. *Handel Wewnętrzny*, 5(364), 258-275. Retrieved from: https://www.researchgate.net/publication/338831428_Mozliwosci_zastosowania_koncepcji_CSR_w_terytoryalnym_partnerstwie_wielosektorowym#fullTextFileContent, 17.12.2023.
27. Rutkowska, M. (2006). Adaptacja społeczno-zawodowa. In: H. Bieniok (Ed.), *System zarządzania zasobami ludzkimi przedsiębiorstwa*. Katowice: Akademia Ekonomiczna Katowice.
28. Stacho, Z., Stachová, K., Hudáková, M. Stasiak-Betlejewska, R. (2017). Employee adaptation as key activity in human resource management upon implementing and maintaining desired organizational culture. *Serbian Journal of Management*, 12(2), 305-315.
29. Szczepański, J. (1963). *Socjologiczne zagadnienia wyższego wykształcenia*. Warszawa PWN.
30. Ulrich, D., Brockbank, W. (2008). *Tworzenie wartości przez dział HR*. Kraków: Wolters Kluwer.
31. Włodarczyk, K. Misiak-Kwit, S., Mazur-Wierzbička, E. (2022). Wybrane procesy zarządzania personelem w polskich i słowackich organizacjach. *Zeszyty naukowe Wydziału zarządzania GWSH*, 19, 51-60. Retrieved from: https://www.gwsh.pl/content/biblioteka/org/zeszyty/zarządzanie-zn19/ZN19_Wlodarczyk.pdf, DOI: 10.53259/2022.19.05, 16.12.2023.
32. Wolniak, R. Hąbek, P. (2016). Quality Assessment of CSR Reports – Factor Analysis. *Procedia - Social and Behavioral Sciences*, 220, 541-547.
33. Woźniak, J. (2013). *Rekrutacja; Teoria i praktyka*. Warszawa: PWN.

34. Żarczyńska-Dobiesz, A. (2008). *Adaptacja nowego pracownika do pracy w przedsiębiorstwie*. Kraków: Wolters Kluwer Polska.
35. Ziębicki, B. *Wykorzystanie komunikacji wewnętrznej do adaptacji nowo przyjętych pracowników (prezentacja wyników badań w firmach Polski Południowej)*. Uniwersytet Ekonomiczny w Krakowie. Retrieved from: <http://studenci.pl/zarzadzanie/zasludzkie/sem29.html>, 20.09.2023.
36. Żychlewicz, M. (2015). Społeczna odpowiedzialność biznesu jako strategia prowadzenia działalności polskich przedsiębiorstw. *Współczesne Problemy Ekonomiczne*, 11(858), 281-289.

COMPETENCIES AS DETERMINANTS OF REMUNERATION

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Purpose: The purpose of this study is to determine how the competencies expected by employers affect the possibility of achieving a wage equal to or above the average wage in the economy.

Design/methodology/approach: Achieving the stated goal required a several-step approach. The first step was an analysis of the literature in terms of employers' expectations in the labor market and individual determinants of the salary received. Subsequently, the focus was on obtaining and checking the data (they came from the Human Capital Study -HCS). After this stage, an econometric model was estimated, which, after verifying its correctness, became the basis for analyzing the impact of individual competencies on the proposed salary.

Findings: Based on the results of the logit model, it can be concluded that among the competencies that have a positive impact on wages should be distinguished, among others: the ability to operate a computer and specialized computer programs, the ability to assemble and repair machinery and technical equipment, the ability to perform advanced mathematical calculations, cooperation with people of other nationalities, willingness to travel frequently, and willingness to work unusual hours.

Research limitations/implications: The main limitation of the survey was data gaps. Some employers were unwilling to state the amount they would offer for the indicated position.

Practical implications: Employers have the opportunity to compare what aspects of employee competence, businesses pay attention to, and how they value them. Based on this data, the approach of a particular organization can be verified and adjusted to market conditions.

Social implications: Based on the analysis, it is possible to see which competencies are particularly valued by employers. By developing them, employees can increase the likelihood of receiving a higher salary. Consequently, this will contribute to improving their living conditions. These results can also influence job seekers, who, by developing the indicated competencies, can adapt to the requirements of the labor market and thus shorten the job search period.

Originality/value: The added value of the article is to show the expectations of employers and their direct impact on the chance of obtaining a high salary.

Keywords: competencies, wages, logit model.

Category of the paper: Research paper.

Introduction

Currently, when the unemployment rate is close to natural unemployment and employers often face the problem of insufficient labor supply in the market, it becomes an important aspect to encourage candidates to take up employment. An important role in this case is, of course, played by the incentive system and the motivators proposed within it. Consequently, one of the key aspects is the level of remuneration offered to potential employees. It is this element that largely determines the choice of a particular employer.

Considering how important an aspect of salary is, it is worth considering what qualities and competencies contribute to its level. In other words, it is worth analyzing what qualifications and skills employers expect and how this translates into the proposed salary.

The purpose of this study is to determine how the competencies expected by employers affect the possibility of achieving a wage equal to or above the average wage in the economy.

According to the Central Statistical Office's definition, "wages and salaries include monetary payments paid to employees or other natural persons (i.e., gross wages and salaries), representing expenses incurred by employers to pay for work performed, regardless of the source of their financing (from own or reimbursed funds) and regardless of the basis of the employment relationship or other legal relationship or legal action, on the basis of which the work or service is performed" (Kamorska et al., 2020).

When starting to consider the determinants of remuneration, it is impossible to ignore the influence of such factors as the general level of wages in the economy, the difficulty of working in a given position, labor market conditions, work experience, the financial capabilities of the company or elements of a secondary nature, such as discriminatory factors and cronyism. One element that should also be included in this set of determinants is the possession of competence.

In the literature authors have pointed to various divisions of competencies. On the one hand, the Council of the European Union indicated the need to promote key competencies from the perspective of lifelong learning, among which it distinguishes: basic skills for understanding and creating information, personal and social competencies (especially pro-health competencies), competencies in natural sciences, technology, engineering and mathematics, digital competencies, competencies in entrepreneurship, creativity and initiative, foreign language communication skills, civic competencies and awareness of the importance of competencies (Council Recommendation, 2018; Stuss, 2016).

Subsequent studies (Oleksyn, 2006; Wodecka-Hyjek, 2011) indicated that competencies can be considered from different perspectives:

- competencies that condition the performance of an organization, such as management competencies, knowledge, memory or competencies adopted from outside (e.g., licenses);
- professional and job competencies;
- competencies possessed and attainable.

According to another division, a distinction should be made between the following skills: core, function-specific, and role-specific for an employee. The first type of competency is consistent for the entire organization, the second is related to the job position, while the third includes competencies specific to a particular employee (Springer, 2011; Gajda et al., 2013; Wieczorek-Szymańska, 2009).

According to the classification of F. Delamare Le Deist's and J. Winterton's (Le Deist, Winterton, 2005), competencies are divided using two division criteria: the area of application of competencies (professional or personal) and those resulting from the type of activities in which competencies are used (conceptual, operational). The division of competencies according to this classification is presented in Table 1.

Table 1.

Classification of competencies according to Le Deist's and J. Winterton's

	Professional	Personal
Conceptual	Cognitive	Meta-competence
Operational	Functional	Social

Source: Le Deist, Winterton, 2005, p. 39.

Another division focused on managerial competencies, among which we should distinguish (Grzybowska, Łupicka, 2017):

- technical skills - including knowledge and skills related to work,
- managerial competencies - including decision-making and conflict resolution skills,
- social competencies - understood as an individual's motivation, ability to work in a team or leadership skills.

The last of the presented divisions will be used in the rest of the article, including the empirical part.

Literature review

The literature on competencies have showed a tendency to focus on employer surveys in general. Entrepreneurs identify what competencies they think are crucial for the jobs they offer. The surveys usually do not refer to the salary offered. Table 2 shows the expectations of employers in selected countries of Central and Eastern Europe, taking into account the division into technical, managerial and social competencies. As can be seen - in the group of technical competencies, the frequently indicated skill is computer literacy, creativity, willingness to learn new things, and taking initiative. In the group of managerial competencies, employers often expect employees to take responsibility, solve problems and manage conflict, and have the ability to work independently. In the last group of competencies, employers most often indicated the ability to work in a group, knowledge of the native and foreign language, communication skills, the ability to adapt to change or commitment. Some employers also indicated that loyalty to the organization was an important element. It is worth noting that employers are more likely to focus on expectations for technical and social competencies, rather than managerial ones.

Table 2.

Employers' expectations of employees in selected Central and Eastern European countries

	Poland	Slovakia	Latvia	Hungary	Lithuania
Technical competencies	<ul style="list-style-type: none"> - operation of computer, tablet, smartphone - operation of specialized computer programs - operation of machines, tools and technical equipment - creativity - willingness to acquire new knowledge - ability to analyze and draw conclusions - analytical thinking - goal-oriented - thoroughness 	<ul style="list-style-type: none"> - learning from feedback - goal-oriented - performance of tasks 	<ul style="list-style-type: none"> - taking the initiative - computer literacy - willingness to acquire new knowledge - goal-oriented - taking care of order and organization of work 	<ul style="list-style-type: none"> - taking initiative - knowledge of modern IT tools - creativity - willingness to acquire new knowledge - acquisition and processing of information - knowledge of practical methods used in the profession -high professional competence, up-to-date theoretical knowledge 	<ul style="list-style-type: none"> - taking the initiative - computer skills - creativity - willingness to acquire new knowledge - having the necessary knowledge, both general and specialized

Cont. table 2.

Managerial competencies	<ul style="list-style-type: none"> - taking responsibility - coordinating the work of others - resolving interpersonal conflicts - ability to work independently - time management and punctuality 	<ul style="list-style-type: none"> - taking responsibility 	<ul style="list-style-type: none"> - ability to plan and control (tasks and their implementation) - ability to lead a team 	<ul style="list-style-type: none"> -taking responsibility - ability to manage conflict - problem solving -ability to manage change - decision-making skills - ability to work independently 	<ul style="list-style-type: none"> - ability to work independently - time management
Social competencies	<ul style="list-style-type: none"> - ability to work in a group -proficient use of Polish language - fluent use of English language -communicative-ness -ease in establishing contacts -sincerity and openness - cooperation with people of other nationalities - dealing with stressful situations 	<ul style="list-style-type: none"> - ethical behavior - ability to adapt to change - flexibility - willingness to do something extra - commitment 	<ul style="list-style-type: none"> - ability to work in a group - knowledge of Latvian language - knowledge of foreign languages - communicative-ness - empathy - discipline - intelligence - motivation - reliability and loyalty to the organization 	<ul style="list-style-type: none"> - ability to work in a group - foreign language skills - communicative-ness - ethical behavior - ability to adapt to change - flexibility - load tolerance and endurance - tolerance of a different point of view - commitment -confidence and motivation 	<ul style="list-style-type: none"> - ability to work in a group - ability to find oneself in a situation - intelligence - solidarity and loyalty to the company

Source: Own preparation based on: Lisa et al., 2019, p. 77; Górnica et al., 2022, p. 51; Slok et al., 2015, pp. 71-72; Lotko et al., 2016, pp. 304-307; Kantane et al., 2015, p. 227; Tóth-Téglás et al., 2016, p. 180; Gawrycka et al., 2020, pp. 1099-1001; Szydło et al., 2021, p. 11.

A different approach can be seen in the literature, in which the authors try to determine the individual factors that determine the level of wages received. One of this type of research is a study based on the 2001, 2003, 2006, 2009 Labour Force Survey data. The authors estimated three logit models for each year: general, for women and for men. Thus, twelve models were estimated. Based on their results, it can be concluded that the determinants of wages are gender, age, seniority, education, company size and occupation. At the same time, the study confirmed that women earned less than men. Another important finding was that with increasing age and seniority, salaries of the general population increased (Kompa, Witkowska, 2018).

Another study gave a picture of the determinants of wages in some European Union countries. Based on data from the Labour Force Survey, estimates of multinomial ordered logit models were carried out. Considering the results of the survey, it should be noted that men, regardless of country, are more likely to have higher wages compared to women. Another aspect that should rather go without saying is that with higher job position, the chance of a higher salary also increases. An important factor that influenced salary in some countries was having a child. In Poland, having children lowered the chances of a higher salary (Witkowska et al., 2019).

Methods and data

The data used in the empirical part came from the Human Capital Study conducted in 2021. According to the methodology adopted, the survey covered about 3500 enterprises, of which about a thousand observations came from large companies, another thousand from medium-sized enterprises, while the remainder were small enterprises with a minimum of two employees. The draw of enterprises was stratified, disproportionate in terms of entity size, and the groups of PKD sections in the sample represented equally (Antosz, 2018). Due to data gaps, a total of 2278 observations were used in the study.

The logit model used in this article belongs to the group of qualitative models. It has the form (Walesiak, 2011):

$$\ln \frac{p_i}{1-p_i} = x'_i \beta \quad (1)$$

where:

$\ln \frac{p_i}{1-p_i}$ – logarithm of the odds ratio of accepting and not accepting the value of 1 by the dependent variable;

x'_i – vector of independent variables;

β – vector of model parameters.

In the model author estimated the probability that a given set of characteristics and competencies will contribute to a salary at the 2021 national average (PLN 5888.80) or higher. The dependent variable in this case was binary, that was, it took the value 0 or 1:

$$y = \begin{cases} 1, & \text{a wage equal to or higher than the average wage in the economy} \\ 0, & \text{a wage lower than the average wage in the economy} \end{cases}$$

Table 3 shows a number of variables that were used to estimate the full model. They were divided into four subcategories: education, work experience, expected gender and other competencies. The first category included five variants of the variable determining the expected education of an employee, the second included three variants of the variable determining the length of work experience, and the third distinguished three variants of gender expectations: female, male and irrelevant. The last group distinguished between 20 competencies and two variables characterizing expected attitudes (TC12 and SC5), which were divided into three groups: technical, managerial and social competencies.

Table 3.

A set of explanatory variables used to estimate the logit model

VARIABLES				
Education		Seniority		
LSE**	lower secondary education and below	LTY** less than a year	F1T5* from 1 to 5 years	MT5Y* more than 5 years
SE*	secondary education	Expected gender		
BVE*	basic vocational education	GENW* woman	GENM* man	GENNM** no matter
HEB*	higher education- bachelor degree			
HEM*	higher education –master degree			
OTHER COMPETENCES				
1 = high level of competence 0 = low or medium level of competence				
Technical competences				
TC1	information analysis and drawing conclusion			
TC2	learning new things			
TC3	using a computer (tablet or smartphone) and specialized computer programs knowledge			
TC4	knowledge of machines, tools, and technical devices			
TC5	assembly and service of machines and technical devices			
TC6	knowledge of basic calculations			
TC7	performing advanced mathematical calculations			
TC8	artistic abilities			
TC9	physical fitness			
TC10	ingenuity, creativity			
TC11	administrative work and record – keeping			
TC12	readiness to work unusual hours required by the employer			
TC13	fluent in spoken and written Polish			
Management competences				
MC1	willingness to take responsibility for the performance of tasks			
MC2	time management (punctuality) and independent organization of work			
MC3	coordinating the work of other employees			
MC4	resolving conflicts			
Social competences				
SC1	overcoming stressful situations			
SC2	group work			
SC3	establishing contacts with people and being communicative and expressing thoughts clearly			
SC4	cooperating with people of different nationalities			
SC5	willingness to travel frequently			
*indication of the variable in the model.				
**base variable.				

Source: own preparation based on Human Capital Study data.

Results

Given that there have been a small number of studies in the literature that directly indicate the expectations of employers and their impact on wages, it is worth filling this gap. To this end, logit model estimations were carried out. The variables in Table 3 became the basis for estimating the full model. The stepwise (a posteriori) method was used to eliminate variables, which was insignificant, and then the model with significant explanatory variables

was estimated. Assumed significance level, is $\alpha = 0.1$. Table 4 shows the estimates of the model with significant explanatory variables.

Table 4.
Logit model with significant explanatory variables

Variable	Coefficient	Standard error	Wald Chi-Square	p-value		Marginal effect	Odds ratio
Intercept	-1.5634	0.1627	92.3707	<.0001	***	-	-
TC3	0.3314	0.1308	6.4176	0.0113	**	0,0434	1.393
TC4	-0.3050	0.1375	4.9240	0.0265	*	-0,0399	0.737
TC5	0.2704	0.1437	3.5412	0.0599	*	0,0365	1.310
TC7	0.2444	0.1265	3.7353	0.0533	*	0,0329	1.277
SC2	-0.5276	0.1308	16.2649	<.0001	***	-0,0743	0.590
SC4	0.3738	0.1272	8.6328	0.0033	***	0,0493	1.453
SC5	0.2688	0.1455	3.4121	0.0647	*	0,0361	1.308
TC12	0.4990	0.1445	11.9311	0.0006	***	0,0678	1.647
TC13	-0.2528	0.1372	3.3954	0.0654	*	-0,0340	0.777
BE	-0.6625	0.1707	15.0584	0.0001	***	-0,0762	0.516
SE	-0.8764	0.1684	27.0963	<.0001	***	-0,0991	0.416
HEM	0.5981	0.1452	16.9554	<.0001	***	0,0872	1.819
GENW	-2.2098	0.3722	35.2485	<.0001	***	-0,1627	0.110
F1T5	0.4602	0.1175	15.3332	<.0001	***	0,0602	1.584

Source: own calculation based on Human Capital Study data.

The verification of the built model is also an important element. Referring to Table 5, it can be noted that McFadden's R-square coefficient takes the value of about 0.12. Low values of this coefficient are a characteristic for a model with a dichotomous dependent variable (Kosko, Osińska, 2007). The accuracy of its predictions also provides important information regarding the verification of the estimated model (Kufel, 2011). It can be seen that this value is almost 67%, indicating that the model's predictions are much better than random classification.

Table 5.
Selected measures of logit model fit

Specification	Model
McFadden R-square	0,1217
Corrected R-square	0,1084
Likelihood ratio test	275,473
Log-likelihood	-994,374
Accuracy (total)	66,9
Odds ratio	4,45

Source: own calculation based on Human Capital Study data.

The final element indicating a good fit of the model is the Receiver Operating Characteristic (ROC) curve. The area under this curve takes values in the range from 0.5 (the model has no predictive power) to 1 (the model has perfect prediction) (Gruszczyński, 2012). For the estimated model, the area under the ROC curve is about 0.75 (figure 1), which gives reason to conclude that the model is a good fit to the empirical data.

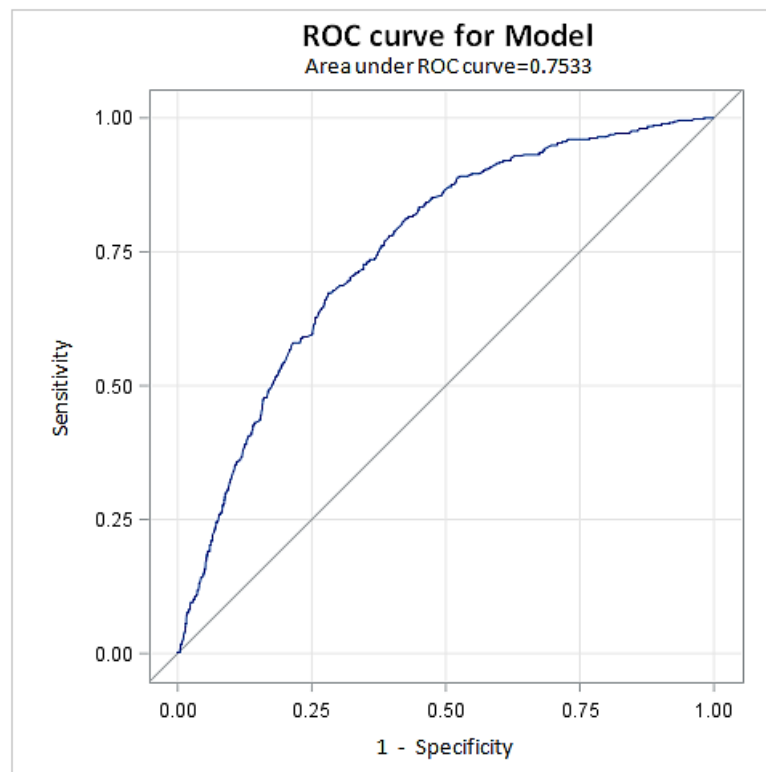


Figure 1. Receiver Operating Characteristic curve for logit model.

Source: own preparation based on SAS.

Referring to the initial set of characteristics contained in Table 1, it should be noted that for each group, at least one variant of the variable proved to be statistically significant.

Among the variables relating to educational level, secondary education, basic vocational education and master's degree proved to be statistically significant. Considering the variable determining job tenure, the only statistically significant variant turned out to be tenure of 1 to 5 years. On the other hand, when considering the effect of the expected gender of the employee on the probability of receiving a higher salary, it can be seen that the statistically significant variant turned out to be that of the female gender.

The last group of variables were the competencies of employees. Among them, statistically significant and at the same time positively influencing the probability under study were: the ability to operate a computer and specialized computer programs, the ability to assemble and repair machinery and technical equipment, perform advanced mathematical calculations, cooperate with people of other nationalities, willingness to travel frequently, willingness to work unusual hours.

Competencies that reduce the likelihood of earning a salary at the national average or higher included: operation of machinery and technical equipment, ability to work in a group, fluency in Polish.

Conclusion

As already noted, based on model verification, the model is a good fit to empirical data. However, in order to be able to talk about its implication value, it is necessary to verify whether the obtained results reflect reality.

With regard to the group of variables characterizing the level of education, it can be noted that completing a master's degree increases the probability of obtaining a higher salary by almost 9 p.p. The variants of secondary and basic vocational education turned out to be statistically significant and at the same time lowering the probability studied. Although it may seem that the earnings of individuals with lower secondary education and below should be lower than the salaries of those with vocational and secondary education, market research studies in the literature do not confirm this trend (Wróbel, 2023). This state of affairs may be the result of earlier entry into the labor market, and increasing work experience may determine an increase in salary levels.

The aforementioned relationship is shown by another variable, namely seniority. As already mentioned, those with seniority of 1 to 5 years are more likely to earn a higher salary (by about 6 p.p.).

Another group of variables related to employers' expectations of the gender of the employee they want to hire for a given position. The probability examined decreased by more than 16 p.p. when employers indicated that they wanted to hire a woman, showing that the estimates confirmed the existence of a wage gap.

The last group of variables concerned competencies, including employee attitudes. Considering those qualities that positively affect the probability of receiving a high salary, it should be noted that the issue of willingness to work unusual hours has the greatest impact (an increase in probability of almost 7 p.p.), the ability to work with people of different nationalities also turned out to be an important element (an increase in probability of almost 5 p.p.). Another variable that results in a 4.3 p.p. increase in the probability tested is the ability to operate a computer and specialized computer programs. On the other hand, each of the other statistically significant variables that positively affect the probability under study, namely the ability to assemble and repair machinery and technical equipment, perform advanced mathematical calculations or the willingness to travel frequently raises the probability by more than 3 p.p. It is also important to distinguish competencies whose possession negatively affects the probability of having a high salary. The variable most affecting this probability is working in a group (a decrease in probability by more than 7 p.p.). It can be assumed that those who work independently bear more individual responsibility for decisions made, the implementation of assigned tasks or their qualitative dimension. In the case of work teams, this responsibility may be distributed among group members. Hence, the remuneration of those working in a group may be lower.

A skill that will also significantly negatively affect the surveyed probability (down almost 4 p.p.) is the operation of machinery and equipment. While the repair of such equipment often requires significant technical skills, hence, as mentioned, positively affects the surveyed probability, their operation is often considered repetitive work, belonging to simple jobs that can be performed by less skilled people. As a result, these salaries can be below the average salary in the country.

The last competency considered is fluency in Polish. This variable, too, is among the traits negatively affecting the probability studied (lowering it by more than 3 p.p.). A high level of language proficiency will be characterized mainly by people with a humanities education. This group of people is often indicated as having a lower salary level (Magda et al., 2015). In addition, it is also worth noting that for a significant proportion of companies, it is now more important to be able to communicate in a foreign language, especially English. This determines the ability to establish contacts with contractors from other countries, as well as to respond to the changing environment, in which people of other nationalities are increasingly common. These people are customers of many companies, hence the emphasis of many, especially large companies, on proficiency in English.

When considering the results obtained, it is important to consider how consistent they are with previous research. Both Kompa and Witkowska (2018) and Witkowska et al. (2019) pointed out that one important factor is gender. Women earn less than men and at the same time are less likely to earn a higher salary. The results confirm this trend. Similarly, Lotko et al. (2016), Kantane et al. (2015), Tóth-Téglás et al. (2016), Slok et al. (2015), Górnjak et al. (2022) indicated that one of the most important skills is computer skills, as well as specialized programs - such conclusions can also be drawn based on the present study. Based on Table 4, it is worth noting that employers mainly focus on technical and social competencies in their expectations. The survey also has confirmed that managerial competencies do not significantly affect salary levels. However, the study did not confirm employers' expectations regarding the ability to work in a group and speak the native language, it turned out that these competencies negatively affected the chance of achieving a high salary.

References

1. Antosz, P. (2018). *Metodologia badania: bilans kapitału ludzkiego 2016-2023*. Warszawa: PARP, Uniwersytet Jagielloński.
2. Council Recommendation of 22 May 2018 on key competences for lifelong learning (2018). [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01))

3. Gajda, J., Cichoń, S., Gaudy, A. (2013). Rozwój zawodowy pracownika organizacji elementem warunkującym jego poczucie podmiotowości. *Przegląd Naukowo-Metodyczny. Edukacja dla Bezpieczeństwa, No. 1*, pp. 137-153.
4. Gawrycka, M., Kujawska, J., Tomczak, M. (2020). Competencies of graduates as future labour market participants—preliminary study. *Economic Research – Ekonomska Istraživanja, Vol. 33, No. 1*. pp. 1095-1107. doi: 10.1080/1331677X.2019.1631200.
5. Górniak, J., Kocór, M., Prokopowicz, P., Szczucka, A. (2022). *Bilans kapitału ludzkiego 2022/2021: raport z badania pracodawców: powrót do rzeczywistości: drugi rok pandemii oczami polskich firm*. Warszawa: PARP, Uniwersytet Jagielloński.
6. Gruszczyński, M. (2012). Tablica trafności oraz krzywa ROC. In: M. Gruszczyński (Eds.), *Mikroekonometria. Modele i metody analizy danych indywidualnych* (pp. 91-96). Warszawa: Wolters Kluwer business.
7. Grzybowska, K., Łupicka, A. (2017). Key competencies for Industry 4.0. *Economics & Management Innovations (ICEMI), No. 1*, pp. 250-253.
8. Kantane, I., Sloka, B., Buligina, I., Tora, G., Busevica, R., Buligina, A., Dzelme, J., Tora, P. (2015). Expectations by Employers on Skills, Knowledge and Attitudes of Employees. *European Integration Studies, No. 9*, pp. 224-234. doi: 10.5755/j01.eis.0.9.12809.
9. Komorska, E., Krystosiak, I., Strzelecka, H., Tuszyńska, E., Winiarz, A., Żelazny, T. (2020). *Methodological report Wages and salaries in the national economy*. Warszawa: GUS.
10. Kompa, K., Witkowska, D. (2018). Factors affecting men's and women's earnings in Poland. *Economic Research-Ekonomska Istraživanja, Vol. 31, No. 1*, pp. 252-269. doi: 10.1080/1331677X.2018.1426480.
11. Koško, M., Osińska, M. (2007). Uogólniona metoda najmniejszych kwadratów i modele zmiennych jakościowych. In: M. Koško, M. Osińska, J. Stempińska (Eds.), *Ekonometria współczesna* (pp. 161-194). Toruń: TNOiK.
12. Kufel, T. (2011). *Ekonometria: rozwiązywanie problemów z wykorzystaniem programu Gretl*. Warszawa: PWN.
13. Le Deist, F.D. Winterton, J. (2005). What is competence? *Human Resource Development International, Vol. 8, No. 1*, pp. 27-46. doi: 10.1080/1367886042000338227
14. Lisa, E., Hanelova, K., Newman, D. (2019). Comparison between employers' and students' expectations in respect of employability skills of university graduates. *International Journal of Work-Integrated Learning, Vol. 20, no. 1*, pp. 71-82.
15. Lotko, M., Razgale, I., Vilka, L. (2016). Mutual expectations of employers and employees as a factor affecting employability. *The European Journal of Social and Behavioural Sciences, No. 17*, pp. 2240-2259. doi:10.15405/ejsbs.199
16. Magda I., Tyrowicz J., van der Velde L. (2015). *Nierówności płacowe kobiet i mężczyzn. Pomiar, trendy, wyjaśnienia*. Warszawa: Instytut Badań Strukturalnych.

17. Oleksyn, T. (2006). *Zarządzanie kompetencjami. Teoria i praktyka*. Kraków: Oficyna Ekonomiczna.
18. Sloka, B., Kantāne, I., Buligina, I., Tora, G., Dzelme, J., Buševica, R., Buligina, A., Tora, P. (2015). Employers' Needs and Expectations for Qualified Employees (Case Study on the Opinions in One of the Regions in Latvia). *Economics and Business*, No. 2, pp. 69-75. doi:10.1515/eb-2015-0011
19. Springer, A. (2011). Problemy definiowania i klasyfikowania kompetencji pracowników. *Zeszyty Naukowe Wyższej Szkoły Bankowej w Poznaniu*, No. 34, pp. 249-259.
20. Stuss, M.M. (2016). Rynek pracy a oczekiwania pracodawców. In: T. Wawak (Eds.), *Zarządzanie w szkołach wyższych i innowacje w gospodarce* (pp. 150-158), Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
21. Szydło, R., Wiśniewska, S., Tyrańska, M., Dolot, A., Bukowska, U., Koczyński, M. (2021). Employer Expectations Regarding the Competencies of Employees on the Energy Market in Poland. *Energies*, No. 14, pp. 1-21. doi: 10.3390/en14217233
22. Tóth-Téglás, T., Hlédik, E., Fónadová, L. (2016). An Analysis of Employer Requirements of University Graduates. *Acta Polytechnica Hungarica*, No. 5, pp. 169-188. doi:10.12700/APH.13.5.2016.5.10
23. Walesiak, M. (2011). Modelowanie i prognozowanie zmiennych dwumianowych. In: M. Walesiak (Eds.), *Analiza danych jakościowych i symbolicznych z wykorzystaniem programu R* (pp. 112-130). Warszawa: C.H. Beck.
24. Wieczorek-Szymańska, A. (2009). Zarządzanie kompetencjami w procesie kształtowania jakości w organizacji. *Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania*, No. 12, pp. 127-138.
25. Witkowska, D., Matuszewska-Janica, A., Mentel, G. (2019), Determinanty wynagrodzeń w wybranych państwach Unii Europejskiej. *Roczniki Kolegium Analiz Ekonomicznych*, No. 55, pp. 9-24.
26. Wodecka-Hyjek, A. (2011), Zarządzanie kompetencjami a offshoring działalności. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie*, No. 854, pp. 65-76.
27. Wróbel, W. *Wynagrodzenia osób z różnym wykształceniem w 2022 roku*. Ogólnopolskie Badanie Wynagrodzeń. Retrieved from: <https://wynagrodzenia.pl/artukul/wynagrodzenia-osob-z-roznym-wyksztalaniem-w-2022-roku>, 28.10.2023.

SUSTAINABLE REGIONAL DEVELOPMENT AND PERIPHERALITY AND INNOVATION IN THE CONDITIONS OF GLOBALIZATION

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Purpose: The main aim of the article is to characterize and analyze the issue of sustainable development in the regional dimension, with particular emphasis on peripherality and innovation as a context of modernization changes in the conditions of globalization.

Design/methodology/approach: The article uses a method of analysis of literature in the field of regional studies, referring to the problems of regional development in the perspective of conditions and changes in the macroscale. The thematic scope of the article includes an analysis of the theoretical foundations of regional development, the issue of regional disparities and developmental distances, the characteristics of peripherality and innovation as phenomena determining opportunities and barriers to development in the conditions of the globalization process.

Social implications: The impact of the characteristics and analysis contained in the article can mark itself in terms of the goals and directions of regional policies formulated and implemented by public authorities at different levels. It can contribute to increasing the awareness and scope of knowledge of the regional community, especially its decision-making circles, with regard to the main goals and directions of development at the regional level, taking into account the role of innovation in overcoming the state of peripherality and marginalization under the prevailing global development trends.

Originality/value: The value of the article is based on a focused analysis of the issue of sustainable regional development and showing its determinants in a new perspective, determined by the phenomena of peripherality and innovation as a context of changes on a global scale. The characteristics and analyses of the issue in question contained in the article are part of the trend of regional studies oriented towards the search for ways to overcome inter-regional disparities and disparities in order to achieve regional balance and convergence.

Keywords: sustainable regional development, peripherality, innovation, globalization.

Category of the paper: General review.

Introduction

Globalization is one of the most important determinants of the economic, political and social sphere of action, directing the dynamic, tense and contradictory transformations of the modern world. The current stage of globalization, due to the violence and unpredictability of changes in the macroscale, should be treated as a qualitatively new phenomenon, requiring the use of new analytical and research schemes (Jałowicki, 2007). The process of globalization creates a new environment in which economies, states, regions and societies operate. It obliges you to change your existing habits and rules of thinking and acting. The phenomenon of globalization should be understood dialectically, which means that events at one pole of a straddling relationship often give rise to dissimilar or opposite phenomena at the other pole (Giddens, 2002). Actions and events remote in space and seemingly disconnected from each other, however, condition and affect each other, causing significant consequences for the economies and societies of many countries and regions.

The transformations taking place in the macroscale today have diverse character and multiple effects in the economic, political and social spheres (Pietraś, 2002; Wnuk-Lipiński, 2004). Despite the tightening of international and corporate ties in the economic sphere, globalization does not lead to the withdrawal of the state from economic activity. On the contrary, it enforces innovative policies related to economic development, stimulating employment and competitiveness of enterprises. Contemporary globalization processes create conditions for effective actions at the level of countries and regions in the use of various forms of innovation (Oniszczyk-Jastrząbek, 2011).

Globalization is a forcing factor for innovation and modernization, especially in areas classified, due to underdevelopment, as semi-periphery and periphery (Tuziak, 2013). On the other hand, modernization is accelerating globalization in the areas that are at the heart of this process. There is no doubt that in the conditions of globalization there is an increase in inequalities and disparities in development, both in the international, domestic and regional dimension (Dorożyński, 2011). The differences and divisions typical of globalization bear the hallmarks of the center-periphery dichotomy. The countries and regions included in the center play a decisive role in economic processes. The remaining areas in a weaker position must adapt to the situation and optimally arrange their relations with the center in order to achieve development balance.

Regional development: Elements of theory

Regional development is the subject of regional studies, economics, sociology and social geography (Isard, 1969; Chojnicki, 2004; Sagan, 2007; Jałowiecki, Szczepański, Gorzelak, 2007). The concept of regional development also belongs to the basic canon of concepts in the sociology of social change. On the basis of sociologically oriented analyzes of the presidents of change and development, apart from the theory of modernization and the theory of dependent development, the concepts of alternative development, i.e. endogenous, regional and local development are most often mentioned (Krzysztofek, Szczepański, 2002; Jałowiecki, Szczepański, Gorzelak, 2007). The authors of this type of concept emphasize the role of endogenous factors in the form of internal resources of individual regional and local communities, the use of which to a large extent determines the sustainable economic development of given socio-territorial systems. The issue of regional development has been the subject of a lively scientific discourse since the middle of the last century (Stackelberg, Hahne, 2011). The multifaceted nature of development in the regional dimension makes it difficult to define it precisely and clearly define the set of factors and conditions affecting the direction, pace and results of this process (Głuszczyk, 2011; Grillitsch, 2019; Łązniewska, 2022). Attempts to define regional development taking into account the balance of economic and social factors point to changes in regional productivity measured by population size, employment, income and value of added production. It is emphasized that regional development also includes social development identified with the level of health care, prosperity, quality of the natural environment, creativity (Dziemianowicz, 1997).

Since the mid-70s of the 20th century, the approach to the issue of regional development and growth referring to bottom-up factors and resources of development has become increasingly important (Taylor, Stohr, 1981; Bassand et al., 1986). The concept of development “from below” in the formulated practical recommendations postulates the use of local resources and development factors, the increase of self-management, the activity of local and regional communities, and overcoming barriers and developmental difficulties, first of all, on their own strength. This approach refers directly to the idea of endogenous development and to the perspective of capturing socio-economic phenomena and processes on a local and regional scale. The change of perspective from global to local causes the importance of exogenous factors of development to endogenous ones to decrease. However, both external and internal factors are important for the pace and dynamics of development. In practice, factors of both types occur in different proportions and combinations, defining a region-specific development path. Proper use of exogenous factors, including external programs and funds, depends to a large extent on endogenous determinants, mainly on the efficiency of regional elites, who are able to competently and efficiently use external developmental impulses to accelerate structural change, the aim of which is to adapt the characteristics of a given region to current and future development mechanisms and the corresponding location criteria (Gorzelak, 2009).

Under the conditions of globalization, the phenomena of polarization and territorialisation of socio-economic development are observed to intensify and deepen, which is not conducive to achieving a state of equilibrium (Jewtuchowicz, 2005). On the one hand, centers of dynamic and innovative development are being created, on the other hand, peripheral and marginalized regions, which, aware of their delays, join the inter-regional competition to meet the contemporary development challenges (Churski, 2011; Tuziak, 2013). Regional disparities in development processes have multiple causes. It results, among other things, from the different capacities of individual regions to create an institutional, administrative, R&D, financial, etc. environment. For the creation and operation of innovative enterprises (Aydalot, 1986; Saxenian, 1994; Florida, 2004; Jewtuchowicz, 2005). Inter-regional differences in the pace and level of development processes are also due to the growing role of territorial links of production systems, the size and quality of human and social capital, as well as the historical conditions of development of individual regions.

The traditional perception of regional development, emphasizing the importance of economic and spatial factors, has been replaced by a multi-faceted and multidimensional approach to this process. In theoretical analyses and practical recommendations, the importance of qualitative factors of business location is increasingly emphasized. Qualitative criteria in the form of qualifications of the labor force, efficiency of public administration, living conditions and natural environment, diversification of the economic structure and development of the broadly understood communication infrastructure have become important assets of the region in competition for innovative capital (Jałowicki, Szczepański, Gorzelak, 2007). From this perspective, regional development is understood as a balanced coexistence of economic, socio-cultural and political phenomena (Hryniewicz, 2000).

According to the assumptions of the theory of sustainable development, it is assumed that the socio-cultural factors occurring in a given area, among others, the level of living of the inhabitants – their health and safety, the social climate, the quality of the natural environment. This approach to regional development is similar to the definition of social development understood as social change, i.e. transformation of one or more elements of the social system (Krzysztofek, Szczepański, 2002).

Sustainable regional development in the context of peripherality and innovation: A global perspective

Sustainable development is the subject of research and analysis in various spatial dimensions, as well as in many spheres of functioning of modern economies and societies (Tuziak, 2010). The essence of sustainable development in the region dimension is to counteract excessive regional disparities and to strive for the balanced development of regions, as well as

pro-development oriented and optimal use of the available resources. Globalization processes cause changes in the external environment of the functioning of regions in the social and economic dimension. Contemporary development trends consist in moving away from existing growth factors (capital, land, labour force) to own resources owned by the regions, such as convenient geographical location, the state of the natural environment and natural values, the level of development of technological, communication, social and cultural infrastructure (Świąder, 2012, p. 135). Structural changes in the global economy include a clear increase in the importance of the service sector and a simultaneous decline in the importance of heavy industry and traditional manufacturing industries for innovative sectors and industries (Tuziak, 2019, 2021).

The new system of dependencies and connections on a global scale is manifested, among other things, in asymmetrical relations between centers and peripheries. In contemporary, non-spatial concepts of regional peripherality, the underdevelopment of information society infrastructure, low levels of social and human capital, underdeveloped civil society, inefficient and weak networks of local enterprises, low levels of institutional density and poor links of the region with the global environment (Olechnicka, 2004) are considered its main determinants. The state of peripherality is often associated with problems of inequality, marginalization and underdevelopment. The negative phenomena resulting from peripherality are particularly evident in the relations between centers and peripheral areas. The predominance of the center over the periphery manifests itself in the economic, political, social, cultural and institutional spheres. It is possible to reduce it and to compensate for disparities and developmental differences by launching a mechanism of socio-economic development based on endogenous resources and potentials, among which innovation plays a fundamental role in the broad sense.

In the literature of regional studies, two main groups of theories relating to the development of regions that are attributed the characteristics of peripherality can be identified (Taylor, Stohr, 1981; Grosse, 2007). The first refers to the mechanism of development based on exogenous factors, and the second refers to development using endogenous resources. The basic thesis of the concept of exogenous development is that the development of peripheral areas cannot be initiated using only their internal potential, because it is insufficient, often poorly realized and unrecognized. On the grounds of the theory of exogenous development, the assumption is made that there is a natural spill over of technological innovation, experience and capital from highly developed regions to peripheral ones. The outermost regions should seek external investment capital and create conditions for the transfer of advanced technologies. They should also follow the path of development and draw on the experience of the most developed countries and regions. According to the concept of exogenous development, there is a division into countries and regions that create high-tech innovations and those that only try to implement modern, innovative production and organizational solutions. A major problem for the outermost regions is the low absorption capacity to attract external investors and the use of development support funds. The concepts of exogenous development adopt a linear development scheme and

a hierarchical structure of regions. Its summit is formed by megacities, and at the bottom there are peripheral areas, which develop thanks to the spilling of development processes from highly developed regions. The exogenous development scheme excludes the diversity of development paths of peripheral regions and the possibility of skipping ("skipping") stages of development.

The concepts of endogenous development assume that sustainable development should be based on the region's own resources and potential. The use of internal factors and the concentration of capital and knowledge in the region allow the periphery to avoid development dependent on domestic centers and foreign investors (Grosse, 2007; Stimson, Stough, Nijkamp, 2011). On the basis of the concept of endogenous development, the principle of the free spilling of development from the center to the periphery is questioned. It is emphasized that global free-market processes foster the accumulation of capital, knowledge, human resources and entrepreneurship in the central regions, while peripheral areas are becoming increasingly marginalized, becoming only a source of resources and a market for dynamically developing centers. In the outermost regions, it is difficult to initiate processes of capital accumulation, knowledge and innovation, and of social and institutional capital accumulation. Endogenous development concepts assume that each region has a specific set of characteristics and resources that create its development potential. It recognizes the importance of external factors and the benefits of transferring experience, technology and institutional solutions, provided that they are adapted to regional specificities and development needs.

Uneven spatial concentration of regional development, resulting, among other things, in the peripheralization of some areas, is the subject of analysis within the framework of the theory of growth poles (Perroux 1955). According to this concept, economic development is not balanced, sustainable, but point (island), that is, concentrated in the most developed enterprises, sectors and fields of industrial activity, which form the so-called growth poles, which are the driving force of the whole economy. These innovative, competitive, highly developed entities have an extensive, well-developed network of cooperative links with other companies, research and public authorities (Elvekrok, Velfen, Nilsen, Gausdal, 2018). They effectively obtain a monopoly position, subordinating and making other market players dependent on them. The theory of growth poles also applies to the most developed regions. They attract companies from high-tech, globally competitive industries. Economic activity is concentrated in areas with a high level of development, mainly in metropolitan regions. They gain a lasting advantage in economic competition, strengthen their position in relation to the outermost regions, making them dependent on their own economic and trade policy (Grosse, 2002, p. 28; Tuziak, 2019, pp. 135-136).

On the assumption that the imbalance of socio-economic development is the result of uneven growth of economic sectors and spatial disparities in regional development, the concept of geographical growth centers is based (Hirschmann, 1958). Thanks to the dynamic economic expansion of growth centers, resulting from the activity of motor units located in them (enterprises, clusters, economic sectors), development is spread to neighboring regions.

Geographical growth centers are therefore a strong stimulator of development processes of uneven character. Innovation is the basis for the polarization of development, and the accumulation of their effects in growth centers gives them a dominant position compared to less developed areas. The dominance of growth centers is mainly due to their ability to innovate and provide competitive advantages in terms of organization and production technology.

Territorialisation and spatial diversity of development are the subject of research and analysis leading to the conclusion that regional disparities and inequalities are often the result of a long historical process in which economic, social and cultural factors accumulate and interact (Myrdal, 1957). The mutual strengthening of economic, socio-political and cultural causes the deepening of the diversity of development in space. The widening of the development gap between areas of intensive growth (central regions, metropolises) and peripheral areas is facilitated by the phenomenon of cumulative and circular causality, which is in fact a self-repeating mechanism of a vicious cycle that perpetuates and deepens the development gap between centers and peripheries. Growing regional disparities mean that the growth poles (central regions), which are the place of concentration of new locations of economic activity, are developing faster and faster, and areas of economic stagnation are increasingly subordinated economically, politically and culturally to the growth poles. However, some positive effects of the spread of development outside the centers are accompanied by the effect of leaching, i.e. draining the development resources of peripheral regions and their progressive dependence on highly developed regions. Innovations are the basis for the polarization of development, and the accumulation of economic benefits from them in the growth poles makes them dominate less developed areas, exploiting their endogenous resources and perpetuating marginalization. In a situation of progressive divergence, sustainable regional development becomes practically impossible (Wójcik, 2008; Borowiec, 2018).

Polarization and uneven regional development is the main theme of analyzes within the core and periphery model (Friedmann, 1986). The core are highly developed areas, where the economic activities of the most competitive, innovative enterprises are located. The core regions dominate the periphery not only in the economic sphere, but also in the political and cultural sphere. Their advantage results, among other things, from the fact that they form a network of connections and territorial systems characterized by a high level of ability to innovate (Gałązka, 2017, p. 29). The centres contribute to initiating and stimulating the development process in the backward and peripheral regions, but it is subordinated to the objectives and needs of the central areas. The core-periphery model is a spatial scheme of the regional system structure, which is based on the assumption of uneven development. The core region is characterized by a high level of development in contrast to the peripheral region, which remains dependent on the core, deepening the state of underdevelopment and marginalization. The ability to produce innovation and significant development potential are the characteristics of core areas (Tuziak, 2017, p. 137). Their growth is based on diverse effects and, above all,

on innovation related to the concentration of high-quality human capital and social capital in core areas as factors conducive to the production of innovation and interconnections of stimulating innovation processes. Core areas affect the environment by creating and consolidating market, administrative and economic dependence, hierarchical relationships, developmental impulses, strengthening self-reliance and the exchange of people, goods and information (Dominiak, Churski, 2012, p. 60). They are more interested in maintaining development asymmetry than in pursuing harmonious, sustainable development in the regional dimension.

The theoretical concepts based on the assumption of spatial unevenness of development refer to the considerations and analyzes of Manuel Castels (2007). In the context of globalization, economic growth is mainly generated by global metropolises and technopolies, as well as by the most developed industrial regions. These areas dominate the rest of the world in economic, political and cultural terms. Metropolises and technopolies concentrate the highest economic, technological, innovative and financial potential, making them the main centers of economic growth and the creation of new knowledge on a global scale. The modern, computerized and organized world economy is networked. It surrounds the globe with a system of dense multidirectional connections and communication channels, through which information, scientific knowledge, technologies, goods, financial resources flow. The network structure enables global transfers of capital, products and innovation between all actors active in the global economy. The density and interdependence of connections is increasingly characteristic of modern society. It takes on the structural and functional characteristics of a network society, which is expressed, among other things, in the growing role of the global economic and political elites initiating and controlling global processes.

Summary

In the context of the characteristics and analyzes presented in the article, it is concluded that the chances of peripheral regions entering the path of sustainable development are increasingly determined by endogenous factors. They are mainly socio-cultural in nature and relate, inter alia, to the quality of human and social capital, the ability to create innovation, as well as to the quality and density of networks of cooperation and links between entities forming the regional innovation system, i.e. enterprises, public administration, the sphere of science and business environment institutions.

The ability to adapt quickly and optimally to permanent changes in the external environment is, in the context of globalization and increasing economic competition, decisive for the functioning and development of enterprises as well as entire regions and countries.

Only a creative and innovative and adaptive response to changes really increases development opportunities, ensuring a better position in the competitive fight.

Socio-economic processes occurring on a global scale in different ways are manifested at the regional level in new relationships and dependencies resulting from global development trends. Practical recommendations in this situation boil down to the suggestion that regional authorities should take effective action to develop the awareness and culture of the innovative society and the location of innovative enterprises on their territory, which create modern jobs and drive development and progress. In addition, they make it possible to gain a competitive advantage in inter-regional competition, which is conducive to equalizing development disparities and emerging from a state of marginalization and peripherality.

The use of a regional resource of development factors to create a competitive and innovative economy does not necessarily mean a radical break with the past. It may refer to existing development resources and traditions in the sphere of social and economic activity. In the context of the conditions determined by the process of globalization, a model of regional development emerges, in which two areas can be distinguished. The first area involves the innovative development of an already existing resource of development factors linked to traditional regional economic activities. The second sphere is the consistent building of a new resource for the endogenous, balanced and sustainable development of the region in the form of support for high-tech industries.

References

1. Aydalot, Ph. (1986). *Trajectoires technologiques et milieux innovateurs*. In: Ph. Aydalot (ed.), *Milieux innovateurs en Europe*. Paris: GREMI.
2. Bassand, M., Brugger, E.A., Bryden, J.M., Friedmann, J., Stuckey, B. (eds.) (1986). *Self-reliant development in Europe. Theory, problems, actions*. Aldershot: Gower.
3. Borowiec, J. (2018). Konwergencja regionalna w Unii Europejskiej w latach 2000-2016. *Prace Naukowe Uniwersytetu Ekonomicznego*, z. 536, 39-48.
4. Castells, M. (2007). *Spółeczeństwo sieci*. Warszawa: PWN.
5. Chojnicki, Z. (2004). Problematyka metodologiczna studiów regionalnych. *Studia Regionalne i Lokalne*, 4(18), 5-11.
6. Churski, P. (ed.) (2011). Zróźnicowanie regionalne w Polsce. *Biuletyn KPZK PAN*, z. 248. Warszawa.
7. Dominiak, J., Churski, P. (2012). Rola innowacji w kształtowaniu regionów wzrostu i stagnacji gospodarczej w Polsce. *Studia Regionalne i Lokalne*, 4(50), 55-60.
8. Dorożyński, T. (2011). Rozwój regionalny a globalizacja i regionalizacja gospodarki świata. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 221, 147-156.

9. Dziemianowicz, W. (1997). *Kapitał zagraniczny a rozwój regionalny i lokalny w Polsce*. Warszawa: EUROREG, Uniwersytet Warszawski.
10. Elvekrok, I., Velfen, N., Nilsen, E.R., Gausdal, A.H. (2018). Firm innovation benefits from regional triple-helix networks. *Regional Studies*, 52(9), 1214-1224. DOI: 10.1080/003443404.2017.1370086.
11. Florida, R. (2004). *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Live (Paperback)*. New York: Basic Books.
12. Friedmann, J. (1986). The World City Hypothesis. *Development and Change*, 17(1), 69-83. DOI: 10.1111/j.1467-7660.1986.tb00231.x.
13. Gałązka, A. (2017). Teoretyczne podstawy rozwoju regionalnego – wybrane teorie, czynniki i bariery rozwoju regionalnego. *Studia BAS*, no. 1(49), pp. 9-61.
14. Giddens, A. (2002). *Nowoczesność i tożsamość. „Ja” i społeczeństwo w epoce późnej nowoczesności*. Warszawa: PWN.
15. Głuszczyk, D. (2011). Istota rozwoju regionalnego i jego determinanty. *Ekonomia Economics. Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 5(17), 68-80.
16. Gorzelak, G. (2009). Fakty i mity rozwoju regionalnego. *Studia Regionalne i Lokalne*, No. 2(36), 5-27.
17. Grillitsch, M. (2019). Following or breaking regional development paths: on the role and capability of the innovative entrepreneur. *Regional Studies*, 53(5), 681-691. DOI: 10.1080/00343404.2018.14634336.
18. Grosse, T.G. (2002). Przegląd koncepcji teoretycznych rozwoju regionalnego. *Studia Regionalne i Lokalne*, 1(8), 25-48.
19. Grosse, T.G. (2007). *Innowacyjna gospodarka na peryferiach?* Warszawa: Fundacja Instytut Spraw Publicznych.
20. Hirschman, A.O. (1958). *The strategy of economic development*. New Haven: Yale University Press.
21. Hryniewicz, J. (2000). Endo- i egzogenne czynniki rozwoju gospodarczego gmin i regionów. *Studia Regionalne i Lokalne*, 2, 53-77.
22. Isard, W. (1969). *General Theory. Social, Political, Economical and Regional*. Cambridge, MA: MIT Press.
23. Jałowiecki, B. (2007). *Globalny świat metropolii*. Warszawa: Scholar.
24. Jałowiecki, B., Szczepański, M.S., Gorzelak, G. (2007). *Rozwój lokalny i regionalny w perspektywie socjologicznej*. Tychy: Śląskie Wydawnictwo Naukowe, Wyższa Szkoła Zarządzania i Nauk Społecznych w Tychach.
25. Jewtuchowicz, A. (2005). *Terytorium i współczesne dylematy jego rozwoju*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.
26. Krzysztofek, K., Szczepański, M.S. (2002). *Zrozumieć rozwój. Od społeczeństw tradycyjnych do informacyjnych*. Katowice: Wydawnictwo Uniwersytetu Śląskiego.

27. Łązniewska, E. (2022). *Gospodarka cyfrowa – rozwój regionalny – odporność*. Poznań: Uniwersytet Ekonomiczny w Poznaniu.
28. Myrdal, G. (1957). *Economic Theory and Underdeveloped Regions*. London: Duckworth.
29. Olechnicka, A. (2004). *Regiony peryferyjne w gospodarce informacyjnej*. Warszawa: Centrum Europejskich Studiów Regionalnych i Lokalnych UW, Scholar.
30. Oniszczyk-Jastrząbek, A. (2011). Polityka innowacyjna państwa a proces globalizacji. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 221, 491-499.
31. Perroux, F. (1955). Note sur la notion de pole de croissance. *Economie Appliquee*, 1-2(7), 307-320.
32. Pietraś, M. (ed.) (2002). *Oblicza procesów globalizacji*. Lublin: Wydawnictwo Uniwersytetu Marii Curie-Skłodowskiej.
33. Sagan, I. (2007). *Teorie rozwoju regionalnego i ich praktyczne zastosowanie*. In: G. Gorzelak, A. Tucholska (eds.), *Rozwój, region, przestrzeń*. Warszawa: Ministerstwo Rozwoju Regionalnego, Centrum Europejskich Studiów Regionalnych i Lokalnych UW (EUROREG).
34. Saxenian, A.L. (1994). *Regional Advantage. Culture and Competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press.
35. Stackelberg, K. von, Hahne U. (2011). *Teorie rozwoju regionalnego*. In: M.S. Szczepański, A. Śliz, R. Geisler, B. Cymbrowski (eds.), *Socjologia regionu i społeczności lokalnych. Antologia*. Opole: Wydawnictwo Uniwersytetu Opolskiego.
36. Stimson, R., Stough, R.R., Nijkamp, P. (2011). *Endogenous regional development. Perspectives, Measurement and empirical investigation*. Aldershot: Edward Elgar Publishing Ltd.
37. Świąder, M. (2015). Zrównoważony rozwój regionalny. *Acta Universitatis Wratislaviensis, No. 3656, Prawo CCCXVIII*, 131-146.
38. Taylor, D.R.F., Stohr, W.B. (1981). *Development from Above or Below? The Dialectics of Regional Planning in Developing Countries*. New York: John Wiley&Sons.
39. Tuziak, A. (2010). Socio-Economic Aspects of Sustainable Development on Global and Local Level. *Problems of Sustainable Development, Vol. 5(2)*, 39-49.
40. Tuziak, A. (2013). *Innowacyjność w endogenicznym rozwoju regionu peryferyjnego. Studium socjologiczne*. Warszawa: Scholar.
41. Tuziak, A. (2017). Innowacyjność i kapitał ludzki w rozwoju regionu. *Nierówności społeczne a Wzrost Gospodarczy*, 4(52), 106-120, DOI: 10.15584/nsawg.2017.4.7.
42. Tuziak, A. (2019). Peryferyjność a nierówności i dysproporcje rozwojowe na poziomie regionalnym. *Nierówności Społeczne a Wzrost Gospodarczy*, 3(59), 131-148. DOI: 10.15584/nsawg.2019.3.9.
43. Tuziak, A. (2021). Innvativeness as a resource for the development of a peripheral region, *Scientific Papers of Silesian University of Technology. Organization and Management Series, No. 152*. pp. 219-231, DOI: 10.29119/1641-3466. 2021.152.17

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44. Wnuk-Lipiński, E. (2004). *Świat międzyepoki – globalizacja, demokracja, państwo narodowe*. Kraków: Wydawnictwo Znak, Instytut Studiów Politycznych PAN.
 45. Wójcik, P. (2008). Dywergencja czy konwergencja: dynamika rozwoju polskich regionów. *Studia Regionalne i Lokalne*, 2(32), 41-60.

INTERCULTURAL COMPETENCIES IN MANAGERS OF AGRICULTURAL UNIVERSITIES IN THE ERA OF BUILDING THE SOCIETY 5.0

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Purpose: Contacts with foreigners and their somewhat different ways of thinking and behavior (often incomprehensible to the Polish society), reaching back to the roots of the culture of a given country, region or community, are becoming an everyday reality nowadays. These processes also affect the change of standards in the field of intercultural competencies of managerial staff. The aim of this paper is to discuss the development of cultural competencies in managers that are necessary in the management of intercultural organizations.

Design/methodology/approach: The paper uses the desk research method of analysis. The analysis of available subject literature and data obtained from the websites of six Polish agricultural universities enabled establishment of facts, verification of data and presentation of results.

Findings: The considerations presented in the article indicate that the key element of the changes taking place in organizations are intelligent human resources with cultural competencies. International cooperation and foreign contacts are important – whether through participation in common projects, conferences, research or student internships. Joint actions are also required rather than individual actions and the initiatives undertaken are consistent with the concept of the society 5.0.

Practical implications: A common space for development, modern technology, creative thinking and joint commitment of the managerial staff and the academic community enable the building of a super-intelligent society and universities fit for the 21st century.

Social implications: The advances in technology should always be used with consideration of the needs and the good of people, regardless of cultural differences. The world of people, machines and their surroundings should be interconnected and all these elements should be able to communicate with each other.

Originality/value: The article is an original approach to searching for solutions that influence the change of standards in the area of key competencies of managerial staff, including intercultural competencies.

Keywords: cultural competencies, intercultural manager, changes in organizations.

Category of the paper: research paper.

1. Introduction

The vision of a super intelligent society uses the latest technologies and databases to optimize human activities in all dimensions of life (Rybak, 2023). In the face of the process of globalization and the internationalization of management, cooperation and communication with people from different countries and even continents are becoming more and more common. International teams are being created to implement projects; businesses are faced with mergers and strategic alliances. Contacts with foreigners and their somewhat different ways of thinking and behaviour (often incomprehensible to the Polish society), reaching back to the roots of the culture of a given country, region or community, are becoming an everyday occurrence. The abovementioned processes have also significantly influenced the change of standards in the field of key competencies of managerial staff, including intercultural competencies.

Polish universities focus their activities on the education of managerial staff. Changes are occurring, both in the activities of schools themselves and in the environment in which they operate. This is related not only to the development of infrastructure, but also to broadly understood changes in curriculums. New extramural branches of higher education institutions are being opened (also abroad) and new fields of study and college departments are being created to meet the needs of the labour market. New postgraduate studies are launched, including foreign-language courses for managers; cooperation is established with employers and numerous foreign partners; national and international conferences are systematically organized – all this in order to educate staff for the innovative economy in the best possible way. Students' science clubs that operate locally fit perfectly into the activities of universities. The best proof of how Polish universities have changed over the past 20 years is their growing position in various rankings and the number of awards they receive each year. Their activity is not only strictly and exclusively related to education, but is also intertwined with the sphere of social life through sports, cultural or even charity activities. It is thanks to the authorities of universities, their passion, creativity, perseverance and commitment that it was possible to create universities fit for the 21st century, not only by building modern campuses and infrastructure, but most of all by shaping the academic community.

The aim of this paper is to discuss the development of cultural competencies in managers that are necessary in the management of intercultural organizations, in the aspect of the activities of Polish agricultural universities.

2. Material and Methodology

The aim of this work is to discuss the development of cultural competencies in managers that are necessary in the management of intercultural organizations. These include universities whose activities are aimed at strengthening the academic community's natural curiosity about the world, educating, stimulating imagination, competency acquisition and openness to changes using the latest technology advancements, including artificial intelligence. The paper uses the desk research method of analysis. The analysis of available subject literature and data obtained from the websites of six Polish agricultural universities enabled establishment of facts, verification of data and presentation of results.

3. Society 5.0 – the Society of Imagination

Society 5.0, also called super-intelligent or creative, is a recipe for a new era man. According to the Japanese, it is defined as a human-centric society model of interpersonal relations. It uses economic progress to solve social problems using systems and technologies that strongly integrate cyberspace with real physical space. This is another society, which follows the hunting, agrarian, industrial and finally information society that we currently have (Twaróg, Mieczkowski, 2019; DuVall, 2019). In Society 5.0, of which Japan is considered a model, all aspects of society are shaped by the latest technologies. The society of the future is to be one in which new values and services are constantly created, making people's lives more comfortable, while ensuring sustainable and lasting development (Twaróg, Mieczkowski, 2019). Society 5.0 is intended to improve life through the effective use of data on a large scale, in which the world of people, machines and their entire surroundings are interconnected and able to communicate with each other (Tomański, 2023).

Society 5.0 assumes the connection of cities and societies, which is supposed to change the customs, industry, services and living space. Artificial intelligence is to be able to provide necessary products and services to people who need them, at the required time and quantity (Twaróg, Mieczkowski, 2019).

Reaching level 5.0 depends on cooperation between business, states and science which is the basis for creating innovations at both national and global levels. The key element is the use of the big data and the coordination of many existing systems to optimize human activities in all dimensions of life: from shopping to improving production and decision-making processes (Rybak, 2013). 5.0 assumes the creation of one data system based on trust and exchange of information, and the most important thing in this aspect is international cooperation, which is sometimes difficult to achieve (Trends of the future..., 2023). In the school of the future,

the teacher should be a friendly and helpful guide in the world of knowledge. Therefore, it is necessary to invest in the education of managerial staff and, most importantly, give them the opportunity to implement modern and diverse education methods. Moreover, the current way of teaching (lecturing knowledge, disciplining and checking the learned material) must be replaced by learning through experience, which will unleash creativity and develop the ability to solve various problems because *The economy of the future needs (...) schools whose walls are left by people who are curious about the world and open to new knowledge* (Trends of the future..., 2023).

Continuing education in the field of modern technologies may soon turn out to be a necessary condition for the development of any organization and may also involve the need to retrain employees or the necessity to acquire new competencies or specialists. The future will therefore require not only openness to new technologies but also knowledge of how to use them, which may become the key to increasing competitiveness and business development (Rybak, 2023).

4. Cultural Competencies

In the subject literature, there is no unanimity in the numerous definitions of competencies. G. Filipowicz defines competencies as dispositions in the field of knowledge, skills and attitudes that allow the performance of professional tasks at an appropriate level (Filipowicz, 2004). A. Sajkiewicz also recognizes the knowledge used at work, experience, abilities and predispositions to cooperate in achieving the company's goals, the ability to act professionally and ethical cultural values (Sajkiewicz, 1999).

For the purposes of this article, it was assumed that cultural competencies are the abilities to use cultural patterns within a given culture (Encyclopedia..., 2023). Thus, cultural competencies include a set of acquired features and abilities that enable free participation in culture, in accordance with norms and values. It is the ability to recognize, learn and change the content of culture. Thanks to specific competencies, cultural content can be passed on to the next generations and the cultural capital can be enriched with new values and patterns. These are necessary for full participation in society (Założona, Lisowska, 2018).

According to A. Thomas's concept, intercultural competencies are understood as the ability to notice and respect in oneself and in other people the cultural conditions and factors that affect perception, evaluation, feeling and behaviour. Moreover, it is the ability to use them productively, in the meaning of mutual adjustment, from tolerance towards incompatibilities to the development of synergistic forms of cooperation and patterns of interpretation and creation of the reality around us. Intercultural competence understood in this way is an increasingly

necessary element in modern organizations, which increases flexibility in situations of contact with different behaviours and communication styles (Thomas, 2003).

As can be seen from the above definitions, the concept of intercultural competence is a broad concept. It includes not only knowledge of customs, behaviour, language, values, social norms, the ability to respond appropriately in the event of contact with a different culture, but also attitudes of openness, tolerance and respect towards culturally different people (Barney, 1991).

In business, intercultural competence plays a significant role in every area of a company's activity, i.e. formulating a vision and mission, establishing a business profile, obtaining various permits, designing goods and services, managing human capital, acquiring and retaining customers, building relationships with the environment and the employer's image. The dynamically changing conditions in which enterprises operate increasingly require the expansion of their operations into foreign markets and the building of a network of international contacts.

It should be remembered, however, that cultural competencies are not only the responsibility of the managers, but also the employees of the entire organization. It is important to create awareness of the existence of cultural differences and the benefits resulting from them.

The acquisition and development of cultural competencies is a complex and long-term process. Initially, it is important to get to know the native culture, because the environment is perceived and assessed best through the prism of the values rooted in it. Next, it is important to develop cultural awareness among all the employees and even their families. Finally, it is important to model the organizational culture towards flexibility and innovation and to shape a favourable climate for it (Nikitrowicz et al., 2019).

5. Intercultural Competencies of a Manager

A global manager combines the role of an intercultural connector, an intercultural negotiator, a person initiating the process of intercultural synergy and a leader operating at the crossroads of cultures (Nowakowski, 1999). It is not possible to build a universal profile of an intercultural manager, which results from the diversity of organizations and their environments. However, it can be attempted to identify certain key components of these competencies.

They include but are not limited to: high interpersonal skills (including greater orientation towards people than tasks), linguistic skills, motivation to live abroad and cultural curiosity, tolerance of uncertainty and ambiguity, flexibility and willingness to adapt, patience, expressing respect for others, cultural empathy, a sense of humour (as a buffer for frustration, a safety valve in depression or a trigger for interpersonal relationships) as well as cross-

culturally determined specialist knowledge and skills regarding the type of work or task performed. Naturally, an additional area are qualification requirements depending on the area and culture of the manager's country of work. The cultural factor is one of the most important variables that determine the success of international management (Stor, 2009).

The competence profile of an intercultural manager is closely related to the specificity of the international market. Therefore, the manager must be characterized by high sensitivity to cultural needs, the ability to adapt and learn from others, the spirit of entrepreneurship and communication skills in conditions of cultural diversity. Other desirable features include: the ability to identify and combine the best elements from different cultures, the ability to introduce a new work culture in multinational teams, and the efficiency in using practical instruments that counteract cultural clashes. These features are characteristic of a global leader who achieves cultural synergy (Pocztowski, 2007; Bieniek, Steinerowska, 2014).

The managers' command of intercultural competencies in modern organizations has become a necessity and is a valuable resource of the company as it provides many benefits. It constitutes significantly facilitated cooperation with foreign partners and building lasting relationships with them (Kacprzak et al., 2017); it enables minimizing or avoiding failure associated with introducing goods and services to foreign markets. Intercultural competencies also help to avoid losing an attractive contract as a result of poorly conducted negotiations and increase the effectiveness of communication with clients. They can also help to improve the process of managing employees of different cultures or increase the number of innovations implemented as a result of the work of teams which consist of culturally diverse employees. For example, in this context the word *planning* is optimized, e.g. in relation to the meaning of the word *tomorrow* – in some cultures it means *immediately*, in others *never*. The manager's cultural competencies can significantly reduce stress before business meetings and improve the quality and comfort of work in intercultural environments. Important benefits also include preventing the repetition of stereotypes and reducing the risks associated with running a business in other countries or on other continents (Dołęga, 2023).

6. The Role of Managers in Shaping the Cultural Competencies in Employees

A modern manager must play many important roles in the organization, which is closely related to the dynamics of changes taking place both inside and outside them. According to I. Stańczyk (2018), the roles of a modern personnel manager include: leadership, implementing changes, improving communication, negotiating and the development of oneself and one's subordinates.

A personnel manager in the role of a leader – thanks to his knowledge, skills, attitudes and personality traits – is a person in the organization who serves as a role model that determines courses of action and influences the behaviour of others in order to accomplish a specific task. The manager focuses on employees and tasks in effective fulfilling of the role of a leader, (Stańczyk, 2018).

The manager is also a change promoter. He or she is the one who prepares, organizes, manages and implements changes in order to introduce them effectively and convince those who are undecided. In addition, he or she ensures the implementation and maintenance of new procedures and behavioural patterns. The leader indicates the direction and vision in the process of change in the organization. It is the leader's task is to motivate towards efficiency and creative work – they therefore inspire and engage members of the organization in the process of changes implemented (Kania, 2015).

One of the important roles of the managerial staff is also to ensure efficient, fair and precise communication within the organizational unit. Thanks to their skills, the personnel manager can anticipate communication difficulties and remove obstacles, while recognizing the communication styles of co-workers, superiors and employees (Stańczyk, 2018; Żukowski, 2008).

The manager in an organization must also be an effective negotiator. This skill is one of the basic characteristics of managers in general, not only because of their contact with customers, but also due to the need for fruitful cooperation with employees and superiors.

The manager is also the creator of their own and their subordinates' development. In order to increase efficiency and effectiveness, he or she fulfils the remaining roles needed to develop its own competencies. At the same time, the manager's role is to motivate and control the development of their subordinates (Żukowski, 2008).

The manager's role in competency management is to define a specific competence model, applicable to employees. This role should be described and classified by the scope of responsibility, authority and behavioural patterns. The manager should appropriately define competency profiles in several possible ways. An example would be a radar chart, containing competencies arranged in rings with radiating scales of competency levels. If the scale has an equal number of levels for all competencies, such a representation takes the form of a radar (Parsloe, Wray, 2002). The radar levels here are: conscientiousness, drawing conclusions, vision, strategic perspective, resource management, communication skills, motivation, ability to develop, achieving goals, self-awareness, emotional resilience, intuition, feeling and exerting influence.

Table 1.*The manager in the shaping of cultural competencies in employees*

Item	UP Wrocław	SGGW Warszawa	UP Poznań	UR Kraków	UP Lublin	UP-H Siedlce
Is a role model	yes	yes	yes	yes	yes	yes
Focus on employees and tasks	yes	yes	yes	yes	yes	yes
Change promoter	yes	yes	yes	yes	yes	yes
Ensuring efficient communication	yes	yes	yes	yes	yes	yes
Effective negotiator	yes	yes	yes	yes	yes	yes
Creator of own and subordinates' development	yes	yes	yes	yes	yes	yes
Attitudes focused on tolerance and mutual respect	yes	yes	yes	yes	yes	yes
Openness to others, to cooperation with people of other cultures and nationalities	yes	yes	yes	yes	yes	yes

Source: author's own study based on the websites of agricultural universities.

With reference to the above considerations, managers play a significant role in shaping employees' competencies, including cultural competencies. These include mainly promoting among employees the attitudes of tolerance, mutual respect, openness to others, active participation in the process of learning and sharing the acquired knowledge and experiences and openness to cooperation with people of other cultures and nationalities (Żukowski, 2008). The managers in modern organizations, including those of higher education, have a wide range of tools to help them achieve the above goal, such as: training, evaluation, motivational instruments, including non-remuneration ones (such as work-life-balance programs, benefits, etc.), which shape a particular culture and climate of the organization. Naturally, the managerial staff itself should be a role model for their subordinates and set a good example through the adopted patterns of attitudes and behaviour.

7. Shaping the Manager's Intercultural Competencies

Shaping the manager's intercultural competencies is quite a broad issue, due to the increasing number of available instruments for implementing related activities, such as constantly modified or emerging new types and kinds of training.

The competencies of the managers, and all the employees in general, can be developed in three key areas, i.e. cognitive (knowledge), affective (skills, including communication) and behavioural (attitudes).

In the subject literature various divisions of competence improvement methods can be found, by many authors and according to various criteria. The basic division includes formal education, on-the-job training and learning in action (Jabłoński, 2009).

The basic ways of improving competencies include: lectures, conferences, reading, e-learning, role-playing, case analysis, job rotation, quality circles, survival training, *self-coaching*, *coaching*, *e-coaching*, mentoring or learning by doing. (Musioł-Urbańczyk, 2010). The choice of the appropriate method depends on many factors. What should be taken into account first is the type of competence to be improved and the preferred, individual learning style of a given person (Musioł-Urbańczyk, 2010).

The specificity of intercultural competencies results in a specific typology of intercultural training, which should be supplemented with several non-standard areas. These include: information training, attribute training, cultural awareness training, conscious behaviour modification, experiential learning and interactive behaviour. Below is a brief description thereof.

Information training involves making the managers aware of the socio-economic conditions that prevail in a given country and explaining the reasons for experiencing culture shock. They usually take the form of traditional lectures, often supported by audiovisual recordings.

Attribute training is a method of the so-called cultural assimilation, which enables the adoption of international standards through the analysis of critical situations (a variant of *case study*).

Cultural awareness training involves making people aware of cultural differences by analogy to the values specific to their own culture and by making participants familiar with the basics of international relations.

Training in the modification of conscious behavior is a method of teaching by solving various adaptive problems. Learning through experience, on the other hand, involves explaining cultural differences through active participation in simulation games that enable direct contact with another culture.

The interactive approach includes solutions that allow participants to interact with representatives of culturally different countries, which is to contribute to shortening the time needed for full adaptation when taking up a foreign position (Beniek, Steinerowska, 2014; Schroeder, 2000).

To sum up, intercultural training aimed at developing "global minds" is conducted using a wide set of tools, including both traditional and modern training techniques that range from classic lectures or simulations to language training, knowledge exchange platforms, videoconferencing and online advisory (Rakowska, 2007; Król, 2016). More frequently, appropriate educational methods include: work in culturally diverse teams, implementing international projects or occasional trips abroad, aimed at familiarizing the managers with the target environment (Rakowska, 2007; Bieniek, Steinerowska, 2014).

People with a well-developed awareness of their own intercultural competence are more flexible, tolerant, and distanced from using stereotypical thinking and prejudices. Eliminating these barriers promotes effective communication and building relationships within the team.

This is a step towards effective cooperation and openness to changes (Król, 2016; Kacprzak, Król, 2015).

In addition to training in cultural differences, language courses and training in disciplines such as international law, stress management, and e.g. *savoir-vivre* in multicultural business are also important (Rakowska, 2007; Król, 2016; Bieniek, Steinerowska, 2014).

Table 2.

Improving managerial competencies at universities fit for the 21st century

Item	UP Wrocław	SGGW Warszawa	UP Poznań	UR Kraków	UP Lublin	UP-H Siedlce
Employment of foreigners	yes	yes	yes	yes	yes	yes
International exchange	yes	yes	yes	yes	yes	yes
Foreign trips of scientific staff	yes	yes	yes	yes	yes	yes
International projects	yes	yes	yes	yes	yes	yes
Working in culturally diverse teams	yes	yes	yes	yes	yes	yes
Knowledge exchange platforms	yes	yes	yes	yes	yes	yes
Cooperation and openness to change	yes	yes	yes	yes	yes	yes
Training and language courses	yes	yes	yes	yes	yes	yes

Source: author's own study based on the websites of agricultural universities.

Each of the universities indicated in table 2 fits into the concept of society 5.0 or a society of imagination, a society using modern technologies and modern teaching techniques.

To sum up, a manager's work requires continuous improvement of general and specialized knowledge, acquisition and development of new skills and managerial competencies. Managers must constantly be ready to adopt new ideas, technologies, structures, good economic practices and cultural values; they must seek opportunities for permanent learning. It is their responsibility to establish the standards of values and behaviour required by the institution. Hence, it is necessary to constantly improve the in-depth knowledge of the institution and its area of operation, while striving for the highest possible efficiency and dedication at work, responsibility for one's own actions and the work of one's subordinates, sensitivity to human affairs, interpersonal and intercultural problems, tolerance towards different cultures, supporting and stimulating the development of colleagues and subordinates (Żukowski, 2008).

8. Summary

It has become an essential requirement in the face of changes taking place in organizations for the managers to have cultural competence. Functioning in a culturally different world has become a reality. These changes were also gradually noticed in all agricultural universities. Curriculums have changed and a trend related to intercultural competencies can be clearly seen in the implementation of individual subjects. When analyzing the profile of graduates from

particular fields, the emphasis on key cultural competencies can also be noticed. International conferences and seminars are systematically organized at universities, and the publications issued are an important instrument for developing this type of competencies. Also, by undertaking studies with foreigners, cooperation with foreign lecturers and international projects, the students have contact with representatives of different cultures and have the opportunity to practically develop intercultural competencies and recognize their essence and importance. With reference to the above considerations, it should be stated that it is not an overstatement to say that Polish agricultural universities are tailored for the 21st century and fit into the concept of society 5.0.

This article certainly does not exhaust the topic, but it is undoubtedly a basis for opening a discussion in this area, especially in matters of improving activities related to the development of competencies, especially the cultural competencies of future managerial staff and the development of higher education.

References

1. Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, Vol. 17, No. 1, pp. 99-120.
2. Bieniek, I., Steinerowska, S. (2014). Kompetencje międzykulturowe na mapie kompetencji zawodowych menedżera. *Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie*, Iss. 71, pp. 33-46.
3. Dołęga, E. *Kompetencja międzykulturowa*. Retrieved from: <http://manager.nf.pl/kompetencja-miedzykulturowa>, 12.11.2023.
4. Du Vall, M. (2019). Super inteligentne społeczeństwo skoncentrowane na ludziach, czyli o idei społeczeństwa 5.0 słów kilka. *Państwo i Społeczeństwo*, Vol. XIX, No. 2, doi: 10.34697/2451-0858-pis-2019-2-001.
5. *Encyklopaedia PWN, Kompetencja kulturowa*. Retrieved from: <http://encyklopedia.pwn.pl/haslo/3924603/kompetencja-kulturowa.html>, 25.11.2023.
6. Filipowicz, G. (2004). *Zarządzanie kompetencjami zawodowymi*. Warszawa: PWE.
7. Jabłoński, M. (2009). *Kompetencje pracownicze w organizacji uczącej się. Metody doskonalenia i rozwoju*. Warszawa: C.H. Beck.
8. Kacprzak, M., Król, A. (2015). Kapitał ludzki na rynku pracy. *Turystyka i Rozwój regionalny*, No. 4, pp. 33-44.
9. Kacprzak, M., Król, A., Wielewska, I. (2017). Human Capital on the European Labour Market. *Scientific Journal Warsaw University of Life Sciences – SGGW. Problems of World Agriculture*, Vol. 17(XXXII), No. 4, pp. 143-150.

10. Kania, S. (2015). Przywódca jako kreator zmian w organizacji. *Management Forum*, Vol. 3, No. 2, pp. 38-43.
11. Król, A. (2016). Koncepcje zarządzania kapitałem ludzkim w aspekcie procesu globalizacji i kształtowania kultury organizacji. *Zarządzanie. Teoria i Praktyka*, No. 4(18), pp. 59-66. Warszawa: Wyższa Szkoła Menedżerska w Warszawie.
12. Musioł-Urbańczyk, A. (2010). *Kompetencje kierownika projektu i możliwości ich kształtowania*. Gliwice: Wydawnictwo Politechniki Śląskiej.
13. Nikitrowicz, J., Młynarczuk-Sokołowska, A., Namiotko, U. (2019). *Przestrzenie międzykulturowe w badaniach i praktyce edukacyjnej*. Białystok: Uniwersytet w Białymstoku.
14. Nowakowski, M. (1999). *Wprowadzenie do zarządzania międzykulturowego*. Warszawa: Difin.
15. Parsloe, E., Wray, M. (2002). *Trener i mentor*. Kraków: Oficyna Ekonomiczna.
16. Pochtowski, A. (2007). *Zarządzanie zasobami ludzkimi: strategie, procesy, metody*. Warszawa: PWE.
17. Rakowska, A. (2007). *Kompetencje menedżerskie kadry kierowniczej we współczesnych organizacjach*. Lublin: Wydawnictwo Uniwersytetu Marii Curie-Skłodowskiej.
18. Rybak, A. *Spółeczeństwo 5.0, czyli nowe kompetencje potrzebne od zaraz*. Retrieved from: <https://pl.linkedin.com/pulse/spo%C5%82ecze%C5%84stwo-50-czyli-nowe-kompetencje-potrzebne-od-zaraz->, 25.11.2023.
19. Sajkiewicz, A. (1999). *Zasoby ludzkie w firmie*. Warszawa: Poltext.
20. Schroeder, J. (2000). *Zarządzanie kadrą w przedsiębiorstwie międzynarodowym*. Poznań: Wydawnictwo Akademii Ekonomicznej.
21. Stańczyk, I. (2018). *Wsparcie organizacyjne menedżerów*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
22. Stor, M. (2009). Wyzwania wobec międzynarodowej kadry menedżerskiej w gospodarce opartej na wiedzy. In: T. Kupczyk (Ed.), *Uwarunkowania sukcesów kadry kierowniczej w gospodarce opartej na wiedzy* (pp. 37-42), Warszawa: Difin.
23. Thomas, A. (2003). Interkulturelle. Kompetenz – Grundlagen, Probleme und Konzepte. *Erwägen Wissen Ethik- Streitforum für Erwägungskultur*, No. 14, pp. 137-228.
24. Tomański, J. *Japoński człowiek nowej ery, czyli społeczeństwo 5.0*. Retrieved from: <https://sektor3-0.pl/blog/japonski-czlowiek-nowej-ery-czyli-spoleczenstwo-5-0/>, 25.11.2023.
25. *Trendy przyszłości – społeczeństwo 5.0*. Retrieved from: <https://biurokarier.p.lodz.pl/studenci-absolwenci/artykuly/trendy-przyszlosci-spoleczenstwo-50-25.html>, 5.11.2023.
26. Twaróg, J., Mieczkowski, P. (2019). *Krótką opowieść o społeczeństwie 5,0 czyli jak żyć i funkcjonować w dobie gospodarki 4,0 i sieci 5G*. Warszawa: Krajowa Izba Gospodarcza Elektroniki i Telekomunikacji Fundacja Digital Poland.

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27. Załona, Z., Lisowska, B. (2018). *Kluczowe kompetencje rozwijane w kształceniu i wychowaniu*. Nowy Sącz: Wydawnictwo Naukowe Państwowej Wyższej Szkoły Zawodowej w Nowym Sączu.
 28. Żukowski, P. (2008). Profesjonalna sylwetka współczesnego menedżera. *Problemy Profesjologii, No. 1*, pp. 25-40.

ANALYSIS OF THE PROBLEM OF TRANSPORT EXCLUSION IN POLAND

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Purpose: The main aim of the article was to conduct a comparative analysis of transport availability divided into voivodeships in Poland. For this purpose, data on the number of regular, urban, suburban and long-distance lines from all voivodeships in Poland was collected and analyzed in terms of changes over the years and existing correlations.

Design/methodology/approach: The research used basic data analysis, sign test and correlation study.

Findings: The problem of transport exclusion in Poland is noticeable. It especially concerns residents of villages and small towns. Research results indicate that this problem has become more serious in recent years due to the reduction in the number of available connections.

Originality/value: The article presents original research on the change in the number of connections over the years and the correlation between the number of inhabitants and the number of bus connections.

Keywords: transport exclusion, passenger transport, city logistics.

Category of the paper: Research paper.

Introduction

Public transport is one of the most essential elements for the dynamic development of the economy. Omissions and neglect of proper organisation of public transport generate a number of problems of transport exclusion. These problems constitute one of the most acute obstacles facing society today. Despite the great importance of public transport and such a significant impact on the quality of life of the inhabitants, the problems of transport exclusion are often overlooked in public discussions.

The aim of this paper is to carry out a comparative analysis of transport accessibility by voivodeship in Poland. The paper was written based on data made available by the Central Statistical Office. The literature research covers the genesis of the concept of the transport

exclusion problem, the concept of passenger transport and issues related to the organisation of passenger transport. The first part of the paper presents a theoretical outline of the problem of transport exclusion in Poland, followed by identification of its potential causes and the effects it may have on society. The research part of the paper includes a comparative analysis of transport accessibility, taking into account the division into individual voivodeships.

Literature review

Public transport as part of meeting the basic needs of society

The role of public transport is one of the key elements in providing mobility to society. It plays an important role in social and economic development. It generates new jobs in the transport services sector, in the industrial sector and influences the development of tourism and trade. Free access to public transport levels existing social inequalities and those generated by its absence, and has a positive impact on social inclusion and poverty reduction. It intensifies the accessibility of cities, suburban and rural regions (European Environment Agency, 2014). It also influences the accessibility of goods and services, thus contributing to the competitiveness of a region. From an urban perspective, it minimises the phenomenon of road congestion, increases the capacity of the road network, has an impact on air quality, greenhouse gas emissions and, consequently, on climate change, public health and the environment (Bastiaanssen, 2021).

From a public transport perspective, the concept of mobility, which is considered to be the ability and freedom to move people, goods or information within a given space, is extremely important. Mobility also refers to the ways in which the public moves from one point to another (International Energy Agency, 2019). Public transport is substitutable to individual transport, and the extent of substitution varies depending on national transport policies (Ustawa z dnia 16 grudnia 2010).

One of the legal acts regulating the operation of public transport in Poland is the Act of 16 December 2010 on public collective transport. The act entered into force on 1 March 2011 and defines the rules for the organisation and operation of regular passenger transport in public collective transport on the territory of Poland, in the following transport modes: road, rail, cable, cable and railway, sea and inland navigation.

Based on the Public Road Transport Act, individual local government units prepare a plan for the sustainable development of public transport. Such a plan specifies, among other things: the transport network on which transport is planned, the assessment and forecast of transport needs, the issues of financing transport services, the principles of organisation of transport,

the expected standard of transport services and the manner of organisation of the passenger information system.

The existence and operation of public transport is a response to existing transport needs. Within the settlement pattern, people's mobility needs related to their daily social, cultural or recreational life are predominant. The sources of transport needs vary widely and depend on many variables. In the case of passenger transport, factors such as demographic structure or ownership of individual means of transport may be important. An analysis of transport needs is important. The information from the analysis can and should provide the basis for the authorities to act on the transport plan (Rucińska, 2012).

Well-organised public transport has a direct impact on society's living conditions. Its proper organisation has a direct or indirect impact on, among other things (Rydzikowski, 2008):

- reducing unemployment through infrastructure investment,
- reducing the disparities in socio-economic development between regions,
- an increase in the need for associated investment,
- growth in construction investment,
- boosting international cooperation.

One of the most important advantages of public transport is its positive impact on minimising the external costs of transport, e.g. the reduction of CO₂ emissions, pollutants and noise. It is estimated that the use of individual car transport to carry one passenger requires almost three times more energy than a bus journey and about six times more than a train journey (Jakubowski, 2021).

The National Inventory Report 2022 prepared by KOBiZE (Krajowy Ośrodek Bilansowania i Zarządzania Emisjami - the National Balancing and Emissions Management Centre) showed that transport in Poland is responsible for as much as 16.8% of greenhouse gas emissions.

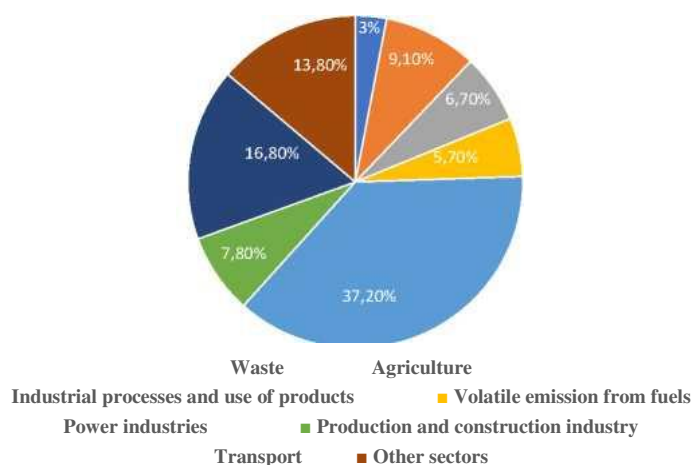


Figure 1. Share of individual source categories in total national greenhouse gas emissions in 2020.

Source: KOBiZE, National Inventory Report 2022 - Synthetic Report, Inventory of greenhouse gas emissions and absorption in Poland for 1988-2020.

According to a 2018 report by the International Energy Agency, public transport is one of the key elements in the fight against climate change and the improvement of air quality especially in urban agglomerations. The study emphasises that the use of public transport, as opposed to individual transport, contributes to the reduction of greenhouse gas emissions and other pollutants (International Energy Agency, 2018). The means of transport used for collective urban transport take up much less space on road networks. It is estimated that there are only around 1.2 to 1.5 passengers per passenger car. This high use of individual means of transport results in a drastic reduction in road capacity. Figure 2 shows the amount of space occupied by individual means of transport for the transport of 30 persons, assuming that there is 1.5 passengers in a passenger car, one bicycle is travelled by one cyclist and one bus is only 75% full.

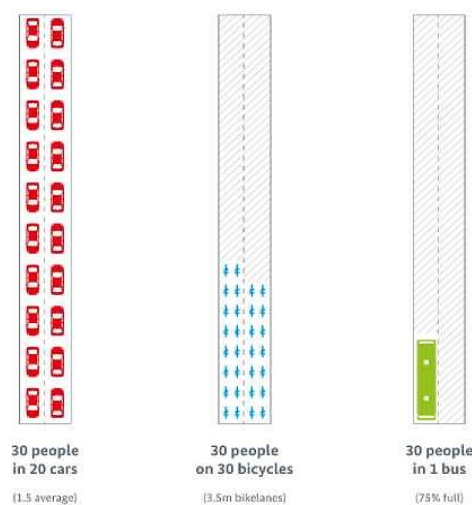


Figure 2. Road space requirements for individual transport modes.

Source: Transformative Urban Mobility Initiative (TUMI), *Road Space Requirements 30 people in 20 cars, 30 people on 30 bicycles, 30 people in 1 bus.*

Public transport and transport exclusion

The inheritance of poverty, lack of access to education, lack of access to adequate health care or unemployment are often cited as causes of various types of social inequality. In view of such serious social problems, it is seldom mentioned that the use of, for example, good educational facilities to obtain the right education or qualifications, attractive jobs or the best health facilities requires adequate transport accessibility. Inadequate access to adequate means of transport disqualifies part of the population from accessing such public services. Transport exclusion is neglected in discussions about the causes of social inequalities, and is undoubtedly one of the reasons behind their occurrence (Komornicki, 2019).

Ombudsman Marcin Wiącek has noted that the problem of transport exclusion is a real obstacle to the realisation of citizens' constitutional rights and freedoms, such as freedom of movement, the right to health care, the right of persons with disabilities to assistance from public authorities in social communication, the right to education and the right to benefit from

public services guaranteeing a decent standard of living. The further away from larger towns or metropolitan areas one travels, the more often rural residents point to the numerous inconveniences related to the lack of an adequate transport connection. Organising and managing public transport is the responsibility of the organisers at the various levels of local government (Starzewski, 2021). In the context of the problem of transport exclusion, the notion of accessibility is extremely important; it refers to the degree of ease with which one can get to a given place, thanks to the existence of appropriate infrastructure and transport services. A particular area is more accessible in terms of transport, the more points it can be reached quickly and efficiently (Ministry of Transport, 2020) Figure 3 shows the distribution of transport accessibility when using bus services for long-distance travel. There is considerable variation between the different regions of Poland. The greatest accessibility is characteristic for large urban agglomerations, and the least for regions distant from these agglomerations.

Transport exclusion is understood as depriving the inhabitants of a given area of the possibility of using public transport. This phenomenon includes mainly limited access to roads, but also to railways, pavements or cycle paths (Dulak, 2018).

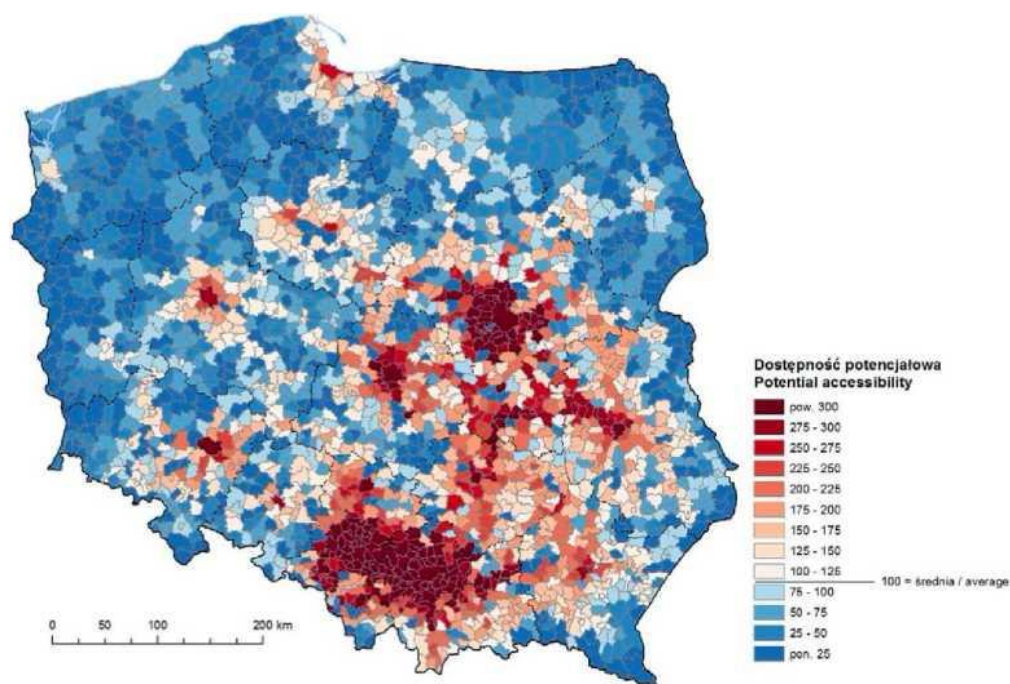


Figure 3. Availability of bus transport for long journeys in Poland in 2018.

Source: Rosik, Pomianowski, Kołoś, Guzik, Goliaszek, Stępnia, Komornicki, 2018 .

Demographic changes and the depopulation of society in mainly rural areas, but also in smaller towns, were also one of the factors contributing to the widening of the problem of transport exclusion. The process of depopulation of rural areas has been ongoing in Poland for several decades. The pace and scale of this process was directly dependent on the economic development of individual regions. Rural depopulation contributed to a decrease in the number of passengers on rural routes, which resulted in their closure. The dispersion of buildings in Poland did not facilitate the optimisation of routes. Rural depopulation and reduced

accessibility of public transport significantly hindered and still hinders daily life for rural residents (Wesołowska, 2016).

The effects of the problem of transport exclusion in Poland are widespread. The Jagiellonian Club estimated that transport organised by local authorities does not exist in an area currently inhabited by around 13.8 million people, which gives us around 36.54% of the Polish population. The scale of the problem is enormous, and it is very often overlooked in social discussions related to social exclusion. According to Jagiellonian Club estimates, between 1993 and 2016 non-urban regular bus transport lost about 75% of its customers, with a reduction of about 50% in the availability of the offer. Since 2004, the average filling of buses has decreased by 40% (Dulak, 2018).

The effects of transport exclusion are often the stories of the people affected. In her reportage book *Nie zdążyć* Olga Gitkiewicz presents stories of people affected by transport exclusion. The society affected by this problem mentions that the lack of adequate transport forces people to give up their jobs, better educational facilities, extra-curricular activities, doctor's appointments, office visits and much more. Transport exclusion contributes to permanent unemployment for people who find it unprofitable to work in remote areas if public transport is not provided in the municipal area. It also proves impossible to get to work if the last return fare is at 3 pm or if it only runs on school days. The removal of direct transport to larger towns also removes the possibility of choosing better educational facilities or taking advantage of the extra activities that often take place in the afternoon. The lack of adequate transport accessibility thus restricts the life choices of young people of school age. A significant effect of the decommissioning is also the functional degradation of smaller towns or district towns, which used to serve as local centres to which residents travelled by public transport. The removal or reduction of connections may result in residents being deprived of access to basic services that enable them to function properly. The lack of a connection to the nearest health centre can result in reduced health. Removal of connections takes away the ability to get to an office, post office or bank, leaving non-motorised people relying solely on the goodwill of those with cars. Lack of access to basic services results in social isolation and reduced quality of life. This problem very often affects older people who do not have a car. The elimination of connections also results in migration from smaller to larger towns. Centralisation forces people to change their place of residence or work. This phenomenon also influences the spatial degradation of smaller towns. The answer to the lack of access to public transport is the choice of individual transport, most often in the form of a purchased personal car. This form of transport is very often chosen by the public, as can be seen in the statistics showing the number of cars per number of inhabitants (Gitkiewicz, 2019; Kaczorowski, 2019).

The lack of well-developed public transport also affects the country's economic development and tourism. Well-developed communication enables tourists to move freely and reach their destination. Highly developed public transport has a direct impact on the living conditions of the population. Public transport assists in generating a higher national income and

supports economic development through its direct impact on unemployment levels, the reduction of social disparities, the need for accompanying and construction investments, and international cooperation.

Methodology of the study

The analysis carried out below aims to present the accessibility of transport in Poland by voivodeships for the period 2014-2021. The data adopted for the analysis was taken from the official website of the Central Statistical Office in Poland. The research focuses on road transport, as it is the most commonly used transport mode in Poland.

The analysis was carried out using mathematical methods, the sign test, forecasting and correlation. The mathematical methods made it possible to determine the percentage decrease/increase in the number of connections and the distances over which connections are made. The sign test is based on the sign of the differences between successive pairs of results. It involves determining the number of pluses and minuses and comparing them with the theoretical value given in the relevant tables. The sign test made it possible to determine whether the hypothesis that there was a significant decrease in the number of connections in most voivodeships was true. Correlations between the population of a province and the number of connections were then examined. The sequence of analysis steps is shown in Figure 4.

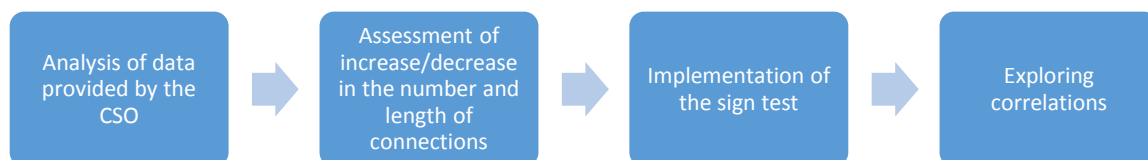


Figure 4. Subsequent stages of the study.

Source: own work.

Analysis of the problem of transport exclusion- results

The comparative analysis began with the collection and organisation of data available from the Central Statistical Office (CSO), followed by the creation of a table which included the number of inhabitants in the region, the number of regular lines and the length of regular lines in the years 2014 and 2021 respectively. The results are presented in Table 1.

Table 1.
Regular lines in 2014 and 2021 by voivodeship

Voivodeship	Number of inhabitants		Regular transport lines in total [pcs]		Difference		Regular transport lines in total [km]		Difference	
	2014	2021	2014	2021			2014	2021		
Dolnośląskie	2909997	2897700	1 243	782	-461	-37%	61 840	30 551	-31 289	-51%
Kujawsko-Pomorskie	2092564	2912200	2 148	904	-1 244	-58%	95 689	35 304	-60 385	-63%
Lubelskie	2156150	2038300	1 218	646	-572	-47%	67 412	31 425	-35 987	-53%
Lubuskie	1021470	1178600	743	543	-200	-27%	30 369	16 797	-13 572	-45%
Łódzkie	2513093	1821895	865	567	-298	-34%	45 252	23 103	-22 149	-49%
Małopolskie	3360581	3430400	252	118	-134	-53%	10 533	5 447	-5 086	-48%
Mazowieckie	5316840	5512800	2 390	890	-1 500	-63%	132 715	58 316	-74 399	-56%
Opolskie	1004416	948600	393	512	119	30%	12 417	14 264	1 847	15%
Podkarpackie	2129294	2085900	674	799	125	19%	30 999	35 378	4 379	14%
Podlaskie	1194965	1148700	642	364	-278	-43%	38 793	27 079	-11 714	-30%
Pomorskie	2295811	2358700	815	588	-227	-28%	39 455	22 489	-16 966	-43%
Śląskie	4599447	4375900	693	335	-358	-52%	35 799	11 006	-24 793	-69%
Świętokrzyskie	1268239	1187700	411	238	-173	-42%	24 891	9 572	-15 319	-62%
Warmińsko-Mazurskie	1446915	1374700	759	335	-424	-56%	44 345	13 943	-30 402	-69%
Wielkopolskie	3467016	3500000	1 262	884	-378	-30%	54 093	30 324	-23 769	-44%
Zachodniopomorskie	1718861	1650000	990	800	-190	-19%	64 010	33 913	-30 097	-47%

Source: own work.

In 2014, Mazowieckie Province had the highest number of regular communication lines (2390 pcs), while Małopolskie Province had the lowest (252 pcs.). In 2021, no voivodeship had more than one thousand connections, with the highest number (904 pcs.) in the Kujawsko-Pomorskie voivodeship and the lowest (118 pcs.) in the Małopolskie voivodeship. As can be seen from Table 1, fourteen out of sixteen voivodeships saw a decrease in the number of regular transport lines in 2021 compared to 2014. The largest decrease amounted to 63% and concerned the Mazowieckie voivodeship, in which the number of regular connections decreased over the period under study from 2390 in 2014 to 890 in 2021. Only in two voivodeships can an increase in the number of connections be observed, by 30% in the Opolskie voivodeship and 19% in the Podkarpackie voivodeship. The situation is similar for the length of regular transport connections. Here, too, a decrease in the length of routes was recorded in 87.5% of the voivodeships, with the greatest decrease of almost 70% in the Śląskie and Warmińsko-Mazurskie voivodeships, which means that the length of routes decreased by 30402 km in the Śląskie voivodeship and 24 793 km in the Warmińsko-Mazurskie voivodeship, respectively. An increase in the length of regular transport routes was recorded in the Opolskie and Podkarpackie voivodeships. The collected data was then sorted out and the number and length of long-distance bus routes in the individual provinces were analysed (Table 2).

Table 2.
Long-distance lines in 2014 and 2021 by voivodeship

Voivodeship	Number of inhabitants		Long-distance lines [km]		Difference		Regional lines [km]		Difference	
	2014	2021	2014	2021			2014	2021		
Dolnośląskie	2909997	2897700	21 673	4 626	-17 047	-79%	10 518	3 518	-7 000	-67%
Kujawsko-Pomorskie	2092564	2912200	16 298	624	-15 674	-96%	25 684	4 982	-20 702	-81%
Lubelskie	2156150	2038300	18 185	6 711	-11 474	-63%	17 150	6 284	-10 866	-63%
Lubuskie	1021470	1178600	5 105	0	-5 105	-100%	10 666	4 820	-5 846	-55%
Łódzkie	2513093	1821895	12 081	1 767	-10 314	-85%	13 225	5 357	-7 868	-59%
Małopolskie	3360581	3430400	495	275	-220	-44%	4 178	1 854	-2 324	-56%
Mazowieckie	5316840	5512800	42 188	28 972	-13 216	-31%	31 553	8 073	-23 480	-74%
Opolskie	1004416	948600	507	0	-507	-100%	2 814	1 090	-1 724	-61%
Podkarpackie	2129294	2085900	7 376	5 853	-1 523	-21%	6 347	6 819	472	7%
Podlaskie	1194965	1148700	15 497	5 291	-10 206	-66%	9 227	4 146	-5 081	-55%
Pomorskie	2295811	2358700	8 056	370	-7 686	-95%	10 616	7 161	-3 455	-33%
Śląskie	4599447	4375900	11 048	1 179	-9 869	-89%	5 694	2 207	-3 487	-61%
Świętokrzyskie	1268239	1187700	11 431	4 337	-7 094	-62%	4 232	373	-3 859	-91%
Warmińsko-Mazurskie	1446915	1374700	13 604	2 118	-11 486	-84%	13 773	3 515	-10 258	-74%
Wielkopolskie	3467016	3500000	6 954	0	-6 954	-100%	14 359	3 641	-10 718	-75%
Zachodniopomorskie	1718861	1650000	17 963	432	-17 531	-98%	22 324	7 570	-14 754	-66%

Source: own work.

Table 2 shows that all the voivodeships surveyed recorded a decrease in the number of longdistance bus lines; moreover, in as many as three voivodeships (Opolskie, Lubuskie and Wielkopolskie) the decrease reached 100%, which means that the lines, all the lines that existed in 2014, were removed completely. Not much better, is the question of the length of regular longdistance lines, only in one of the sixteen provinces a small 7% increase in the length of routes can be seen. Moreover, in 87.5% of the provinces, the decrease was more than 50% over just seven years. The next stage of the analysis was to collect and organise data on the number of urban and suburban lines in each voivodeship in the years 2014 and 2021. The results are presented in Table 3.

Table 3.
Suburban lines and urban lines in 2014 and 2021 by voivodeship

Voivodeship	Number of inhabitants		Suburban lines [pcs]		Difference		Urban lines [pcs]		Difference	
	2014	2021	2014	2021			2014	2021		
Dolnośląskie	2909997	2897700	1 004	687	-317	-32%	25	17	-8	-32%
Kujawsko-Pomorskie	2092564	2912200	1 723	845	-878	-51%	7	0	-7	-100%
Lubelskie	2156150	2038300	900	566	-334	-37%	0	0	0	-
Lubuskie	1021470	1178600	567	436	-131	-23%	9	0	-9	-100%
Łódzkie	2513093	1821895	674	486	-188	-28%	12	15	3	25%
Małopolskie	3360581	3430400	193	98	-95	-49%	15	0	-15	-100%
Mazowieckie	5316840	5512800	1 864	736	-1 128	-61%	32	1	-31	-97%
Opolskie	1004416	948600	332	487	155	47%	9	11	2	22%
Podkarpackie	2129294	2085900	566	700	134	24%	4	0	-4	-100%
Podlaskie	1194965	1148700	462	303	-159	-34%	6	4	-2	-33%
Pomorskie	2295811	2358700	631	466	-165	-26%	20	5	-15	-75%
Śląskie	4599447	4375900	569	271	-298	-52%	16	26	10	63%
Świętokrzyskie	1268239	1187700	332	222	-110	-33%	0	0	0	-
Warmińsko-Mazurskie	1446915	1374700	482	285	-197	-41%	32	0	-32	-100%
Wielkopolskie	3467016	3500000	1 048	824	-224	-21%	6	0	-6	-100%
Zachodniopomorskie	1718861	1650000	676	678	2	0%	15	3	-12	-80%

Source: own work.

Suburban lines are lines within 50-60km connecting rural settlements with municipal, district and provincial centres. In both 2014 and 2021, Kujawsko-Pomorskie voivodeship had the highest number of suburban lines (1723 pcs. in 2014, 845 pcs. in 2021). Unfortunately, over the years, all voivodeships have seen a significant decrease in the number of suburban lines, which in the extreme case was as high as 61%. The Mazowieckie (32 pcs.) and Warmińsko-

Mazurskie (32 pcs.) voivodeships had the largest number of urban bus lines, understood as lines within cities with possible crossing of city boundaries to the nearest catchment area with a length of 5-10 km, in 2014. From 2014 to 2021, 5 voivodeships have completely eliminated urban lines. No city lines are in place in the Świętokrzyskie and Lubelskie voivodeships. The Śląskie voivodeship, on the other hand, recorded a 63% increase in the number of urban lines, which may be due to the reduction in the length of transport routes and the conversion of suburban lines into urban ones.

The next step in the analysis of the problem of transport exclusion in Poland was to perform a sign test. The sign test made it possible to verify the null hypothesis that there was no significant decrease in the number of regular bus lines in total in individual voivodeships over the study period. This test consists of determining the number of pluses and minuses between successive pairs of results and comparing them with table values. The test was performed using Statistica and the analysis was carried out for the years 2014 and 2021. The result is shown in Table 4.

Table. 4

The result of the Statistica program's sign test

Pair of variables	Sign test (number of regular bus lines) The indicated results are significant $p < .5000$			
	Number of voivodeships	Percentage $v < V$	Z	p
Year 2014 and 2021	16	12.50000	2.750000	0.005960

Source: compiled using Statistica.

Sixteen groups (voivodeships) took part in the test. The number of variables for which the difference has a negative value was 12.5%, and the value of the sign test was 2.75. The significance level of the test was 0.005960, which means that $p < 0.05$, so there are grounds for rejecting the null hypothesis, and this means that there is likely to have been a significant decrease in the number of regular bus routes.

The next stage of the research involved examining the correlation between the population in the voivodeships and the number of connections. The analysis was carried out first for the year 2014 and then for the year 2021, both using the Sttistica programme. The results are shown in Figures 6, 7 and table 6, 7.

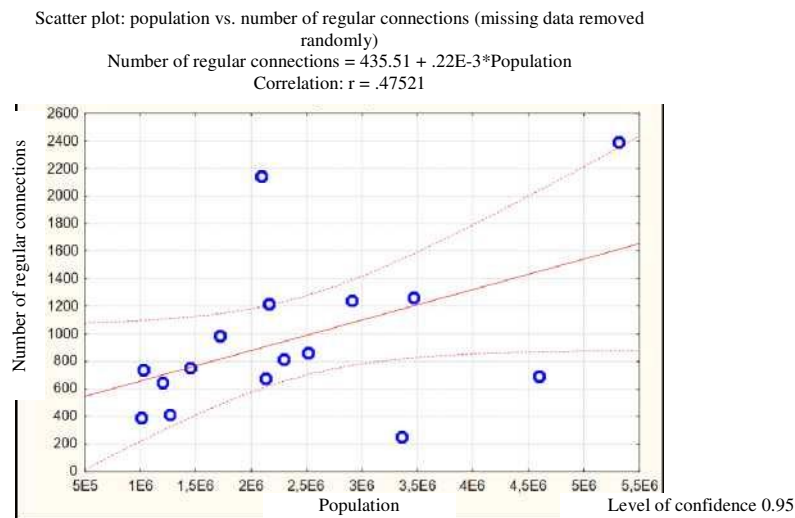


Figure 6. Study of the correlation between population and number of connections in 2014 - scatter plot.
 Source: compiled using Statistica.

Table 6.

Study of the correlation between population and number of connections in 2014

X variable and Y variable	Correlations (correlation study) Identified correlation indexes are significant $p < .05000$ (missing data randomly removes)						
	Average	St. deviation	r(X, Y)	r2	t	p	Significant
Population	2405979	1261494					
Regular connections	969	588	0.475215	0.225829	2.020857	0.062848	16

Source: compiled using Statistica.

As can be seen from table 6, the 42nd value of the correlation coefficient is 0.475 indicating a moderate linear relationship, population to number of regular connections in 2014. The coefficient of determination is 0.2258, which means, the number of regular connections is only explained by 22.58% of the variation in population. The significance coefficient p, is greater than 0.05, which means that, the correlation coefficient is not significantly different from 0.

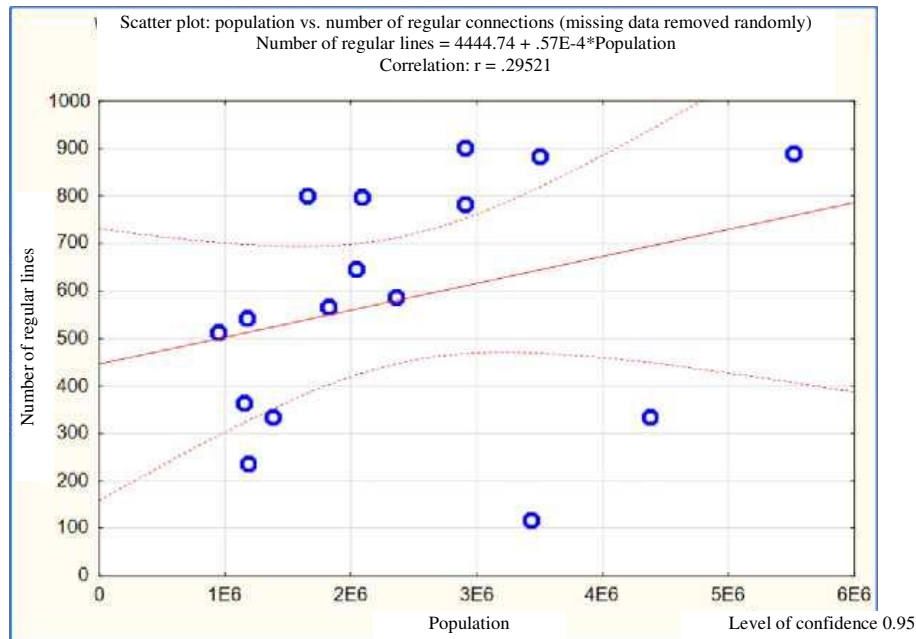


Figure 7. Study of the correlation between population and number of connections in 2014 - scatter plot.
 Source: compiled using Statistica.

Table 7.

Study of the correlation between population and number of connections in 2014

X variable and Y variable	Correlations (sheet 5) Identified correlation indexes are significant $p < .05000$ (missing data randomly removes)						
	Average	St. deviation	r(X, Y)	r2	t	p	Significant
Population	2401381	1295850					
Regular connections	582	250	0.295211	0.087149	1.156101	0.266988	16

Source: compiled using Statistica.

As can be seen from Figure 29, the 42nd value of the correlation coefficient is 0.2952 indicating a weak linear relationship, population to number of regular connections in 2021. The coefficient of determination is 0.0871, which means, the number of regular connections is explained only in 8.71% by the variation in population. The significance coefficient, p, is greater than 0.05, which means that, the correlation coefficient is not significantly different from 0.

Conclusions

The problem of transport exclusion is not a new one, but over the years, we can observe its escalation and how its impact on the surrounding area is changing. The extent of the occurrence of the transport problem depends on the level of transport accessibility, which has changed a lot over the years analysed. Undoubtedly, from 2014 to 2021 the number of regular bus routes,

the length of transport routes, the number of urban and suburban transport lines in each province is decreasing. The results show that the number of inhabitants has a weak influence on the number of regular transport connections in the regions concerned. It should therefore be considered which factors, criteria should be taken into account when organising a network of connections in individual voivodeships. In order to counteract transport exclusion, it is necessary to study the transport needs of the inhabitants, especially in less populated regions with dispersed housing, analyse them and then organise public transport in accordance with the results of the study. Adequate financial support is also necessary, especially for less profitable routes. Less densely populated regions should be provided with new connections, enabling their inhabitants to function properly and to have free access to public services such as health, culture or education and to commute to work.

References

1. Bastiaanssen, J., Johnson, D., Lucas, K. (2021). Does better job accessibility help people gain employment? The role of public transport in Great Britain. *Urban Studies Journal*.
2. Dulak, M., Jakubowski, B. (2018). *Publiczny transport zbiorowy w Polsce. Studium upadku*.
3. Dulak, M., Jakubowski, B. *Publiczny transport zbiorowy w Polsce. Studium upadku*. klubjagielloński.pl, 9.04.2023.
4. European Environment Agency (2014). Focusing on environmental pressures from long-distance transport. TERM 2014: transport indicators tracking progress towards environmental targets in Europe. *EEA Report, No. 7*.
5. <https://klubjagielloński.pl/2018/04/17/publiczny-transport-zbiorowy-w-polsce-studium-upadku/>
6. International Energy Agency (2018). *Global Energy & CO₂ Status Report. The latest trends in energy and emissions in 2018*.
7. International Energy Agency (2019). *Global EV Outlook 2019: Scaling-up the transition to electric mobility*.
8. Jakubowski, B. (2021). Green transport as a key to a sustainable economy, *Report, 4, Green conservatism. Challenges and recommendations in 10 key areas*. Krakow: Jagiellonian Club Centre for Analysis.
9. Kaczorowski, J. (2019). *Wykluczeni. O likwidacji transportu zbiorowego na wsi i w małych miastach*.
10. Komornicki, T. (2019). *Polska sprawiedliwa komunikacyjnie. Institute of Geography and Spatial Planning*. Warsaw: Polish Academy of Sciences.

11. Ministry of Transport. *Construction and the Maritime Economy: Glossary of the Transport Development Strategy to 2020*. Warszawa, p. 5.
12. Rosik, P., Pomianowski, W., Kołoś, A., Guzik, R., Goliaszek, S., Stępnia, M., Komornicki, T. (2018). *Dostępność gmin transportem autobusowym*. Prace Komisji Geografii Komunikacji PTG. Warsaw.
13. Rucińska (2012). *Polski rynek usług transportowych*. Warszawa: PWE, pp. 48-49.
14. Rydzkowski, W., Wojewódzka- Król, K., Babis, H. (2008). *Transport*. Warszawa: PWN.
15. Starzewski, Ł. *Zapewnić każdemu transport publiczny choć do siedziby władz jego gminy - RPO o wykluczeniu transportowym*. Stanowisko Ministra Infrastruktury. Biuletyn Informacji Publicznej RPO, <https://bip.brpo.gov.pl/pl/content/rpo-wykluczenie-komunikacyjne-zapewnic-transport-publiczny-choc-do-siedziby-gminy>
16. Ustawa z dnia 16 grudnia 2010 r. o publicznym transporcie zbiorowym (JoL 2022 item 1343).
17. Wesołowska, M. *Depopulacja wsi- szansa czy zagrożenie dla przestrzeni wiejskiej?* Maria Curie Skłodowska University in Lublin, pp. 251-252.

IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS AT A MANUFACTURING ENTERPRISE THROUGH RES¹ ENERGY OPTIMISATION. CASE STUDY OF NORTHWOOD COMPANY

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Purpose: The objective of the paper is to present and evaluate the realization of Agenda 2030 as well as the implementation of the EU goals concerning sustainable development through energy optimisation at Northwood manufacturing enterprise.

Design/methodology/approach: For the purpose of accomplishing the assumed goal first of all selected aspects of the literature of the subject on sustainable development issues, energy optimisation and enterprise competitiveness were presented. The next step entailed a case study analysis of Northwood company operations. In the presented case study energy optimisation activities were demonstrated.

Findings: Implementation of RES energy optimisation at Northwood company has significantly affected the company's development, increasing the quality and number of fulfilled orders at substantially reduced costs of electrical energy. The incorporation of sustainable development goals in the company's process also indicates positive results.

Practical implications: The results of the analysis are a signal to all institutions and individuals, including managers, people managing production companies, that for the purpose of a company's development it is worth using modern tools and implementing sustainable development goals, which include, inter alia, energy optimisation through the employment of a company's own photovoltaic plant.

Originality/value: The article can be an example and inspiration for similar enterprises.

Keywords: sustainable development, energy optimisation, sustainable production, corporate social responsibility.

Category of the paper: case study.

¹ RES – Renewable Energy Sources.

1. Introduction

An increase in the demand for products of socially responsible companies caused by growing social awareness and responsibility results in a change of conditions in which such enterprises operate. “Green development” of the economy involving effective implementation of sustainable development goals becomes a new path of development. Sustainable development is a socio-economic growth of contemporary society involving the fulfilment of its needs in such a way that does not diminish the possibility of satisfying the needs of future generations. Accomplishing the idea of a sustainable development requires: global conservation of the natural environment, solidarity in relations between various countries, especially rich and poor ones, as well as solidarity with future generations and treating the planes of economic, political, social and ecological activities as being interdependent. The concept of sustainable development is understood as a process within the scope of which it becomes possible to achieve high quality of life in the long term while simultaneously respecting natural and environmental resources and at the same time accounting for growth in the social, economic and spatial spheres.

One of the areas of the economy in which the impact of sustainable development can be noticed is manufacturing of wooden packaging, which plays a crucial role in the contemporary trade and logistics, ensuring the protection and transportation of various products all over the world (Fechner, 2016). An issue gaining importance in the reorganization of production achieved, *inter alia*, through optimisation of processes, including energy optimization (Europe, 2020). For the purpose of this paper the operations of Northwood company were described, a company operating in a sector manufacturing wooden packaging. A great inspiration to implement changes in Northwood towards sustainable energy and production was the long-term cooperation with the Danish company Provipal Aps Mikkel Jorgensen. The EU climate and energy goals implemented in the presented production company translate not only into changes in the operation of a single enterprise, but they also demonstrate the need for undertaking such actions in the entire industrial sector that is the driving force of the economy.

2. Methods

The objective of the paper is to present and evaluate the realization of Agenda 2030 as well as the implementation of the EU sustainable development goals through energy optimisation in Northwood production enterprise.

For the purpose of accomplishing the assumed goal first of all selected aspects of the literature of the subject on sustainable development issues, energy optimisation and enterprise competitiveness were presented. The next step entailed a case study analysis of Northwood company operations. In the presented case study energy optimisation activities were demonstrated. In that part of the paper the materials provided by Northwood were used and they included the company's internal materials, sales reports and costs reports for the period from 2017 to 2022.

3. Sustainable development, energy optimisation and organisation competitiveness – theoretical aspects

In Gro Harlem Brundtland Report of 1987 of the World Commission on Environment and Development titled "Our Common Future" sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Thereby making economic development with simultaneous environmental and socio-cultural balance a priority goal (Rogall, 2010).

In turn, a new vision of sustainable development outlined in Agenda 2030 focuses on five areas defined as 5P: People, Planet, Prosperity, Peace, Partnership. Within the scope of individual areas, the following action rules were developed (Agenda 2030):

- people – activities aiming at reaching out to excluded groups, creating conditions and opportunities for the use of universal human rights and economic advancements by all people, guaranteeing equal access to economic resources, basic services, land, natural resources, technologies and funds to everyone;
- planet – activities integrating social, economic and environmental aspects of development for the purpose of economic growth, social inclusion, rational use of natural environment resources, achieving better quality of life and solving the problem of poverty;
- prosperity – changes in economies intended to create new jobs, development of sustainable consumption and production, the use of new technologies and business potential, ensuring access to good education, health care, clean water, electricity, transport, telecommunication, facilitating starting up a business, investing, trade exchange and intensive sustainable urban development;
- peace – activities aimed at building peace, efficient, fair and responsible institutions, strengthening the rule of law, social inclusion and co-deciding by relevant institutions supporting government, property rights, freedom of speech and the media, political freedom, access to justice and lack of discrimination;

- partnership – actions for partnership based on solidarity, cooperation, responsibility and transparency between governments, local, regional administration, scientific communities, business and all stakeholders.

Contemporary organisations operating in a turbulent and increasingly more demanding environment are forced to undertake various actions in order for them to achieve a competitive advantage. At the age of sustainable development, which in itself creates certain demands towards an organisation, an organisation's competitive advantage is frequently the result of undertaking multi-dimensional activities. When realizing the activities in the areas of sustainable development in their day-to-day operations, modern organisations try to offer products and services, better than competitive ones, but at the same time suited to the expectations of value-conscious consumers. Competitiveness may reflect not only the way in which a company operates on the market, or its ability to survive on the market, but also its ability to adapt to market demands and effective development in specific circumstances, while simultaneously obtaining profits, benefits and building a market position (Kraszewska, Pujer, 2017; Klima, 2017, 2018).

One of the aspects of a modern company operations entails energy. Contemporary development and economic growth stimulate demand for energy, which is its driving force. Energy also constitutes a basic human need, significantly affecting human well-being. Both the production and the use of energy are inextricably linked to the environment. The most realistic way of reducing CO₂ emissions entails a sustainable energy efficiency strategy in combination with renewable energy sources (Pinault, 2021). The purpose of achieving a balance between the environment protection, social development and economic growth, i.e. the pillars of sustainable development, is the use of renewable energy sources and reducing CO₂ emissions (Regulation of the European Parliament..., 2022), improvement of air quality and limiting the extraction of natural resources (Bansard, Schröder, 2021). Investing into renewable energy sources improves the competitiveness of regions in the international arena, increasing their innovativeness and income, thereby leading to industry development 4.0 (Bianchini et al., 2019).

4. Energy optimisation in terms of organisation independence and good-will improvement - discussion

The assumptions of the green economy, constituting the basis for the concept of sustainable development, include investments and development carried out in a way that limits greenhouse gas emissions² and increases energy efficiency, while simultaneously preventing loss of

² Greenhouse gases are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O).

biodiversity (Greenfield, Weston, 2021). Leaving resources in the natural environment to future generations lies at the basis of the definition of sustainable development, that is why energy optimisation with the use of renewable energy sources is an environmental compromise. The foundation of a model sustainable development entails the development of renewable energy sources and economic growth without damaging the environment, which traditionally goes together with economic growth³ (The 17 goals. Sustainable Development Goals).

Closed circle economy constitutes a significant element, which in practice means protection of the environment, health and economic growth by limiting the use and waste of resources and businesses operating in a closed circle (Kara et al., 2022). Circular economy is a fundamental element of the green economy in the energy sector (Muñoz et al., 2021). A source of energy that carries no risk of depletion constitutes sustainable energy, which provides an answer to humanity's energy needs (Bhowmik, Bhowmik, 2020). Examples of sustainable energy sources include wind, water and the sun, which the society considers to be inexhaustible and available to everyone, despite the fact that the methods of such energy generation are capital intensive (Glorieux, 2022).

An improvement in the efficiency of obtaining energy sources, the use of alternative energy sources, reducing emissivity and the use of new technologies represent the goals of Sustainable Energy Development – the SED. It is an area that concentrates on creating and promoting sustainable energy sources and technologies that minimise the impact on the natural environment. The purpose of the SED is meeting present energy needs, while at the same time minimising greenhouse gases emissions and any other negative impact on the planet. Examples of sustainable energy sources include solar, wind, hydro and geothermal energy (Rosen, 2021). Long-term energy stability as well as energy balance and independence is provided by flexible investment approach and a revision of goals, planning processes and implementation of sustainable energy management. Additionally, one needs to remember, from the point of view of an enterprise, about a flexible investment approach to the realization of intended sustainable development goals (Dyukova et al., 2022). Therefore, it seems that the most profitable and the most constructive manner of meeting the challenges related to high energy prices, energy independence and energy security is introducing eco-power engineering into the concept of sustainable development (Baleta et al., 2019). Striving towards energy independence through the reduction of consumption, diversification of suppliers and obtaining energy from renewable energy sources as well as the concept of sustainable energy security plays an increasingly greater role. The European Commission specifies that by 2030 40% of the energy generated in the European Union countries must originate from renewable energy sources (Adamkiewicz,

³ In September 2015 at a summit in New York, leaders of the UN member states signed a document entitled document “Transformation of our world: Agenda for Sustainable Development – 2030” containing 17 Sustainable Development Goals and 169 actions related thereto, which are to be achieved by all parties – ate governments, international organisations, non-governmental organisations, science and business sectors as well as citizens. They focus on 5 areas: 5xP: people, planet, prosperity, peace, partnership. (The 17 goals, Sustainable Development Goals).

2017), while global energy policy of states such as China, India and African countries will play a decisive role in that regard (Borchielini, Minuto, 2020). In highly developed countries the development of renewable energy sources (RES) is the dominant trend. Investments into RES are energy-friendly, they significantly limit the use of natural energy resources, i.e., oil, coal or gas. The UN Agenda report - Renewable Energy Policy Network for the 21st century (REN 21) demonstrates that 27.7% of globally installed power comes from RES. That share corresponds to 22.8% of global demand for energy. Norway is the country with the highest share of RES in the final gross energy with its 65.5% share of renewable energy in its national energy production (Sowa, 2018).

5. Northwood wooden packaging producer – case study⁴ - results

For the purpose of this paper, in order to demonstrate the effectiveness of the implementation of sustainable development goals through energy optimisation in order to increase organisation's competitiveness, an analysis of Northwood company operations was presented. Northwood is a company based in Strzykocin in the West Pomeranian Province.

Northwood has been linked to the lumber industry from the beginning of its existence, i.e., since 2008. The company has got a modern machinery dedicated to lumber processing and it has got innovative processes of gas driers, enabling the production and sale on the international market of certified pallets bearing an IPPC PL 32 436 mark. Northwood is a manufacturer of wooden pallets for distribution of products of high consumption industry, chiefly: food, chemical, metal industries. Production at the company is carried out in a sustainable fashion from direct preparation of the basic pallet components from certified timber (FSC), i.e., planks, struts from roundwood for their assembly, thermal processing and warehousing. Finished products are stored in a finished products warehouse, where they await collection by clients for no longer than three days. Production is planned in such a way so that finished components are collected by their recipient nearly immediately after their completion and so that they should be delivered to a suitable logistical centre in Germany, Denmark, Norway and Sweden. Thermal processing of wooden pallets plays a significant role, since 95% of orders concerns dried pallets with IPPC certificate. The company manufactures various pallet types differing in their specification, depending on the needs and their load carrying capacity. Specification of a pallet, i.e. its components parts such as upper planks, struts, lower planks, depends on the intended purpose of a given wooden pallet. Production of pallets and their components is typically linked with high demand for energy, which affects the costs of production and which has an ecological impact, particularly if such energy comes from non-

⁴ Prepared on the basis of the data provided by Northwood.

renewable sources. That is why the producer strives to achieve processes optimisation in order to reduce energy consumption and to introduce more sustainable production practices.

On the grounds of the premises presented in the theoretical part, the following goals for analysing Northwood operations have been set:

1. assessment of Northwood's energy resources prior to the introduction of RES photovoltaic power plant;
2. assessment of Northwood's energy resources after the introduction of RES photovoltaic power plant;
3. evaluation of advantages and disadvantages of the implementation of sustainable development goals through energy optimisation and the use of RES photovoltaic power plant.

The analysis was conducted with regard to the period from 2017 to 2022. The study took into account the data concerning: production volume, sales volume of finished products, energy demands and production costs related to energy. The data was compared for two periods:

1. the first one, comprising the years of 2017-2019, prior to the use of energy optimisation in the form of photovoltaic plant, and
2. the second one, comprising the years of 2020-2022, following energy optimisation and the incorporation of a photovoltaic plant into the production process.

As previously mentioned, Northwood company has been operating since 2008. In line with Agenda 2030, Northwood has been realizing the sustainable development goals already since 2016 by:

- organising sustainable transport,
- organising sustainable production,
- organising processing including heat recovery,
- exchanging machinery,
- implementing innovations concerning product certification,
- implementing the 3R principle (reduce, reuse, recycle).

In pursuance of goal No. 12 of Agenda 2030 concerning responsible consumption and production, since 2016 Northwood company has been striving to produce more while using less resources and reducing the scale of degradation and pollution, and simultaneously improving their products quality. Sustainable production is additionally linked with promoting effective use of energy. The year 2019 was a breakthrough moment in Northwood in that regard, when it was decided that a new tool in the accomplishment of sustainable development goals will involve the implementation of energy optimisation by building and installing a photovoltaic plant (RES) for the needs of own production. To that end, an analysis was carried out in order to choose the best suited installation for production needs. The choice of the installation was made by specialised companies on the grounds of an analysis of energy consumption data from previous years (the analysis encompassed the years of 2009-2018).

It was determined that the production volume not only kept growing, but it was further predicted that such a trend would likely continue. When building the photovoltaic plant, photovoltaic cells converting solar energy into electricity were used. Photovoltaic panels used comprised:

- photovoltaic cells made of silica, which are responsible for the conversion of solar energy,
- anti-reflex layer applied to the panels surface, which enables increasing the effectiveness of solar light absorption,
- a housing and a frame, protecting the panels from unfavourable atmospheric conditions,
- cables and connections – the panels are fitted with integrated cables and connections, which enable connecting them to the company's electric power system.

Photovoltaic panels collecting solar energy were mounted on the ground. The energy collected is converted into alternating current with the use of an inverter and it directly powers electrical devices and production. The development of sustainable energy at production companies is possible thanks to advancing technologies. When building the photovoltaic plant, microfibers were used apart from the panels, which increase the efficiency of panels. Microfibers are thin layers of materials of very small fibre diameter, smaller than 1 micrometre (1/1000 mm). Fibres are made of silica and polymers. Thanks to the use of microfibers in the panels a higher efficiency was achieved, since microfibers placed on the ground with the use of solar energy reflection result in energy recovery from the bottom layer of photovoltaic panels.

After the introduction of the new energy solution in the form of the photovoltaic plant, Northwood company continued to carry out production consistent with the profile adopted at the beginning of its existence. Details of Northwood's production volumes in the years 2017-2022 were presented in Table 1.

Table 1.

Northwood's production volumes of finished products in 2017-2022 (production expressed in m³)

Year	2017	2018	2019	2020	2021	2022
Production volumes in m³	2.500	3.000	3.500	4.000	4.500	5.000

Source: own compilations on the basis of the data provided by Northwood.

According to the analyses conducted by external companies, prior to the implementation of energy optimisation production volume was on the rise from 2017 to 2022, despite numerous market difficulties in the analysed period (inter alia, COVID-19 pandemic, hostilities in Ukraine). The growing production was further accompanied by increasing sales value of products offered by Northwood (Table 2).

Table 2.*Sales value of finished products in 2017-2022 in Northwood (in PLN)*

Year	2017	2018	2019	2020	2021	2022
Sales value (PLN)	3 320.000,00	3 850.000,00	6 500.000,00	7 950.000,00	8 300.000,00	9 500.000,00

Source: own compilations on the basis of the data provided by Northwood.

An important aspect of the analysed period is the fact that the company was carrying out the same profile of operations both before the implementation of sustainable development goals as well as during and after the implementation of sustainable production, transport and energy optimisation. Simultaneously the service quality was maintained at high level, constantly perfecting the product (R&D since 2016). It is worth noting that in the examined period, along with the introduction of the restrictions related to COVID 19 pandemic (year 2020) and transferring many areas of operations into the virtual world, with energy optimisation in 2022 the company had a record number of orders with increasing energy costs (see Table 2). The sales volume in 2022 rose in relation to 2017 nearly threefold.

A significant indicator of the conducted analysis is energy demand, which along with an increase in production typically rises. In Table 3 changes in Northwood's energy demand were presented for the examined period.

Table 3.*Changes in Northwood's energy demand in 2017-2022*

Year	2017	2018	2019	2020	2021	2022
Energy demand (KW)	100	105	110	120	130	140

Source: own compilations on the basis of the data provided by Northwood.

Along with growth and increased production thanks to the acquisition of new machinery the company's energy demand rose. Greater production and new machinery required increased amounts of energy to power the machinery and to illuminate production halls. Because of increasing industrial production energy demand grew as well, and in order to meet the demand for energy, more effective and sustainable energy sources were implemented, i.e. solar energy obtained from photovoltaic panels. As a supplementation to the above tables, additionally total production costs related to obtaining energy were presented in Table 4. It is worth pointing out and comparing those numbers in the first period (2017-2019) – before the application of the photovoltaic plant, when traditional methods of energy use were employed and in the second period (2022-2022) – after the photovoltaic plant was incorporated into production, when the optimisation solution began to be used.

Table 4*Costs of using energy for production in Northwood in 2017-2022 (PLN)*

Year	2017	2018	2019	2020	2021	2022
Costs of using Energy for production PLN	173.400	183.200	192.100	179.800	169.200	159.200

Source: own compilations on the basis of the data provided by Northwood.

An analysis of the data in Tables 3 and 4 indicates that, on the one hand, a growing production is accompanied by an increase in demand for energy use, however, on the other hand, costs of using such energy since 2020 (i.e., since the implementation of the photovoltaic plant) have been diminishing. It means that the employed optimisation solution in the area of power engineering at Northwood brought about the desired effects. On the grounds of the information obtained from the company it can be concluded that along with the implementation of sustainable development goals and an exchange of machinery to achieve more sustainable production and the incorporation of energy optimisation, total demand for energy from outside has been decreasing with a simultaneous rise in the amount of electric current generated for the needs of production from the company's own power plant (figure 1).

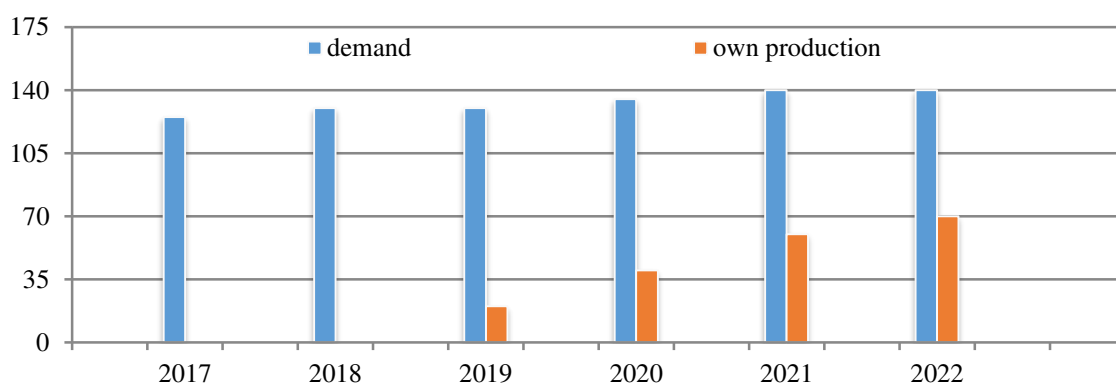


Figure 1. Energy demand at Northwood in 2017-2022, including energy production from its own power plant in 2020-2022.

Source: own compilations on the basis of the data provided by Northwood.

Thus, as is evident from the above data, the results of employing energy optimisation by constructing the company's own photovoltaic plant can be presented not only on the grounds of energy generation statement, but also on the basis of expenditure incurred on external energy. With expanded production of own energy for the purpose of production the transfer of external energy was decreasing, thereby charges for external energy and for energy transfer were falling as well. In 2018, before the incorporation of energy optimisation in the form of the photovoltaic plant, the presented company's average expense incurred on energy was fairly high - over 190 thousand zlotys per year. In 2020, when Northwood introduced energy optimisation and began to produce electricity itself for the purpose of its production, spending on external energy markedly decreased to 180 thousand zlotys per year, with a simultaneous increase in production. Furthermore, surplus of energy generated in the afternoons and at weekends in the summer period were transferred to the power grid and they constituted a passive income for the company, since they were resold. In 2021 and 2022, despite expanding production and sales, energy costs at Northwood were reduced. Energy spending was successively decreasing, moreover, an additional income emerged in the form of resold energy generated in the summer season and at weekends.

On the basis of the information featured in Tables 1-4 and in figure 1 it can be concluded that the implementation of energy optimisation involving the implementation of the company's own photovoltaic plant ought to be preceded by other measures related to the accomplishment of sustainable development goals, which in time will ensure the company's full optimisation and partial independence. The second major conclusion is the fact that the introduction of RES energy optimisation itself would not yield the desired results if it was not consistent with other operations conducted by the company thus far related to the accomplishment of sustainable development goals. Another issue that seems to be of significance in the case of implementation of RES energy optimisation is the consistency and repeatability of the activities in that regard.

A schedule of data for 2017-2022 for Northwood company demonstrated a successive development of the company and the growth of its competitiveness. Thereby the justifiability and at the same time the necessity for the employment of modern and innovative optimisation techniques have been proven with the aim of promoting the brand and improving its competitiveness. The data analysis allows for presenting weak and strong points of RES energy optimisation. The advantages include an increase in production with a reduced cost of energy in a short period of time with relatively low outlays. A disadvantage of the employment of photovoltaic plant, considering the experiences of Northwood company, chiefly involves technical problems related to the organisation and introduction of a new tool, and thereby the need to entrust such types of activities to a professional company having experience in similar operation on the market.

The use of RES energy optimisation by constructing one's own photovoltaic plant for the needs of own production and implementing sustainable development goals also constitute a modern tool of brand promotion. Implementation of sustainable development goals at the company had an impact on the improvement of the brand good-will and warming of its image from heavily industry-focused to a more environmentally-friendly one.

6. Summary

Implementation of RES energy optimisation at Northwood company has significantly affected the company's development, increasing the quality and number of fulfilled orders at substantially reduced costs of electrical energy. The results achieved by Northwood unequivocally demonstrate the positive effects of energy optimisation at a production company through the implementation of a photovoltaic plant for the needs of a company's own production. The incorporation of sustainable development goals in the company's process also indicates positive results. The great inspiration for Northwood Bronisław Misikonis was Provipal Aps Mikkel Jorgensen, which shared the solutions and implementations used. International cooperation between organizations influenced the changes introduced at

Northwood towards sustainable energy and production. The conducted analysis provides evidence to the fact that the fulfilment of sustainable development goals may constitute a promotion not only for the company itself, but it may also increase its competitiveness on the market. The results of the analysis are also a signal to all institutions and individuals, including managers, people managing production companies, that for the purpose of a company's development it is worth using modern tools and implementing sustainable development goals, which include, inter alia, energy optimisation through the employment of a company's own photovoltaic plant. Another important indicator is also the fact that organisations wishing to expand need to establish cooperation with external entities specialised in that area, taking advantage of their experience and granting them freedom to act.

References

1. Adamkiewicz, J. (2017). Zarys koncepcji zrównoważonego bezpieczeństwa energetycznego. *Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie*, z. 104, pp. 103-114.
2. *Agenda 2030*. Ministerstwo Rozwoju, Pracy i Technologii. Retrieved from: <https://www.gov.pl/web/rozwoj-praca-technologia/agenda-2030>, 20.09.2023..
3. Baleta, J., Mikulčić, H., Klemeš, J.J., Urbaniec, K. (2019). Integration of Energy, Water and Environmental Systems for a Sustainable Development. *Journal of Cleaner Production*, vol. 215, pp. 1424-1436.
4. Bansard, J., Schröder, M. (2021). *L'exploitation durable des ressources naturelles: Le défi de la gouvernance*. International Institute for Sustainable Development. Retrieved from: <https://www.iisd.org/system/files/2021-04/still-one-earth-natural-resources-FR.pdf>, 20.10.2023.
5. Bhowmik, C., Bhowmik, S., Ray, A. (2020). Optimal green Energy Source Selection: An eclectic Decision. *Energy & Environment*, vol. 31, no. 5, pp. 842-859.
6. Bianchini, A., Rossi, J., Pelegri, M. (2019). Overcoming the Main Barriers of Circular Economy. Implementation through a New Visualization Tool for Circular Business Models? *Sustainability*, vol. 11, No. 23.
7. Borchielini, R., Minuto, F.D. (2020). What is our Point of View on „Energy Independence and Research for Economic and Environmental Sustainability?” *Tecnica Italia, NA-Italian Journal of Engineering Science*, vol. 64, No. 1, pp. 60-62.
8. Dyukova, V.V., Mongush, Y.D., Haustovich, N.A. (2022). *A study of innovative technologies in the fuel and energy sector*. IOP Conf. Series: Earth and Environmental Science.

9. Europe 2020 – A strategy for smart, sustainable and inclusive growth, COM (2010) 2020, Brussels, 3 March 2010.
10. Fechner, I. (2016). Łańcuch logistyczny. Struktura. Podstawowe ogniwa i funkcje. In: *Opakowania w łańcuchu dostaw. Wybrane problemy* (pp. 27-39). Polska Izba Opakowań.
11. Glorieux, G.(2022). *From words to actions: How to win the climate challenge of our century via sustainable energy*. Union of the Electricity Industry. Retrieved from: https://www.eurelectric.org/in-detail/sustainable_energy, 20.10.2023.
12. Greenfield, P., Weston, P. (2021). The five biggest threats to our natural world and how we can stop them. *The Guardian*, 14.10.2021. Retrieved from: <https://www.theguardian.com/environment/2021/oct/14/five-biggest-threats-natural-world-how-we-can-stop-them-aoe>, 20.10.2023.
13. Kara, S., Hauschild, M., Sutherland, J., McAloone, T. (2022). Closed-loop systems to circular economy: A pathway to environmental sustainability? *CIRP Annals*, vol. 71, No. 2, pp. 505-528.
14. Klima, S. (2017). Rola rozwoju zrównoważonego w kształtowaniu konkurencyjności przedsiębiorstw. *International Entrepreneurship Review*, 3(3), 215.
15. Klima, S. (2018). Ekoinnowacje i ich wpływ na konkurencyjność przedsiębiorstw. *Przedsiębiorczość i Zarządzanie*, 19(10.3).
16. Kraszewska, M., Pujer, K. (2017). *Konkurencyjność przedsiębiorstw. Sposoby budowania przewagi konkurencyjnej*. Wrocław: Exante.
17. Muñoz, J.V., Mendoza, J.M.-F., Aznar-Sánchez, J.-A., Gallego Schmid, A. (2021). Circular economy implementation in the agricultural sector: Definition, strategies and indicators, resources. *Conservation and Recycling*, vol. 170, pp. 1-15.
18. Pinault, M. (2021). *LIFE-Clean Energy Transition the policy context with focus on: Green Recovery, Fit for 55: the revision of the EED and the EPBD-RW*. European Commission 2021.
19. Regulation of the European Parliament and of the Council establishing a Union certification framework for carbon removals. COM (2022) 672 final 2022/0394(COD).
20. Rogall, H. (2010). Ekonomia zrównoważonego rozwoju. *Teoria i praktyka*. Poznań: Zysk i S-ka, p. 58.
21. Rosen, M.A. (2021). Energy Sustainability with a Focus on Environmental Perspectives, Earth Systems and Environment. *Springer Nature*, vol. 5, pp. 217-230.
22. Sowa, S. (2018). Odnawialne źródła energii jako czynnik wpływający na poprawę efektywności energetycznej. *Zeszyty Naukowe Instytutu Gospodarki Surowcami Mineralnymi i Energią Polskiej Akademii Nauk*, nr 105, pp. 187-196.
23. *The 17 goals. Sustainable Development Goals*. United Nations. Retrieved from: <https://sdgs.un.org/goals>, 20.10.2023.

SOCIAL NETWORKING AS A COMMUNICATION TOOL FOR PUBLIC TRANSPORT COMPANIES IN VOIVODSHIP CITIES

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Purpose: The aim of this article is to present the changes in the use and basic advantages of social networks in the communication of public transport companies in voivodship cities.

Design/methodology/approach: The study carried out consisted of analysing the content of the official websites belonging to the selected public transport service companies in order to see how the information on the social networks used (location of plug-ins) is shared, and a review of the active profiles on these sites was carried out to diagnose what content is published. The survey was conducted in October 2023. The results were cross-referenced with the corresponding survey carried out in 2017.

Findings: The survey showed that of the 24 companies analysed from 18 cities, 20 use at least one of the social networks. The most common is Facebook - 19 companies have a profile, followed by YouTube - 9, Instagram - 7 and Twitter 5. 2 companies have profiles on 4 sites at the same time, 4 on 3 sites, 11 have 3 official profiles on different social networks, another 7 companies have 2 each and also 7 have one each. In the case of 4 entities, no profiles were found on social networks. The content, frequency and timeliness of publications on the profiles vary.

Research limitations/implications: Social networks that were less popular at the time of writing (e.g. TikTok - official profiles were identified in 2 cases among the companies surveyed) were not included in the study. The objectives of the communication strategies of the individual entities are not known. This may be part of further research through in-depth interviews with those responsible for promoting the companies. It may also be possible to extend the research to other operators (e.g. inter-municipal, railway, smaller cities, etc.) and among the target audiences of the communication activities in particular services.

Practical implications: On the basis of the author's audit of the communication activities of public transport companies on social networks, this article suggests that the use of social media is an appropriate tactic in the communication of companies (including municipal companies), both in the promotional dimension externally and in communication with citizens - service users, due to the participatory, interactive and open nature of social media.

Originality/value: The publication presents the results of research carried out on the basis of the author's audit of the activity of the public transport companies from the voivodship's cities in the social media.

Keywords: social media, city marketing, public transport, public transport promotion, marketing communication.

Category of the paper: Research paper.

1. Introduction

The ICT revolution, which is the genesis of the transformations observed in the last decades and encompassing various aspects of the functioning of modern society, has also had a major impact on their economic sphere. The emergence of a new hypermodal model of communication (many-to-many), associated with digital space, has led to significant modifications in the structure of economic processes, both at the macro (ensuring a previously unavailable level of transparency and globalisation of markets, creation of new exchange environments, virtualisation of some areas of economic life) and micro (streamlining of internal management processes in enterprises) scale. The turbulence of the contemporary environment of economic entities, forces them to undertake diverse and multidirectional actions aimed at ensuring their stable position, among others, by seeking new, more effective, efficient and efficient ways of communicating with the environment (Pacut, 2016).

Modern marketing activities require companies to communicate effectively with their existing and potential stakeholders. In the case of companies providing public transport services, these will mainly be passengers, but may also include other groups such as employees, advertisers, residents who do not use the company's services (activities encouraging people to change to public transport), lovers of old and new trams or buses, etc. One way of conducting an effective dialogue with the public is to use social media. Nowadays, they have a strong influence on socio-economic processes, which is changing the existing communication profile. Thanks to this, a phenomenon called marketing 2.0 is developing, which refers to the transformation of marketing resulting from the influence of the Internet on communication processes. Marketing 2.0 engages the consumer and triggers immediate feedback. As a result, the addressee of the communication is encouraged to interact or even initiate an independent action (Woźniakowski, 2017, p. 315). An extension of the concept of marketing 2.0 is marketing 3.0, which refers to so-called new wave technology that allows individuals and groups to connect and interact. Customers can express themselves and collaborate with others without much restriction. The current social media fits even more into this dimension, as in the concept of marketing 2.0 the interaction with the consumer was more of a one-to-one relationship, with marketing 3.0 it is said to be a collaboration of the many with the many, which actually reflects the evolution of multiple social communication platforms (Kotler, Kartajaga, Setiawan, 2010, pp. 18-19; Piotrowska, 2015, pp. 6-8). Now Ph. Kotler has introduced the concept of marketing 4.0, which is a natural development of marketing 3.0. Its main premise is the adaptation of marketing to the changing habits of customers in the face of the digital economy. In view of the above, one may be tempted to state emphatically that no enterprise, including a municipal enterprise, is able to communicate effectively with its environment without the use of new media, of which social media is a component.

This paper focuses on presenting the results of the author's own research on the ways in which social media are used by municipal enterprises from voivodship cities providing public transport services. Such entities were chosen because of the relatively large number of their customers and the modest representation of social media in the context of their use by municipal enterprises (in relation to typical commercial entities, especially those operating in the B2C market).

2. Social media in marketing communication

One of the first definitions of social media (used acronym SM), created by H. Rheingold (1993), characterises it as a social cluster emerged on the Internet, where individuals engage in sufficiently long public conversations, with enough emotional involvement to create personal relationships with other individuals in cyberspace. According to A.M. Kaplan and M. Haenlein (2010), social media is "a group of online applications, based on the ideological and technological foundations of Web 2.0, that allow the creation and exchange of user-sourced content". In turn, D. Kaznowski (2016) defines social media as "social media under social control that can be used on any scale, containing both the content of the message and possible viewpoints relating to the information". Thus, social media can be defined as social networks whose main purpose is to enable interaction between their users (Grębosz, Siuda, Szymański, 2016). Slightly more broadly, they can be defined as information channels that enable interaction between users in terms of exchanging information, knowledge, expressing opinions, comments, etc. (Jędrych 2015). According to the concept of many-to-many communication.

Social media can have a wide range of applications in business, well beyond marketing communications. Table 1 presents a classification of social media by type and outlines the main areas of application. It should be noted that this is one possible classification. However, at the time of writing, it appears to be the most relevant to how social media are used in business practice.

Table 1.

The use of social media in business

Type of social media	Main areas of application	Business objectives	Example
Building and maintaining relationships			
Social networking (social - mass communities)	Public relations, marketing, sales, customer service, csr (corporate social responsibility), research and development	Building image, engaging customers, communicating and obtaining information, building relationships	Facebook
Social (business) network	Human resources management, public relations	Image building, employee recruitment, networking	LinkedIn, GoldenLine

Cont. table 1.

Sharing			
Video service	Public relations, marketing, sales, csr	Image building, offer presentation	YouTube, Vimeo, TikTok
Photo service	Public relations, marketing, sales, csr	Image building, presentation of the company and its offerings	Pinterest, Instagram, Flickr
Keeping informed and commenting			
Microblog	Public relations, marketing, csr	Image building, information, relationship building	X
Publication of content (presentation of resources, opinions, views)			
Blog	Public relations, marketing, csr	Image building, information, relationship building	wordpress.com, blogger, blogspot, blox
Wiki	Information and knowledge management, research and development, public relations	Building a corporate knowledge base	Wikipedia, mfiles
Co-creation and cooperation			
Crowdsourcing service	Research and development, public relations, marketing, csr	Acquisition of knowledge and new ideas, research and development	Kickstarter, wspieram.to
Exchange of place information			
Geolocation service	Public relations, marketing, sales	Building image, improving brand awareness, building relationships	Foursquare
Exchange of opinions			
Discussion forum	Public relations, marketing	Image building, customer engagement, information gathering	forum.gazeta.pl, fora.pl

Source: own research based on: Buchnowska, 2013, p. 57.

3. Study subjects and research methodology

Municipal companies occupy an important position in the process of satisfying the needs of the population by directly performing a significant part of the public tasks imposed by law on local government units. It can be concluded that municipal companies are an institutional instrument for local development policy. The term "municipal company" does not appear in the Polish legal order. It can be regarded as a general term, indicating affiliation and, at the same time, ownership of this economic entity. Its separation into the form of a company with a market character, entails consequences in three areas: economic, political and technical. In economic functioning, such an entity is a separate legal entity and is characterised by a high degree of decision-making autonomy. It has a legal personality, has its assets separated from local government property, and acts freely in economic transactions and is liable for this. Thus, a municipal company should be understood as a management entity whose resources (assets) are fully or predominantly public property of the local government unit within which it was established. The criterion for the separation of a municipal company is essentially of

an ownership nature. It can be said that a municipal company is an enterprise providing a variety of public services (Dolewka, 2017).

Municipal companies are intended to play a servant role towards local communities, as they operate in the so-called sensitive sectors (directly providing services to residents), i.e. providing heat and water, collecting sewage, transporting public transport, etc., i.e. they carry out local government tasks of a public utility nature (Dolewka, 2017). Typical features of the public utility sphere are: meeting the daily, common needs of the users of public life; lack of storage, larger-scale production and, consequently, the need to operate continuously; the predominantly monopolistic nature of the activity; the need to have significant reserves of production capacity, which leads to a large share of fixed costs in the overall production costs; the need for significant integration of public bodies to manage activities in the public utility sphere due to the high capital intensity, social nature of the needs met and monopolistic nature of the activity (Sadowy, 2000).

All entities matching the above considerations for municipal enterprises providing public transport services from all voivodship cities were selected for the study. In the case of two voivodeships (Kujawsko-Pomorskie and Lubuskie), enterprises from two cities were taken into account due to the administrative division in force related to the location of the seat of the voivode and the regional parliament. In total, 24 entities providing public transport services were taken into account, as in 4 cities (Warsaw, Szczecin, Białystok, Katowice) there are 2 or 3 municipal companies providing the services of interest in this paper.

The study was carried out in October 2017 and repeated in October 2023. The research methodology adopted was to analyse the content of websites and social media profiles belonging to municipal companies from voivodship cities providing public transport services. The research was conducted in 3 stages. In the first, the websites of the above-mentioned entities were checked to see which social media were directly redirected on them (e.g. in the form of social plugins, classic hyperlinks, etc.).

In the second stage, in the absence of a direct reference to a profile on the currently most popular social networking site - Facebook - in the structure of the company's website, they were searched for through the site's internal browser by entering a relevant phrase, e.g. MPK Rzeszów, Miejskie Przedsiębiorstwo Komunikacyjne Rzeszów, etc.

In the third stage, the social media profiles identified in the previous two steps were analysed for content. It was checked whether the profiles were updated on a regular basis, how frequent the publications were, and what the tone of the communication was (e.g. passenger information, press releases, education, offer for advertisers, etc.).

Of the 24 entities identified (and the same number of websites), more than half have at least one social media plug-in in the structure of their own website. The most common is Facebook - 17 (2 additional profiles were identified after using the Facebook browser). Next in terms of popularity are YouTube (9 plugins), Instagram (7) and X (6). Within websites, one plugin was identified for TikTok (MZK Bydgoszcz). The detailed distribution of social

plugins for social media profiles posted on company websites is shown in Table 2. It is noticeable that the number of profiles on Facebook, Instagram and YouTube has increased. There was no change in the number of accounts on X (formerly Twitter), which may be related to the turmoil surrounding the service following its acquisition by E. Musk.

The analysis carried out showed that the companies most actively using social media are MPK Kraków, Gdańskie Autobusy i Tramwaje (they have profiles on 4 sites). In 3 cases, there is no link to a social media profile on company websites, which represents a significant decrease compared to 2017 - at that time there were 12 companies.

Table 2.

Communication about owned social media profiles on websites by municipal companies from voivodship cities providing public transport services (1 = social plugin exists on website; (1) profile found in search engine; 0 = no link to social profile)

No.	City	Website	Social media plug-ins on company websites							
			Facebook		Instagram		Twitter/X		YouTube	
			2017	2023	2017	2023	2017	2023	2017	2023
1	Wrocław	mpk.wroc.pl	1	1	1	0	1	1	0	1
2	Bydgoszcz	mzk.bydgoszcz.pl	0	1	0	1	0	0	0	0
3	Toruń	mzk-torun.pl	1	1	0	0	0	0	0	1
4	Lublin	mpk.lublin.pl	0	0	0	0	0	0	0	0
5	Gorzów Wlkp.	mzk-gorzow.com.pl	1	1	0	0	1	1	0	0
6	Zielona Góra	mzk.zgora.pl	1	1	0	0	0	0	0	1
7	Łódź	mpk.lodz.pl	1	1	0	0	0	0	1	1
8	Kraków	mpk.krakow.pl	1	1	1	1	1	1	1	1
9	Warszawa	metro.waw.pl	1	1	0	1	0	0	0	1
		mza.waw.pl	1	1	0	1	1	1	1	0
		tw.waw.pl	1	1	0	0	0	0	1	1
10	Opole	mzkopole.pl	0	1	0	1	0	0	0	0
11	Rzeszów	mpk.rzeszow.pl	0	0	0	0	0	0	0	0
12	Białystok	kpk.m.pl	0	0	0	0	0	0	0	0
		kpk.bialystok.pl	0	0	0	0	0	0	0	1
13	Gdańsk	gait.pl	1	1	0	1	1	1	0	1
14	Katowice	pkm.katowice.pl	0	1	0	0	0	0	0	0
		tram-silesia.pl	0	1	0	0	0	0	0	0
15	Kielce	mpk.kielce.pl	0	1	0	0	0	0	0	0
16	Olsztyn	mpkolsztyn.pl	1	1	0	0	0	0	0	0
17	Poznań	mpk.poznan.pl	1	1	0	1	1	0	1	1
18	Szczecin	ts.szczecin.pl	0	(1)	0	0	0	0	0	0
		spak.pl	0	0	0	0	0	0	0	0
		spad.szczecin.pl	0	(1)	0	0	0	0	0	0
Total		24	12	17(19)	2	7	6	5	5	9

Source: own research.

Table 3.

Facebook profiles of public transport companies (rounded figures)

No.	City	Website	Number of likes		Number of followers		Content current 2023
			2017	2023	2017	2023	
1	Wrocław	mpk.wroc.pl	19900	55000	20200	62000	Tak
2	Bydgoszcz	mzk.bydgoszcz.pl	-	1000	-	1000	Tak
3	Toruń	mzk-torun.pl	4400	8000	4300	9000	Tak
4	Gorzów Wlkp.	mzk-gorzow.com.pl	1100	no data	1100	3000	Tak
5	Zielona Góra	mzk.zgora.pl	3800	no data	3800	6000	Tak
6	Łódź	mpk.lodz.pl	14300	25000	14200	27000	Tak

Cont. table 3.

7	Kraków	mpk.krakow.pl	53300	90000	53000	95000	Tak
8	Warszawa	metro.waw.pl	9500	30000	9600	34000	Tak
		mza.waw.pl	27000	39000	27800	47000	Tak
		tw.waw.pl	4700	24000	4800	28000	Tak
9	Opole	mzkopole.pl	-	1000	-	2000	Tak
10	Gdańsk	gait.pl	3500	9000	3600	12000	Tak
11	Katowice	pkm.katowice.pl	1000	1000	1000	1000	Tak
		tram-silesia.pl	-	4000	-	4000	Nie
12	Kielce	mpk.kielce.pl	-	4000	-	4000	Tak
13	Olsztyn	mpkolsztyn.pl	730	2000	730	2000	Nie
14	Poznań	mpk.poznan.pl	33000	42000	32500	45000	Tak
15	Szczecin	ts.szczecin.pl	500	5000	500	6000	Tak
		spad.szczecin.pl	600	1000	600	1000	Nie

Source: own research.

Table 4.*Companies providing public transport services on X (formerly Twitter)*

No.	City	Website	Number of posts		Number of followers		Content current 2023
			2017	2023	2017	2023	
1	Wrocław	mpk.wroc.pl	6470	14800	3633	9349	Tak
2	Gorzów Wlkp.	mzk-gorzow.com.pl	654	811	137	292	Nie
3	Kraków	mpk.krakow.pl	4396	9597	4949	12600	Tak
4	Warszawa	mza.waw.pl	155	242	692	1877	Nie
5	Gdańsk	gait.pl	-	6537	-	3327	Tak

Source: own research.

Table 5.*Public transport companies on YouTube*

No.	City	Number of subscriptions		Number of views of the most popular video		Number of films 2023	Content current 2023
		2017	2023	2017	2023		
1	Wrocław	-	702	-	30000	89	Nie
2	Toruń	-	237	-	9100	81	Tak
3	Zielona Góra	-	18	-	640	14	Nie
4	Łódź	587	1630	20800	57000	257	Tak
5	Kraków	322	35600	81700	2500000	103	Tak
6	Warszawa	43	3150	3600	70000	81	Tak
		10	5300	940	1300000	137	Tak
7	Białystok	-	14	-	700	2	Nie
8	Gdańsk	-	223	-	614000	24	Nie
9	Poznań	366	1090	29500	33000	105	Tak

Source: own research.

Table 6.*Public transport companies on Instagram*

No.	City	Website	Number of posts		Number of followers		Content current 2023
			2017	2023	2017	2023	
1	Bydgoszcz	mzk.bydgoszcz.pl	-	18	-	145	Tak
2	Kraków	mpk.krakow.pl	295	812	3280	8248	Tak
3	Warszawa	metro.waw.pl	-	58	-	3160	Tak
		mza.waw.pl	-	117	-	2719	Tak

Cont. table 6.

4	Opole	mzkopole.pl	-	496	-	534	Tak
5	Gdańsk	gait.pl	-	2526	-	6045	Tak
6	Poznań	mpk.poznan.pl	-	340	-	1927	Tak

Source: own research.

Table 3 presents the total number of likes and followers on all identified Facebook profiles. Looking at the numbers, it is clear that the size of the city does not translate into the number of fans in a given community. In order of importance, carriers from Kraków, Wrocław and Warsaw (MZA) have the highest number of followers. The Facebook profiles identified in the study are generally kept up to date. Of the 19 profiles, 3 have remained without new publications for at least 6 months. In the case of 2, posts are added infrequently, i.e. approximately 1/week (MZK Gorzów Wielkopolski; PKM Katowice). In the case of Silesian Trams, the link to Facebook was found on the new website (tramwajeslaskie.pl), while at the same time the old website (tam-silesia.pl) is active. Content is mainly presented to introduce the company to passengers (presentation of rolling stock, depot operation, etc.) and to promote collective public transport (new infrastructure investments, new rolling stock, etc.). Passengers are also informed through profiles on this site about temporary traffic disruptions, or traffic disruptions related to longer-term maintenance works.

Five of the companies surveyed have their own profile on site X. Due to the characteristics of the service itself, the posts are dominated by information about traffic disruptions. MPK Wrocław has the highest number of publications on this site, while the Kraków-based operator has the highest number of profile followers (detailed list is presented in Table 4). 2 profiles are out of date - MZA Warsaw since January 2023, and MZK Gorzów Wielkopolski since 2021.

Nine of the surveyed entities have their own channels on YouTube, but in three cases there are between 2 and 24 videos, and in four cases no new releases have been added for at least a year. In the case of presence on YouTube, the number of regular subscribers to a channel is less important, and the reach of the videos, measured among other things by the total number of views of the message, is the most important. Table 5 presents the total number of subscribers to each channel and the number of views of the most popular video. The MPK Kraków channel has the highest number of subscribers, the most popular video was posted on the same channel (a video from 2014 showing a simulation of a cyclist being hit by a tram).

The published films cover a variety of topics: presentation of vehicles, infrastructure (e.g. showing the work of a tram depot), educational (e.g. how to buy a ticket from a ticket machine or via the Internet, promotion of culture among passengers), promotional (e.g. presentation of tourist lines served by vintage vehicles). However, the most popular films are those that depict various situations from the roads, recorded with cameras installed in public transport vehicles. It can be concluded that they are educational, are often published as a "warning" and present various dangerous situations encountered by drivers and motorists on a daily basis, such as irresponsible behaviour of other road users (e.g. sudden encroachment on

the road by a pedestrian, blocking of the road by another vehicle, etc.). A second group of equally popular films are those showing the behaviour of a heavy vehicle - bus or tram - in an extreme situation, e.g. simulating the emergency braking of a tram in order to make other road users aware of the distance needed for the tram to come to a complete stop compared with the braking distance of a passenger car.

In the last social network analysed, Instagram, 7 profiles were identified. GAIT has the most posts published, while MPK Kraków has the most observers. The published photos and graphics are in keeping with the nature of the service and are usually pictures of vehicles in different parts of the city, against the background of characteristic places. With some posts, the companies try to involve participants, encourage interaction (which is one of the essential functional features of modern social media), e.g. through riddles, such as the photo published by MPK Kraków showing a fragment of a Solaris bus with a sticker with the image of the company mascot of the bus manufacturer with the question "Do you know how many 4th generation Solaris buses we currently own?". The responses that appeared indicated the number of vehicles and additional information that this number will change as the delivery of more modern buses is expected soon.

4. Summary

The study showed that municipal companies providing public transport services do not use the potential of social media to communicate with different stakeholder groups, mainly passengers. From a marketing communication point of view, their social media profiles can be communicated via their own website through dedicated plugins. The use of social media by companies is beneficial due to the following aspects (Podlaski, 2011, pp. 24-31; Woźniakowski, 2016, pp. 22-23):

- One's own website is promoted and the effectiveness of positioning is increased, making it easier for the recipient (e.g. a passenger) to find the desired content by typing the relevant keywords into a search engine;
- Users of social networks accept the presence of particular companies or brands on them. Internet users interested in a particular brand count on, among other things, dedicated competitions, promotions, offers, etc., and look for, as in other corners of the web, curiosities, various information concerning the liked brands;
- The content presented is relatively unintrusive. Once a company has created a profile, users decide for themselves whether they want to join the fan base and thus follow the published content;

- A presence in social media strengthens the image in the long term, as well as credibility and trust, provided that there is continuous contact with users and that even difficult (from the company's point of view) topics (e.g. frequent delays, rolling stock breakdowns, etc.) are not avoided;
- The company receives immediate feedback from users on the activities carried out on individual profiles;
- Active use of social media gives wide access to audiences and, through a variety of activities, it is possible to achieve a variety of marketing communication objectives aimed at predefined audiences.

The possibilities for the use of social media in different areas of the operation of a municipal public transport service company are shown in Table 7.

Table 7.

Opportunities for public transport service companies to use social media

Marketing	<ul style="list-style-type: none"> • Increased passenger loyalty through engagement in continuous dialogue • Creation of an internal community to define marketing objectives and ensure continuity of activities • Implementation of marketing communication campaigns (complementing traditional marketing) • Protecting brand reputation through active monitoring in SM and influencing them
Sales	<ul style="list-style-type: none"> • Creating potential and attracting new customers • Increase sales through easier access to product reviews from existing customers (e.g. promotion of season tickets, etc.)
Customer service	<ul style="list-style-type: none"> • Reducing acquisition costs and improving passenger loyalty by answering frequently asked questions quickly on social media • Posting of instructions and videos giving passengers the opportunity to solve specific problems themselves (e.g. how to read new timetables at bus stops)
Human resources management	<ul style="list-style-type: none"> • Recruitment - identification of external candidates (e.g. drivers, bus mechanics, etc.) • Training and coaching of employees using videos and podcasts (e.g. how to behave when accosted by a vulgar passenger, etc.) • Development of a community of former employees (alumni) • Employee satisfaction survey
Innovation; research and development	<ul style="list-style-type: none"> • Encouraging passengers to share suggestions and ideas for network development • Involving staff in the innovation process through the use of internal collaboration tools
CSR	<ul style="list-style-type: none"> • Communicating existing values, ongoing programmes or csr projects • Encouraging stakeholders to share their opinions in order to get an immediate response to the content sent out • Strengthen brand image through a permanently maintained csr channel in SM and mitigate the long-term impact of any crisis situation (e.g. press release about the arrest of an intoxicated bus driver of a particular operator, etc.)

Source: own research based on: Martyniuk, Jar, Suszek, 2016, pp. 24-25.

Subscribers on all social media profiles will certainly be interested in information about promotions (e.g. a lower price for season tickets when purchasing an entire year in advance), limited offers (e.g. tickets for collectors, etc.). However, it is important to keep the right proportions. If only product information is published, the profile will become a kind of advertising post that most people will ignore. The 70-20-10 rule can be applied here, according to which 70% of the content should be information of value to fans (e.g. information about the

current traffic situation, unplanned disruptions, renovations, etc.), 20% should be links to content created by other users (e.g. photos and films showing the carrier's means of transport woven into the cityscape), and only 10% should be information about promotions - content of a commercial nature (Adamiec, 2016).

The most common mistakes surveyed entities make when running their own social media profiles are:

- The company's primary identifying element, the logo, is misaligned with the space provided for the profile picture in the profile page structure (it was usually too large);
- Clicking on a social plug-in placed in the structure of a company page does not open a new browser tab with the company's profile on a given social network, but only overlooks the content displayed so far;
- Social plug-ins are placed in an inconspicuous place on the website or are simply missing;
- Maintaining inactive profiles;
- Infrequent posting of content;
- Content not tailored to the specifics of a particular social network, as well as a lack of any incentive to interact with the company.

All of the above weaknesses in the communication process may give the recipients of the message (mainly passengers) a somewhat distorted picture of the operation of the companies, which may have an impact on its perception in general, including the quality of the services provided. One might be tempted to suggest that the lack of skilful communication activities through social media (due to the popularity of social networking sites in modern society) by public transport providers in large cities contributes to a lower interest of potential passengers in these services in favour of alternative means of urban transport (mainly their own car). It should be noted, however, that despite the apparent shortcomings, there has been progress over the years in the use of social media in the communication activities of the companies surveyed. The survey showed that of the 24 companies analysed in 18 cities, 20 use at least one social media site. The most common is Facebook - 19 carriers have a profile (12 in 2017), followed by YouTube - 9, Instagram - 7 and Twitter 5 (5, 2 and 5 respectively in 2017). 2 companies have profiles on 4 sites at the same time, 4 on 3 sites, 11 have 3 official profiles on different social networks, another 7 companies have 2 each and also 7 have one each. For 4 entities, no profiles were found on social networks.

References

1. Adamiec, T. (2016). *15 sposobów na wykorzystanie mediów społecznościowych w biznesie*. <http://czaplicka.eu/15-sposobow-na-wykorzystanie-mediow-spolesznosciowych-w-biznesie/>, 17.08.2016.
2. Buchnowska, D. (2013). Analiza i ocena poziomu wykorzystani mediów społecznościowych przez największe polskie przedsiębiorstwa. *Informatyka Ekonomiczna*, 4(30), p. 57.
3. Czech, M. (2017). *Media społecznościowe w biznesie*. <http://marketingibiznes.pl/social-media/media-spolesznosciowe-w-biznesie>, 12.01.2017.
4. Dolewka, Z. (2017). Funkcjonowanie spółek komunalnych w Polsce. *Prace naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 477, p. 60.
5. Grębosz, M., Siuda, D., Szymański, G. (2016). *Social media marketing*. Łódź: Wydawnictwo Politechniki Łódzkiej.
6. Jędrych, E. (2015). Wykorzystanie mediów społecznościowych w zarządzaniu pracownikami w organizacjach gospodarczych. *Zeszyty Naukowe Uczelni Vistula*, 6(44), p. 120.
7. Kaplan, M., Haenlein, M. (2010). Users of the World, Unite! The Challenges and Opportunities of Social Media. *Business Horizons*, 1(53), pp. 59-68.
8. Kaznowski, D. (2016). *Social media – społeczny wymiar internetu*. In: J. Krolewski, P. Sala (eds.), *E-marketing. Współczesne trendy. Pakiet startowy* (p. 89). Warszawa: PWN.
9. Kotler, Ph., Kartajaga, H., Setiawan, I. (2010). *Marketing 3.0*. Warszawa: MT Biznes.
10. Kotler, Ph., Kartajaya, H., Setiawan, I. (2017). *Marketing 4.0. Moving from Traditional to Digital*. Hoboken, New Jersey: John Wiley & Sons, Inc.
11. Martyniuk, D., Jar, K., Suszek, E. (2016). *Biznes społecznościowy – nowa era w komunikacji biznesowej*. Warszawa: Deloitte.
12. Miotk, A. (2013). *Skuteczne Social Media. Prowadź działania, osiągnij zamierzone efekty*. Gliwice: Helion.
13. Pacut, M. (2016). Media społecznościowe w komunikacji marketingowej organizacji non profit. *Handel Wewnętrzny*, 3(362), p. 239.
14. Piotrowska, M. (2015). Marketing w erze 3.0. *Marketer+*, 5-8, pp. 6-8.
15. Podlaski, A. (2011). *Marketing społecznościowy. Tajniki skutecznej promocji w social media*. Gliwice: Helion.
16. Rheingold, H. (1993). *The virtual community. Homesteading on the electronic frontier*. Reading, MA: Addison-Wesley.
17. Sadowy, M. (2000). *Ekonomika przedsiębiorstw komunalnych (zarys problematyki)*. In: M. Majchrzak, A. Zalewski (eds.), *Samorząd terytorialny a rozwój lokalny. Monografie i Opracowania*, 483. Warszawa: Szkoła Główna Handlowa.

18. *Social media w biznesie*. <http://www.forbes.pl/jak-wykorzystywac-social-media-w-biznesie,artykuly,178472,1,1.html>, 15.09.2015.
19. Woźniakowski, M. (2015). Internetowe narzędzia public relations w komunikacji marketingowej największych polskich przedsiębiorstw. *Przegląd Organizacji*, 6, p. 19.
20. Woźniakowski, M. (2016). *Marketing społecznościowy w polskich przedsiębiorstwach*. Łódź: Wydawnictwo Biblioteka.
21. Woźniakowski, M. (2017). Media społecznościowe w komunikacji sieci komórkowych. *Ekonomiczne problemy usług*, 1(126/2), pp. 315-320.

THE IMPACT OF THE COVID-19 PANDEMIC ON THE DEVELOPMENT OF SELECTED REGIONS OF UE COUNTRIES

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Purpose: The purpose of the considerations presented in the paper was to examine the changes that occurred in both population and GDP size and in selected economic sectors as a result of the outbreak of the COVID-19 pandemic in the highlighted EU regions.

Design/methodology/approach: The paper examined the impact of the COVID-19 pandemic on the population of selected EU regions, GDP in those regions, and the impact of the pandemic on the unemployment rate, the number of people at risk of poverty or social exclusion, the number of nights spent in overnight accommodations, the number of passengers traveling by air, the number of people who ordered goods or services online in the past year, and employment in high-tech sectors. The impact was examined by analyzing development trend models for selected variables and verifying the hypothesis of constancy of model parameters with the Chow test. Predictions of selected variables were also counted if there had been no pandemic and compared to actual values from the COVID-19 pandemic period.

Findings: Not all regions were equally affected by the effects of the pandemic. This was undoubtedly influenced by the authorities' struggle with the effects of the pandemic, but also by the entrepreneurial spirit of the residents of the regions studied. Also in different spheres of economic life, the effects of the pandemic varied from negative to positive.

Research limitations/implications: Further research should also include the other EU regions and more economic sectors, allowing us to group regions according to similarities in coping with the pandemic and calculate spatial correlations. A problem we may encounter is the lack of sufficient data, which may result in the exclusion of some regions and economic sectors from the study.

Social implications: Through the research, we can highlight regions that are coping better with the effects of a pandemic, and this can inspire regions that are coping less well. In the future, regions can look up to the actions carried out by authorities in other regions to offset the effects of pandemics (or other disasters with global effects) and transfer them to their own region.

Originality/value: The article compares regions within the boundaries of which are national capitals. It was shown which region did best in combating the effects of the pandemic and which did less well. The article also shows what the impact of the pandemic was on the various branches of the economy.

Keywords: COVID-19 pandemic, trend models, Chow test.

1. Introduction

The COVID 19 pandemic had a major impact on both social and economic life around the world, this has been addressed in many scientific articles (Ambroziak, 2020; Czajkowska, 2020; Długosz, 2021). This article examines the impact of the pandemic on the development of selected regions of the EU. Undoubtedly, the impact of the pandemic varied across countries and even across different regions of these countries. The study aims to identify which areas of the economy (among those studied) were most affected by the pandemic, and whether it had a stimulating or destimulating effect on the development of the area and economic life in the analyzed regions. While the literature offers a study of the impact of the pandemic on specific industries (Bukowski, 2023; Hasić, 2023; Nguyen et al., 2021) in terms of the economy of the country as a whole, the following paper examines the impact of the pandemic on specific regions.

In addition to the main objective of examining the changes that occurred as a result of the COVID-19 pandemic in selected economic sectors in the highlighted regions of EU pastures, a research hypothesis was also put forward stating that the effects of the pandemic were not felt in the same way in all regions. Also, in different spheres of economic life, the effects of the pandemic varied.

In addition to the changes in population and GDP of selected regions, the analysis included 6 areas of the economy:

- unemployment rate,
- people at risk of poverty or social exclusion,
- nights spent in tourist accommodations,
- air transport of passengers,
- people who ordered goods, or services over the past year on the Internet,
- employment in high-tech sectors.

All analyses were conducted in 22 EU regions. They are regions in which the capital cities of the selected countries are located: Région de Bruxelles-Capitale, Praha, Hovedstaden, Berlin, Attiki, Comunidad de Madrid, Île de France, Grad Zagreb, Lazio, Latvija, Luxembourg, Budapest, Malta, Noord-Holland, Wien, Warsaw Capital, Área Metropolitana de Lisboa, Bucuresti - Ilfov, Zahodna Slovenija, Bratislavský kraj, Helsinki-Uusimaa, Stockholm.

Using data from Eurostat (Eurostat, 2023), a trend function was estimated for each region and each variable, and then verified

In the next step, the increments of the variables in 2020 and 2021 compared to the previous year were calculated. The trend models were also estimated again using data up to 2019, and forecasts for 2020 and 2021 were calculated. Finally, the relative increments of the actual values to the forecast values were counted. The forecasts can tell us what the values of the variables would be if the pandemic had not occurred.

2. Methodology

Using time series data on individual economic sectors for selected regions, trend functions were estimated using the Least Squares Method. Polynomial trends of the first, second and third degree were used in the modeling.

$$y_t = \alpha_0 + \alpha_1 t + \xi_t \quad (1)$$

$$y_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \xi_t \quad (2)$$

$$y_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \alpha_3 t^3 + \xi_t \quad (3)$$

Model verification included checking whether the random component of the model has a normal distribution with the Jarqua-Berry test, examining the autocorrelation of the residuals with the Durbin-Watson test and the Lagrange multiplier test, as well as verifying the hypothesis of heteroskedasticity of the random component with the White test. Unfortunately, it was not always possible to estimate the parameters of the model that passed the verification process. This was mainly due to the lack of data. Models that passed the verification process correctly were subjected to the Chow test to examine the stability of the models' parameters. The lack of stability of the models' parameters unambiguously meant a significant change in the trend of a given variable, and therefore a significant impact of the COVID-19 pandemic on a given variable in the study region. The absence of grounds for rejecting the null hypothesis of parameter stability does not mean that there has been no change in the values of the variables, but only that the expected value of the forecast error is zero, i.e., the forecast is unbiased. All tests are widely described in the econometric literature (Biolik, 2018; Maddala, 2006; Osińska, 2007).

3. Population

The COVID-19 pandemic has undoubtedly had a significant impact on socio-economic life worldwide. The first case of SARS-CoV-2 coronavirus infection was detected in November 2019 in Wuhan of China's Hubei Province, a city of 12 million people. In March 2020, the coronavirus pandemic spread to Europe and North America, among others. According to UN data, more than 6.9 million people worldwide had died from COVID-19 by May 2023 (Termedia, 2023).

Authorities in no EU region have protected their citizens from coronavirus infections. Studying the population from 2010 to 2021 in the studied regions, it was not possible to estimate the trend function for 2 regions due to the lack of data. For the remaining regions, the Chow test was performed after estimating the model parameters. For 7 regions (35%), the Chow test did not detect structural changes in the analyzed models.

On average, in the 20 regions analyzed, the population fell by about 0.01% in 2020 compared to 2019, so the decrease was insignificant. It should be remembered that in addition to births and deaths, the population is affected by migration. Since the analysis covered the regions in which the capital cities are located, we can expect that the migration balance in these regions is positive. In the next step, population projections for 2020 and 2021 were calculated on the basis of data from 2010-2019. Finally, the average share of the actual population to the projected population was calculated (Table 1).

Table 1.

Average share of actual population to projected population in 2020 and 2021

Year	Share
2020	99.31%
2021	99.25%

Table 1 shows that the average decrease in the actual population compared to the projected population was almost 1%, and this is a significant difference. It can be stated that the COVID-19 pandemic slowed down the development of the studied regions. The largest decrease in population in 2020 compared to 2019 was in Prague (4.9%), and the largest increase was in Luxembourg (1.3%) (Figure 1).

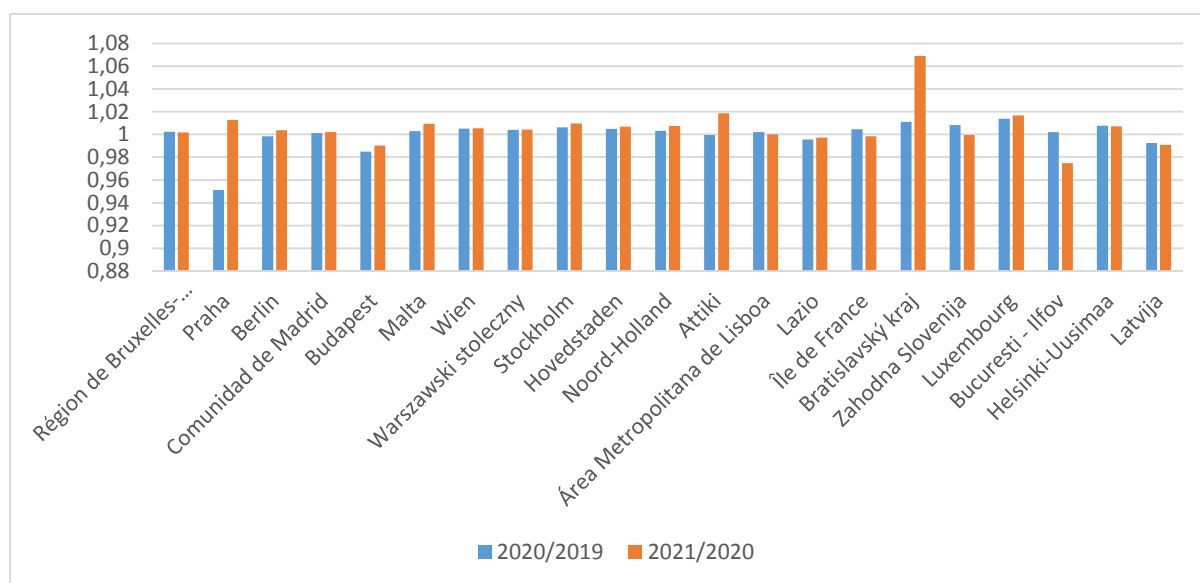


Figure 1. Relative population growth in 2020 and 2021 compared to the previous year.

In 2021, compared to 2020, such large population declines are no longer observed, although in the Bucuresti - Ilfov region the decrease was about 2.5%. On the other hand, the Bratislavský kraj region saw a population increase of as much as 6.9 percent.

4. Regional gross domestic product

A slowdown in regional development is associated with a slowdown in GDP growth. Again for 2 regions the trend function could not be estimated, because the models did not pass the verification process. This time, in 6 cases out of 20 (30%), the Chow test failed to detect significant structural changes in the models. Thus, it can be argued that in the vast majority of regions there was a significant change in GDP as a result of the COVID-19 pandemic.

Among the regions for which the trend models could be developed, the average decrease in GDP was 3.7%, and among all 22 regions it was 3.8%. Only 3 regions saw an increase in GDP in 2020 compared to 2019 - in the Hovedstaden, Luxembourg and Stockholm regions, where the increase was between 1.3 and 3.9 percent. The largest decrease in GDP was in the Comunidad de Madrid - 9.8 percent.

An average GDP decline of 3.7% is a very high decline, but given that these regions are still developing, the potential GDP decline could have been even larger. Table 2 shows the average share of actual GDP values in their projections calculated on the basis of new trend functions.

Table 2.

Average share of GDP value in the forecast GDP value in 2020 and 2021

Year	Participation
2020	92.19%
2021	95.65%

Table 2 shows that the gap between actual GDP and what could have been reached is even greater. The COVID-19 pandemic certainly had a significant impact on slowdown in economic growth. The exception is Luxembourg, where the share of GDP to projected GDP in 2020 was more than 101.7%.

It can also be seen from Table 2 that in 2021 the situation began to improve rapidly, and on average the GDP share was lower than the forecast by about 4.35%.

The relative GDP growth by region is shown in Figure 2.

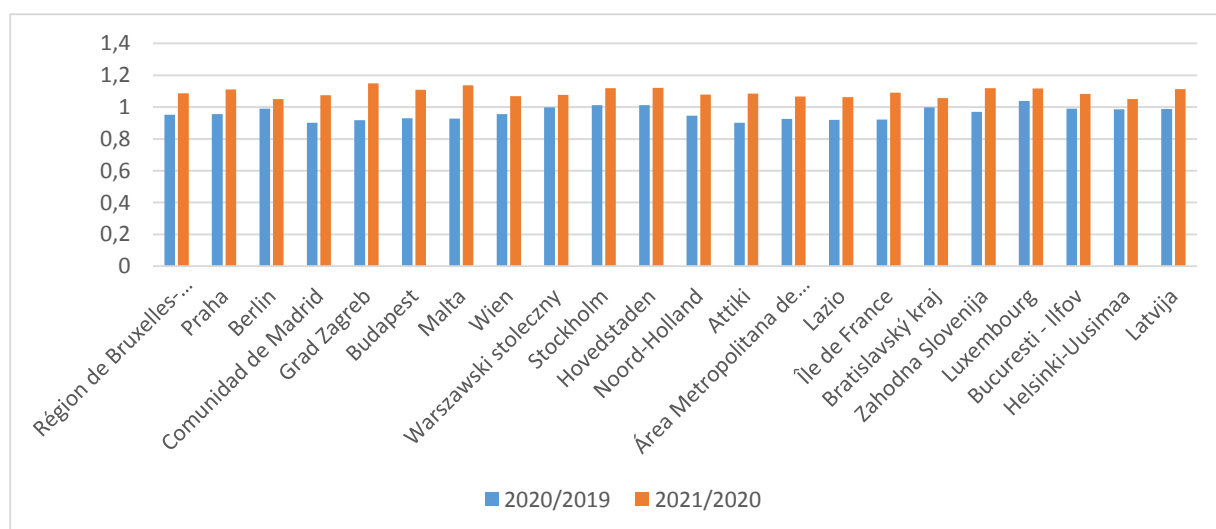


Figure 2. Relative GDP growth in 2020 and 2021 in the examined EU regions.

Figure 2 shows that the recession resulting from the COVID-19 pandemic in the studied regions did not last long, and in 2021 there was an increase in GDP in all regions. The highest GDP growth was recorded in Zagreb (15%), and the lowest in the Helsinki-Uusimaa region (5%).

5. Unemployment rate and people at risk of poverty or social exclusion

On the one hand, in 2020, on average, the population of the studied regions decreased, and on the other hand, the value of GDP also decreased. What impact did both of them have on the change in the unemployment rate?

For 17 regions it was possible to estimate a trend model. In 10 out of these 17 models, the Chow test did not give grounds to reject the hypothesis of no structural change in the models. In most cases (59%), there was no significant structural change in the trend models. If we look at the change in the unemployment rate in 2020 compared to 2019, it can be noticed that only 3 regions out of 22 saw a decrease, which means that in 19 regions (86%) the unemployment rate increased (Figure 3). In 2021, the unemployment rate increased in 7 regions and decreased in 13.

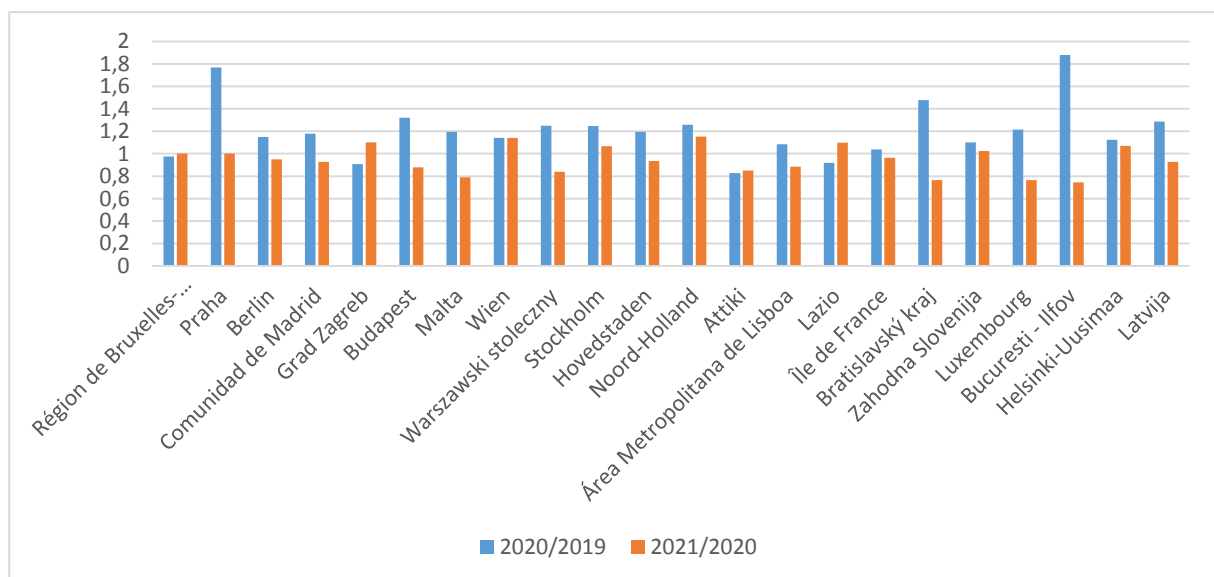


Figure 3. Relative increases in the unemployment rate in 2020 and 2021 in the examined EU regions.

When comparing the actual unemployment rates in 2020 and 2021 with the forecasts for those years, it can be found that in both 2020 and 2021, only 1 region (out of 19) had an actual unemployment rate lower than the forecast¹. This was the Área Metropolitana de Lisboa region.

¹ In the case of the unemployment rate, no average relative changes are provided because the forecast values of the unemployment rate are sometimes small (close to 0) and the relative differences between the actual unemployment rate and the forecasts are huge (in the case of the Zahodna Slovenija region it is 4500%), which has a very large influence on the average.

This can lead to the conclusion that the outbreak of the pandemic had an impact on the unemployment rate in the studied regions.

The number of people at risk of poverty is associated with growing unemployment. For this variable, Eurostat has a very poor database, so trends were not estimated for individual regions, and only the relative changes for 2019-2020 and 2020-2021 were calculated (Figure 4). Of the 14 regions for which data were available, in 2021, 8 observed a reduction in the share of people at risk of poverty in the total population, and in 1 region the rate remained unchanged. This means that in 5 regions the share of people at risk of poverty increased. In the studied regions, the average decrease in this share in 2020 was 5%.

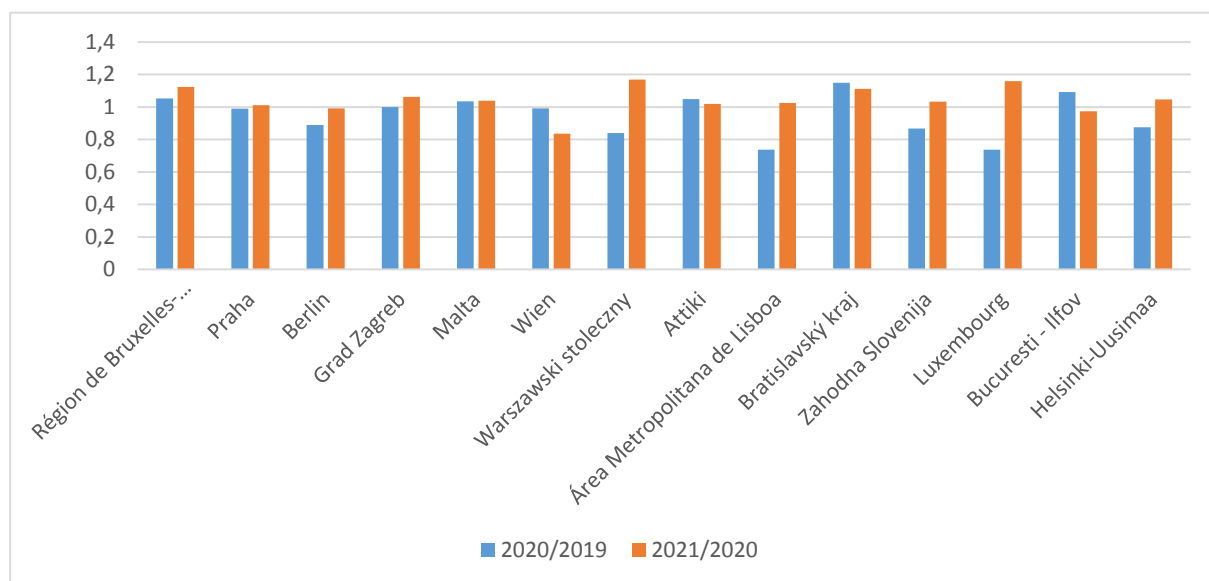


Figure 4. Relative increases in the number of people at risk of poverty in 2020 and 2021 in the surveyed EU regions

In 2021, the situation worsened the average increase in the share of people at risk of poverty for the surveyed regions was more than 4%. In as many as 11 regions, the share increased, and only in 3 it decreased.

Overall, the worst situation was in the Bratislavský kraj region because in 2020 the number of people at risk of poverty, compared to 2019, increased by about 15%, and in the following year by another 11%. In 2021, the largest relative increase in the analyzed variable was observed in the Warsaw Capital Region - an increase of 17%.

6. Nights spent at tourist accommodation establishments and air transport of passengers

During the COVID-19 pandemic, various countries introduced several restrictive regulations to counteract the spread of the pandemic. This undoubtedly had a significant impact on the tourism industry. Of the trend models for the 14 regions that could be estimated,

the Chow test detected significant structural changes in all of them. The average decrease in occupied beds in 2020 compared to 2019 in all 22 regions was 64% (Figure 5), which meant disaster for the tourism industry. The following year saw an increase in occupied beds, reaching an average of 34%.

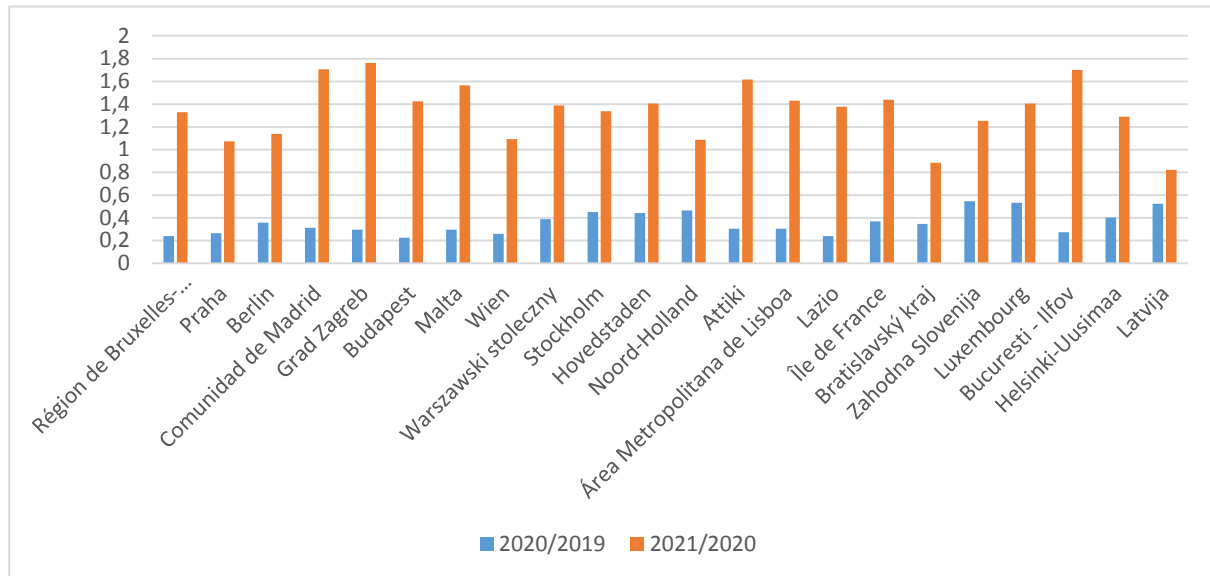


Figure 5. Relative increase in the number of occupied bed places in 2020 and 2021 in the surveyed EU regions.

In 2020, the worst situation was in Budapest, where the number of occupied beds decreased by 78% compared to the previous year, and the best situation was in the regions: Zahodna Slovenija, Luxemburg and Latvija. In 2021, a decrease in occupied beds was only observed in 2 regions, i.e., in Bratislavský kraj and Latvija. Three regions saw an increase of more than 70%, with the largest increase in the Grad Zagreb region (76%).

For 15 regions the forecasts for 2020 and 2021 could be calculated. Certainly, not assuming the outbreak of the pandemic, the forecasted number of occupied beds was much higher than the actual number of occupied beds, as confirmed in Table 3.

Table 3.

Average share of nights spent in tourist accommodation facilities in the forecast of nights spent in tourist accommodation facilities in 2020 and 2021

Year	Participation
2020	35.06%
2021	43.07%

In 2021, the situation was much better, but it was still bad. The travel industry seems to have suffered the most from the pandemic. The number of travelers is also related to accommodation bookings. The study examined only passengers using air transport.

For this variable in all 17 estimated models the Chow test showed significant structural changes in the models. Thus, the outbreak of the pandemic affected not only the accommodation facilities, but also passenger transportation. The average decline in the number of passengers in

the 19 regions for which data were available reached 74% in 2020 compared to 2019 (Figure 6), which represents even greater decrease than for occupied accommodations. Comparing the number of airline passengers to their projections for 2020 proves to be even worse, with a drop of 77%. In 2021, the situation improved and there was a 23% increase in passengers served compared to 2020, but the situation was still very bad compared to the non-pandemic forecasts (the actual number of passengers was 71% less than the projected number of passengers). Such a tough situation in the airline market contributed to the collapse of 103 carriers, but interestingly, as many as 126 new airlines were established during the pandemic (Money, 2023).

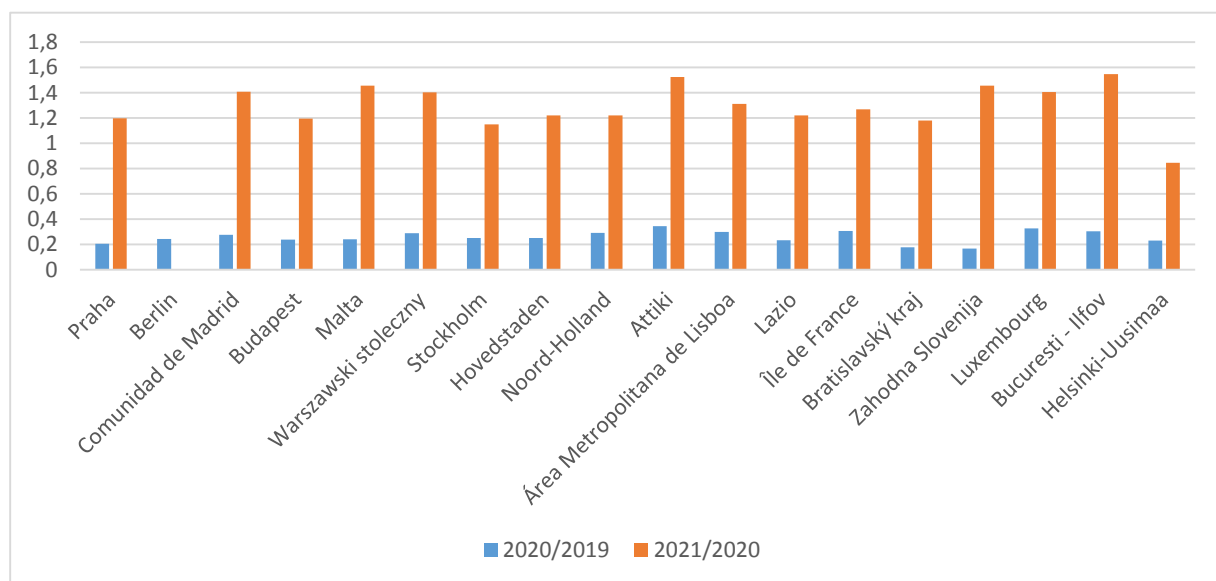


Figure 6. Relative increases in the number of air passengers in 2020 and 2021 in the examined EU regions.

The worst situation was in the Helsinki-Uusimaa region, which observed decline in the number of passengers both in 2020 and 2021. For 2 years, the number of passengers fell by more than 80 percent.

7. Individuals who ordered goods or services on the internet for private use in the last year

During the pandemic, many countries, including Poland, introduced restrictions on the free movement of people. Seeing the enormous number of the pandemic victims in the world, people avoided direct contact with other people. The situation created room for trade to flourish via the Internet.

Due to the lack of data, trend models were developed for only 11 regions, in 5 of which the Chow test indicated that there was a significant structural change in the models. We can therefore argue that in almost half of the surveyed regions for which the trend function was

estimated, the pandemic had a significant impact on the number of people ordering goods or services over the Internet. The surveyed regions saw an average increase of 26% in the number of people ordering online in 2020 compared to 2019. This is certainly a significant increase, but such a substantial increase was affected by the result of the Bucuresti-Ilfov region, where it amounted to almost 80%. In all 16 regions for which data was available, the average increase in the number of people ordering online was 14% (Figure 7). It should be noted here that during the period under study, the Lazio region saw an 11% decrease in the number of people ordering goods or services on the Internet. In the following year, the average increase was almost 5%.

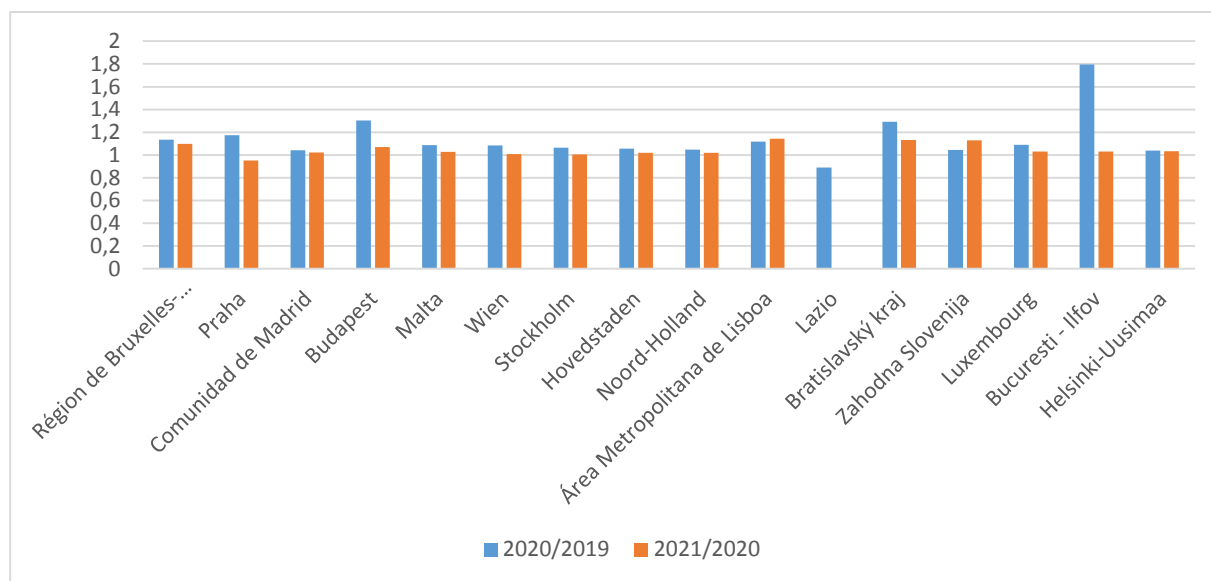


Figure 7. Relative increase in the number of people shopping online in 2020 and 2021 in the surveyed EU regions.

Growth of 14% in 2020 and 5% in 2021 should be considered significant, especially since it is 10 and 13 percentage points higher than forecast, respectively.

8. Employment in high-tech sectors

The increase in ordering goods and services on the Internet and the more frequent introduction of remote work by employers is associated with an increase in high-tech employment. Such a significant increase in high-tech employment is not confirmed by the Chow test; only in 4 out of 18 cases it indicated a significant structural change in the models. In all 22 regions, the increase in 2020, compared to 2019, averaged 7% (Figure 8), with 5 regions experiencing a decrease in employment in the sector and 1 remaining unchanged. The largest increase in employment occurred in the Noord-Holland region reaching around 31%, while the largest decrease occurred in the Grad Zagreb reaching 22%.

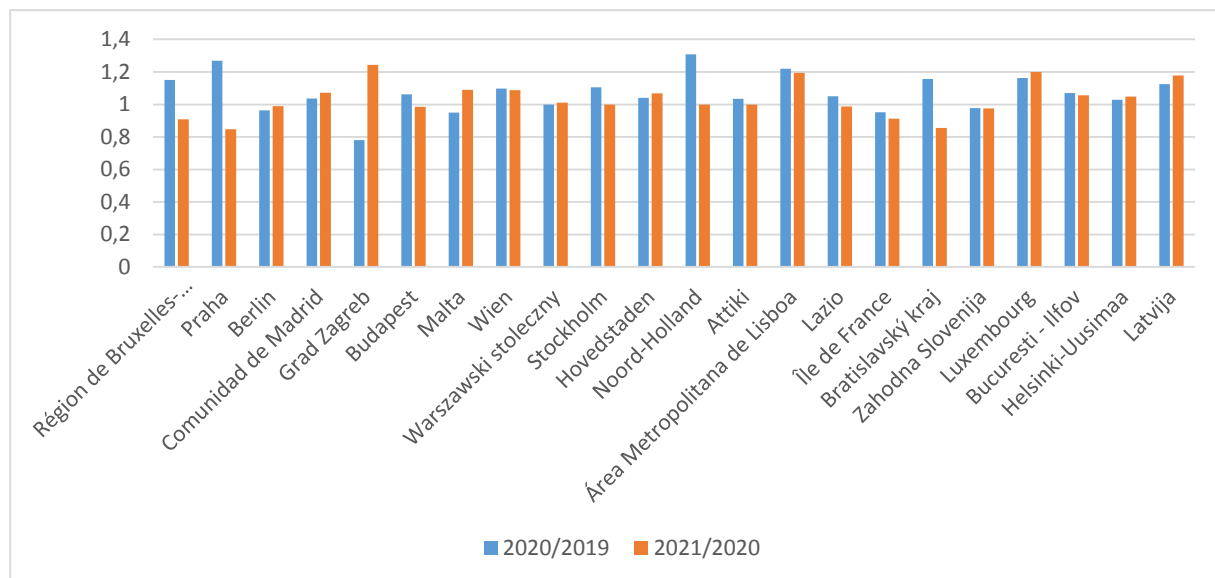


Figure 7. Relative increase in the number of people employed in the high technology sector in 2020 and 2021 in the surveyed EU regions.

In 2021, the average increase in employment in the surveyed regions was only 2.5%. The largest increase, i.e., almost 25% was observed in the Grad Zagreb region, where the largest decline had been reported before.

Comparing actual employment in the high-tech sector with forecasts that did not assume a pandemic would occur, it can be seen that in 2020 there was an increase in employment in this sector compared to forecasts (by an average of 5%), but in 2021 actual employment was at the forecast level (the average share of actual employment in forecast employment was 1). It can be concluded that the pandemic had a short-term impact on employment in the high-tech sector.

9. Conclusions

The COVID-19 pandemic undoubtedly had a major impact on the development of EU regions. There are capital cities in the studied regions, so they tend to be the fastest growing. In terms of population, the largest decline in 2020 was observed in Prague. The decrease was 4.5%, and if we look at the decrease in population relative to projections it is as high as 6.3% in Prague. Among the surveyed regions, there were also 4 in which the population in both 2020 and 2021 was higher than forecast. For 65% of the estimated trends, the Chow test indicated structural changes in the trend models, which means that the pandemic in these cases had a significant impact on the population.

The decline in population also had an impact on the decline in GDP. In 2021, there was not a single region where the population decreased, and GDP increased. The largest decline in GDP in 2020 was in the Comunidad de Madrid region. In this Spanish region, the decline in GDP

reached 10%. In 2021, the European economies began to rebound and none of the surveyed regions saw a decline in GDP. Special attention should be paid to 3 regions, i.e., Stockholm, Hovedstaden and Luxembourg. These regions saw GDP growth in both studied years, and it was significant. The ratio of GDP in 2021 to 2019 was between 13.4 and 15.9%. It can be concluded that the COVID-19 pandemic has a stimulating effect on GDP growth because in 2021 it was higher in these regions than projected on the basis of trends by 6.3 to 11.3 percent.

In other regions, the growth was not that impressive, and in 3 cases there was a decrease in GDP in 2021 compared to 2019 GDP (Attiki, Área Metropolitana de Lisboa, Lazio).

The pandemic also had an impact on the unemployment rate. The worst situation was in the eastern part of the EU, in the Bucuresti - Ilfov, Praha and Bratislavský kraj regions. The increase in the unemployment rate was 88%, 77% and 48%, respectively. While in the Bucuresti-Ilfov and Bratislavský kraj regions the unemployment rate fell sharply in the following year, it did not change in Prague. Significant increase was also seen in the Noord-Holland and Stockholm regions, both of which saw large growth in the unemployment rate in both years. In 2021, the unemployment rate was 45% and 33% higher in these regions than in 2019, respectively.

Although the unemployment rate increased the most in Prague, the number of people at risk of poverty did not change for the 2 analyzed years. The worst situation was in the Bratislavský kraj and Région de Bruxelles-Capitale. In 2020, the number of people at risk of poverty in Portugal's Área Metropolitana de Lisboa region dropped significantly, with a decrease of almost 25%.

Undoubtedly, the COVID-19 pandemic had the greatest impact on the tourism industry, as indicated by earlier analyses. For both occupied accommodation and passenger air transport, the Chow test indicated a structural change in the parameters in all estimated trend models. This means, statistical confirmation of the very large impact of the pandemic on the tourism industry. Even significant increase in occupied accommodations and air passenger transport did not compensate for the losses of 2020. Tourism-oriented regions were by far the worst affected. In the Île de France region, the number of occupied beds fell from more than 84.6 million to more than 31.2 million. In terms of absolute numbers, the Lazio region came in second, with a drop from 39 million to 9.3 million occupied beds. In the case of passenger air transport, the worst situation was observed in the Bratislavský kraj and Helsinki-Uusimaa regions, where the decline in passengers in 2021 compared to 2019 was about 80%.

The pandemic outbreak also provided an opportunity for other industries to flourish. Due to restrictions on movement and the proliferation of remote work in many areas, it seemed natural that online commerce and high-tech job growth would flourish. Indeed, in 2020 and 2021, there was an increase in online sales of goods and services much higher than predicted by the trend models despite the fact that the Chow test confirmed a significant change in trend for only almost half of the estimated models. The largest increase in customers ordering goods

and services online was noted in Bucharest, with an increase of almost 80% in 2020. Only the Lazio region saw a decrease in the number of online shoppers in 2020.

In terms of employment in the high-tech sector, a significant increase was observed in 2020, the rate of which fell in 2021. In that year, the average employment in the surveyed sector was at the level of forecasts, so it can be said that the pandemic had a very short-term impact on this industry.

In conclusion, it can be stated that the COVID-19 pandemic had an impact on all the studied regions, but its intensity was varied. Regions that are related to the tourism industry suffered the most.

Further study should cover other EU regions and a larger number of economic sectors, which will allow for grouping regions according to similarities in coping with the pandemic and calculating spatial correlations.

References

1. Ambroziak, Ł. (2020). Wpływ pandemii COVID-19 na handel rolno-spożywczy Polski: pierwsze doświadczenia. *Zeszyty Naukowe SGGW w Warszawie - Problemy Rolnictwa Światowego*, Vol. 20, No. 4, pp. 5-17, doi: 10.22630.
2. Biolik, J. (2018). *Podstawy ekonometrii z Excelem i Gretlem*. Katowice: Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach.
3. Bukowski M. (2023). Wpływ pandemii na branżę turystyczną w Polsce, In: M. Bukowski, H. Gawroński, K. Olszewska, K. Sidorkiewicz, K. Starańczak (Eds.), *Globalne, europejskie i krajowe skutki pandemii Covid-19 dla gospodarki. Wybrane problemy* (pp.35-64). Elbląg: Wydawnictwo Akademii Nauk Stosowanych w Elblągu.
4. Czajkowska, A. (2020). pandemii COVID-19 na działania CSR podejmowane przez przedsiębiorstwa. *Zeszyty Naukowe UE w Krakowie - Problemy Rolnictwa Światowego*, Vol. 3, No. 987, pp. 45-62, doi: 10.15678.
5. Długosz, P. (2021). *Trauma pandemii COVID-19 w polskim społeczeństwie*. Warszawa: CeDeWu.
6. Eurostat. Retrieved from: <https://ec.europa.eu/eurostat>, 10.10.2023.
7. Hasić M. (2023). Wpływ pandemii Covid-19 na zachowania konsumenckie Polaków w handlu elektronicznym, In: M. Bukowski, H. Gawroński, K. Olszewska, K. Sidorkiewicz, K. Starańczak (Eds.), *Globalne, europejskie i krajowe skutki pandemii Covid-19 dla gospodarki. Wybrane problemy* (pp. 129-152). Elbląg: Wydawnictwo Akademii Nauk Stosowanych w Elblągu.

8. Klimczuk, A. (2021). Pandemia COVID-19 z perspektywy teorii ryzyka. In: A. Zybala, A. Bartoszewicz, A. Książkowski A. (Eds.), *Polska... Unia Europejska... Świat... w pandemii COVID-19 – wybrane zagadnienia* (pp. 35-57). Warszawa: Elipsa.
9. Maddala, G.S. (2006). *Ekonometria*. Warszawa: PWN.
10. *Moneyt*. Retrieved from: <https://www.moneyt.pl>, 16.10.2023.
11. Nguyen, V.K.L., Le, T.M.H., Tran, T.M.C., Le, T.T.H., Duong, T.N.M., Le, T.H., Nguyen, T.S., Vo, N.H. (2021). Exploring the Impact of Pandemic on Global Economy: Perspective from Literature Review. *Social Sciences And Humanities*, 29(3), pp. 2033-2087.
12. Osińska, M. (2007). *Ekonometria współczesna*. Toruń: Dom Organizatora.
13. *Termedia*. Retrieved from: <https://www.termedia.pl>, 15.10.2023.
14. *Worldbank*. Retrieved from: <https://www.worldbank.org/en/publication/wdr2022/brief/chapter-1-introduction-the-economic-impacts-of-the-covid-19-crisis>.

AREAS OF BLOCKCHAIN TECHNOLOGY APPLICATION IN MODERN CITY – PART I

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Purpose: The purpose of paper is to indicate the potential of using blockchain technology in smart cities. The author analyzes the state of development of blockchain-based solutions and relates it to areas of the functioning of cities. The aim is also to indicate blockchain applications importance in the context of city residents quality of life and the functioning of various industries operating within them.

Design/methodology/approach: The objectives of the paper were achieved by analyzing literature, industry reports as well as selected blockchain projects' websites. The theoretical scope of the article is the description of blockchain technology application areas within the modern cities, their main characteristics and the potential for its usage.

Findings: The author indicated 6 areas of blockchain application, and then indicated a number of functioning solutions based on blockchain referring to them, and also indicated the potential of the impact of the described solutions on the development of the city. In the summary, areas for further research were indicated, referring to slightly differently perceived aspects of the city's development and improving the lives of its inhabitants.

Practical implications: The successful implementation of blockchain solutions depends on a large amount of conceptual and technological work in organizations. The article suggests areas of blockchain use in the city and indicates examples of already implemented solutions that can constitute a reference point and inspiration for new solutions.

Social implications: The blockchain technology shows the potential to improve the quality of life of city residents in the context of building solutions that eliminate the need for trust in service providers, weakened by frequently observed unethical behavior and negligence in the security and transparency of information flow. The widespread use of blockchain in the city is therefore undoubtedly in the interest of societies.

Originality/value: The paper's originality is expressed in a comprehensive look at the issue of using blockchain in the functioning of modern cities, together with an indication of both the potential of their implementation and already existing solutions in the subject area. Moreover, the author points out social benefits in the form of increased trust and an increase in the city residents quality of life.

Keywords: from 3 to 5 keywords (phrases), justified text, spacing before 6 pt., TNR 12 pt. font, single line spacing.

Category of the paper: Literature review, viewpoint.

1. Introduction

Modern cities are characterized by dynamic development, trying to meet the challenges related to the increasing level of urbanization, sustainable development and effective management of resources (Addas, 2023; Sodiq et al., 2019). In this context, the role of technology becomes crucial, and one of the most innovative ones, gaining more and more recognition, is blockchain technology (Radu, 2020; Choi et al., 2022). Blockchain, originally known as the basis for the functioning of cryptocurrencies, shows the potential for a revolutionary transformation within smart cities, offering not only secure and non-retroactive data storage, but also opening new opportunities in areas such as urban infrastructure management, services for citizens, identification, transport, and environmental and health protection (Ante, 2020). This article reviews the main areas of application of blockchain technology in the context of smart cities, analyzing their potential, benefits and challenges related to the implementation of this innovative solution in processes aimed at developing the city and improving the quality of people's lives. The title of this article suggests that its topic will be published in two papers. The first one focuses on three areas of application of blockchain technology in modern cities: management of food supply chains, the functioning of the tourism industry within cities and intelligent healthcare for its residents. The second article in the series will refer to the telecommunications industry, the energy sector and intelligent transport systems and will be published in one of the next issues of the magazine. In the second part, the topics outlined in this introduction will also be expanded to include aspects related to the administrative management of the city and civic participation and its enhancement thanks to the use of blockchain technology.

2. Materials and methods

A literature review - in particular bibliometrics - was carried out for research without the publishing time limitation on the topic of blockchain technology for smart city area of research. The first step was to analyze publications included in the Scopus database. However, for a comprehensive study, the analysis was deepened to include the Web of Science database. The following queries were run on October 16th 2023:

- Scopus: TITLE-ABS-KEY ("blockchain AND smart AND city").
- Web of Science: TOPIC: ("blockchain smart city"); Indexes: SCIEXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCREXPANDED, IC.

The search results showed given numbers of publications in subject area: Scopus – 1767, Web of Science – 1511.

Figure 1 shows the number of publications on analyzed topics since 2016 in both analyzed databases.

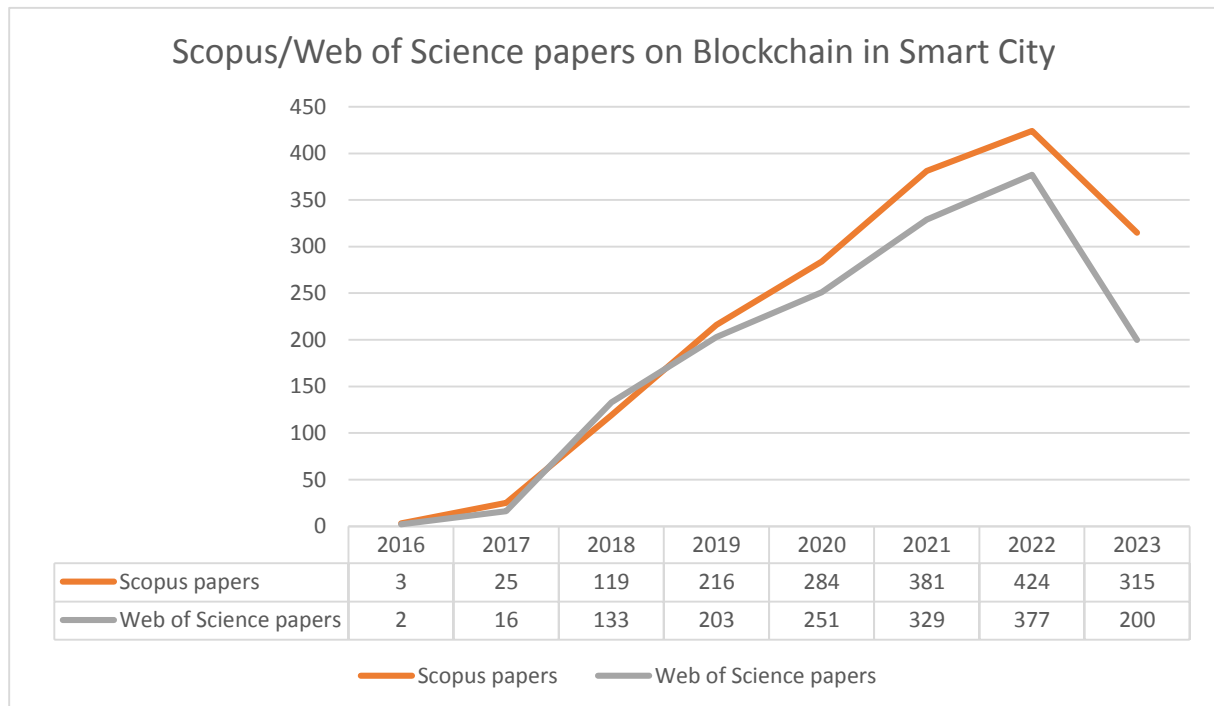


Figure 1. Scopus papers on Blockchain in Smart City.

Source: own elaboration.

The search results indicate a relatively big number of publications embedding the topic of blockchain technology in the field of smart city, which confirms the author's assumptions about the popularity of chosen topic and legitimacy of in-depth analyzes in this area. The graph of the number of papers in the analyzed area clearly shows an upward trend, signaling the constantly growing interest of researchers in the applications of blockchain technology in the area of city management. During the preparation of this article, the literature review resulting from the above bibliometric analyzes was supplemented with a review of reports from analytical and consulting companies as well as a review of selected blockchain projects websites.

3. Blockchain technology applications in the context of smart city

In the era of dynamic changes in the area of urban development and technology, the concept of Industry 4.0 is the foundation of the digital revolution, transforming not only the methods of industrial production, but also introducing significant innovations in the context of smart cities (Safiullin, Krasnyuk, Kaplyuk, 2019; Lepore, Testi, Pasher, 2023). In this context, blockchain technology, which is one of the main pillars of Industry 4.0, plays a key role as a tool enabling effective, secure and transparent data management in urban environments (Javaid et al., 2021).

This article analyzes contemporary solutions based on blockchain technology, positioning them within the concept of smart city and Industry 4.0. The focus was on exploring the ways in which blockchain technology can support the development of smart cities by optimizing processes, improving infrastructure, providing services to residents and creating innovative solutions that constitute the foundation for sustainable urban development in the digital era (Zaczyk, 2022). The issue of the basics of the functioning of blockchain technology and smart contracts was discussed in previous scientific articles by the author of this publication (Zaczyk, 2021), as well as in numerous articles by other authors, therefore it is not discussed in this paper (Warburg, Wagner, Serres, 2019).

Nowadays, developing cities are designed in such a way that it is possible to organize them effectively in the conditions of increasing urbanization, the need to control CO₂ emissions and improving the quality of life of residents thanks to the extensive use of modern ICT technologies (Yusoff, 2020). ICT technologies contribute to the dynamic development of various types of subsystems of the city management system (Tcholtchev, Schieferdecker, 2021). These include the healthcare system, energy management, water management, urban transport system, tourism, food supply chains, education system and many others. The main components of the smart cities concept are presented in Figure 2.

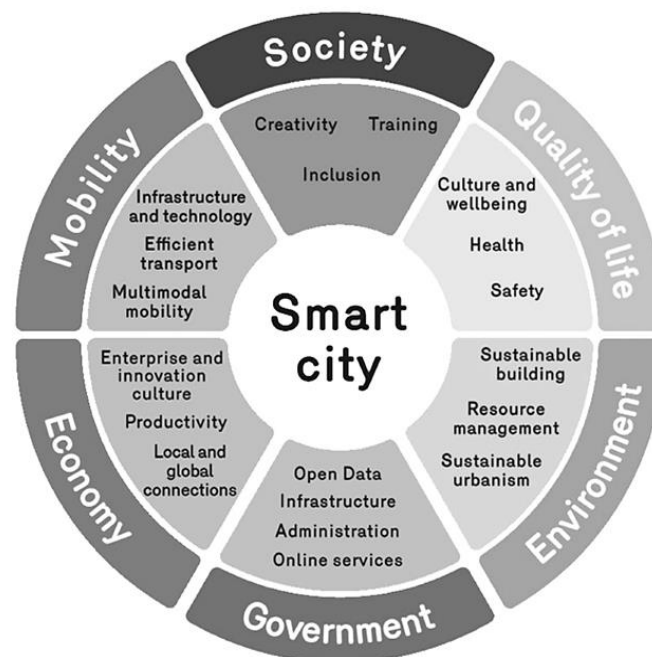


Figure 2. Main components of Smart cities.

Source: Qureshi, Hadi, Haroon, Bashir, Islam, 2020, pp. 75-92.

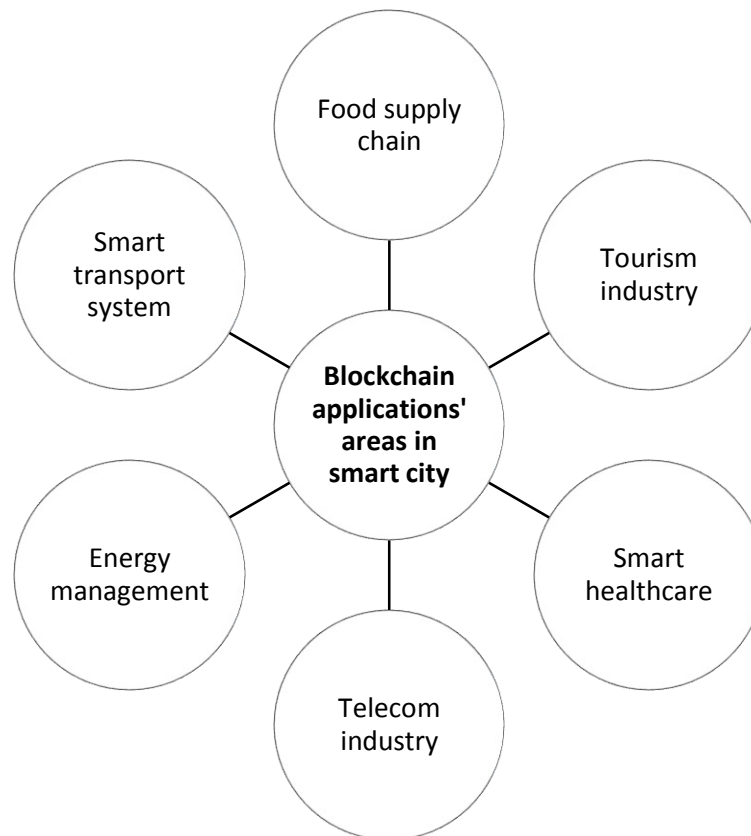


Figure 3. Scopus papers on Blockchain and Artificial Intelligence in Supply Chain Management.

Source: own elaboration based on Ullah, Naeem, Coronato, Ribino, De Pietro, 2023.

The applications of blockchain technology are increasingly being mentioned among the key factors transforming the functioning of modern cities (Treiblmaier, Rejeb, Strebing, 2020). The combination of a wide network of IoT devices, 5G (or even 6G) technology and blockchain technology shows great potential to increase the security of IT processes that improve processes carried out in a modern, smart city (Singh et al., 2020). Blockchain-based systems are able to ensure greater data security, privacy of their users and enable process automation using smart contracts (Gupta et al., 2020). Applications of blockchain technology can be found in many areas of city management, such as: food supply chains, tourism industry, intelligent healthcare, telecommunications industry, energy management, and intelligent transport systems (Ullah et al., 2023).

3.1. Blockchain solutions for food supply chain

Food supplies are an essential part of people's lives in cities. More and more aware consumers demand access to information regarding the sources of origin, degree of processing and storage conditions of food at individual stages of its flow in supply chains (Haji et al., 2020). Blockchain, thanks to its characteristics, ensures a 100% reliable record of the information desired by the customer and enables backtracking of food provenance measured in seconds instead of days, as was the case with more traditional methods (De Conti, 2022).

This has a positive impact on the customer's experience in terms of the safety of the food received, quality compliance verification, and also strengthens data security in the supply chain. The use of blockchain technology in the area of food supply chains involves the use of distributed registers to track all transactions between supply chain participants as well as events related to the flow of goods (Kamilaris, Fonts, Prenafeta-Boldu, 2019). Supply chain links interact with the blockchain ledger using role-specific web and/or mobile applications. An example of the use of blockchain in the food supply chain is the IBM Food Trust (Joo, Han, 2021). The benefits of its use for individual links in the supply chain are indicated in Table 1.

Table 1.

The benefits of the use of IBM Food Trust for links in food supply chain

Food supply chain node	Value added by IBM Food Trust
Growers	-Proving the farm is not a source of outbreak, -connectivity to the supply chain
Food manufacturers	-Instill trust between retailers, suppliers and customers -Automated and reduced manual certificate management
Distributors	-Conduct targeted recalls -Enable internal data sharing
Logistic companies	-Enhanced ability to meet compliance standards -Manual processes reduction
Retailers	-Assure customers food supplied is safe -Conduct targeted recalls quickly
Consumers	-Learn about recalls and increased transparency -Reduce risk of being victimized by food fraud
Certification bodies	-Reduce fraudulent certificates -Increase renewal speed
Food services (HORECA)	-Assure customers food supplied is safe -Reduce wasted food
Regulators	-Identify contamination quickly -Reduce unnecessary testing

Source: Zaczyk, 2022.

Analyzing the potential of the practical use of blockchain in the food supply chain, there are numerous examples of solutions already operating in the industry. Selected of them are indicated in Table 2 (Patel et al., 2022).

Table 2.

Selected blockchain-based solutions for food supply chain management

Solution	Functionality	Source
"Thank my Farmer"	Coffee tracing from its source to the consumption place	thankmyfarmer.com
BC Food Safety Alliance	Imported meat monitoring in the supply chain	jdcorporateblog.com
IBM Food Trust	Collaborative network of growers, processors, wholesalers, distributors, manufacturers, retailers, and others, enhancing visibility and accountability across the food supply chain	ibm.com/products/supply-chain-intelligence-suite/food-trust
Greenfence	Food chain members authentication and recording	gfsi.greenfence.com/
Ripe.io	Supply chain tracking, secure data aggregation and business model digitization, farming processes automation	ripe.io
TagOne	Identification of data tempering, providing clear audit trails and track global natural supply imbalances	tagone.com

Cont. table 2.

Transparent Path	Farm-to-distributor journey of food in real-time displaying	xparent.io
Wholechain	Product information digitizing, tracking of food quality data and coordination between parties during the delivery process	wholechain.com
FoodLogicQ	Supplier documentation centralization, product evaluations facilitation and food recall actions automation	foodlogiq.com
Mojix	Food safety compliance automation, expiration date tracking and inventory management	mojix.com
AgriDigital	Building a profitable, equitable and sustainable future for agricultural businesses and their communities	agridigital.io

Source: own elaboration.

The solutions presented in Table 2 are largely based on smart contracts and enable deepening relationships between supply chain participants, eliminating the need for trust within it and bringing benefits to all its participants, as shown in the example of IBM Food Trust (Table 1). The examples listed in Table 2 are solutions dedicated to the supply chains of a specific food product (coffee, meat) or solutions treating the food supply chain more broadly - as a coherent logistics system.

3.2. Blockchain solutions for tourism industry

Tourism is an area where cities and regions can look to increase their attractiveness and encourage many people to visit them (Khairi, Darmawan, 2021). Blockchain technology based solutions are also used in this area. There is possibility to find them in many areas related to tourism such us (Erol et al., 2022):

- booking systems – the use of smart contracts can revolutionize booking systems, which will gain the ability to automate the management of reservations and payments while minimizing the involvement of intermediaries and ensuring trust thanks to the software,
- identity authentication and verification – eliminating the need to use physical documents, reducing the risk of fraud and fraudulent activities,
- loyalty programs and rewards - increasing the transparency and flexibility of the solutions used,
- destination tracking and management - accurate and reliable tracking of tourist movements and behaviors, tourists' activities real-data capturing,
- reputation systems and reviews – verifying reviews coming from customers of tourism industry companies of different types.

Examples of applications of blockchain technology in the area of broadly understood tourism are indicated in Table 3.

Table 3.*Examples of blockchain-based solutions in tourism industry*

Solution	Functionality	Source
Trippki	A blockchain-based project that aims to create better customer loyalty schemes in the travel and tourism industry	blog.trippki.com
ShoCard and SITA	Improving the identity management in the travel industry through blockchain	crunchbase.com/organization/shocard-inc
Krispay	Digital wallet allowing Singapore Airlines customers to turn their FFPs into payments which are developed by KPMG and Microsoft	singaporeair.com/en_UK/s/g/ppsclub-krisflyer/use-miles/krispay/
Lockchain	A direct market place for many hotels, airlines and more. It uses the decentralized system for payment, property management, booking process and lot more	lockchain.ai
Bed-swap	Ability to move inventories between various points of sale and selling margins, launched by TUI	forbes.com/sites/bernardmarr/2018/12/07/the-amazing-ways-tui-uses-blockchain-to-revolutionize-the-travel-industry/
BeeToken	Home-sharing platform with the usage of blockchain technology to put customers in contacts with hosts, so that they can arrange and pay for stays	beetoken.com
Winding Tree	Baggage tracking via blockchain and a booking platform	windingtree.com

Source: own elaboration.

In the area of tourism industry, there are currently relatively few solutions based on blockchain technology, but there are still several existing solutions with varying degrees of development (Table 3). Existing solutions, although not very well developed and at an early stage of their life cycle, show the way for the development of blockchain-based tools aimed at improving the functioning of the tourism sector, which significantly influences the attractiveness of a modern city.

3.3. Blockchain solutions for smart healthcare

The healthcare area plays a key role in the functioning of a smart city for several reasons (Al-Azzam, M.K., Al-Azzam, M.B., 2019). Firstly, healthy residents are the foundation of productivity and quality of life in the city (Mouratidis, 2021). Secondly, advanced medical technologies and e-health are an integral part of intelligent systems, enabling health monitoring, rapid response to health threats and improving access to health care (Idoudi, Val, 2021). Additionally, effective health services help reduce the burden on the care system, ensuring faster and more effective action in crisis situations, which is important for the stability and safety of smart city residents.

Blockchain technology has the potential to transform healthcare by placing the patient at the center of the healthcare ecosystem and increasing the security, privacy and interoperability of health data (Chang, Chen, 2020). This technology can provide a new model for health information exchange, increasing the efficiency, immediacy and security of electronic health records (Aloini et al., 2023). Examples of applications of blockchain technology in the field of healthcare are indicated in Table 4.

Table 4.*Examples of blockchain-based solutions in the field of healthcare*

Solution	Functionality	Source
Akiri Switch	A network-as-a-service optimized specifically for the healthcare industry, helping protect transportation of patient health data. The Akiri system does not store data of any kind. ensures healthcare data remains secure and shareable with only the parties authorized for access at the moment when they need it	healthcareitnews.com/news/blockchain-network-service-platform-scores-10-million-ama-backed-health2047
BurstIQ	Complete and up-to-date information about patients' health and healthcare activity, it could help to root out abuse of opioids or other prescription drugs	burstiq.com
Medicalchain	Maintainin the integrity of health records while establishing a single point of truth. Doctors, hospitals and laboratories can all request patient information that has a record of origin and protects the patient's identity from outside sources	medicalchain.com
Avaneer Health	A public ledger to support better claims processing, secure healthcare data exchanges and keep provider directories maintained and up-to-date	avaneerhealth.com
Patientory.inc	Enabling patients, healthcare providers and clinicians to access, store and transfer all important information via blockchain. Patientory helps the healthcare industry move more quickly by housing all patient information under one roof	patientory.com
Embleema	A virtual trial and regulatory analytics platform designed to fast track drug development. Users are recruited to digitally consent to secure, untampered medical data collection, which is then stored on Embleema's blockchain and analyzed	embleema.com
Blockpharma	A solution for drug traceability and counterfeiting. By scanning the supply chain and verifying all points of shipment, the company's app lets patients know if they are taking falsified medicines	Mars, Yousseuf, Cheikhrouhou, Turki, 2021, pp. 197-208.
Tierion	Auditing documents, recording drugs and medicines to keep a clear history of possession. The company uses timestamps and credentials to maintain proof of ownership throughout a medical supply chain	tierion.com
FarmaTrust	Tracking pharmaceuticals, determining the authenticity of medical devices, and maintaining data security for patients scheduling vaccinations and diagnostic testing. The company's services help to keep fake drugs out of the supply chain	farmatrust.com

Source: own elaboration.

As proven in Table 4, there are many more blockchain-based solutions in the healthcare space than in the tourism space. Trust in the holders of patients' medical data is absolutely crucial for the functioning of the medical industry, and the use of blockchain allows it to be ensured thanks to technology. A problem that has been plaguing the medical industry for years is the issue of counterfeit drugs circulating in circulation, and blockchain is able to ensure full transparency of the supply chain, thus ensuring the authenticity of medical products and drugs in the possession of patients. This helps to increase trust and confidence in the medicines they use. The use of blockchain technology in the medical industry, in the opinion of the author of this article, is a milestone in its development and gives hope for a significant improvement in the quality of medical services offered to residents of modern, smart cities.

4. Summary

As shown in this article, blockchain technology is already an important pillar of the functioning of many smart city areas. Blockchain-based solutions clearly demonstrate an impact on improving the quality of people's lives and the functioning of many industries that are key to the development of a smart city. By strengthening the transparency of data flow about residents and business entities operating in the city, they enable direct communication between residents, city authorities and the private sector. Transparent access and use of public services, integrity and security of information are the undoubted and unique advantages of blockchain technology. In fact, in each of the areas called key components of a smart city, blockchain technology offers a number of innovative solutions, and the dynamics of their development indicates a further expansion of the spectrum of emerging projects based on this technology.

As for the suggestion regarding future areas of scientific research, it is also worth noting the potential of blockchain-based solutions enhancing civic participation (resident loyalty platforms, complaint management systems), affecting the labor market (certifications and register of references on the blockchain), civic identity and culture (registers of monuments, grants for civil society), land development (land registration, documenting the conditions of real estate), or security (chain of custody on the blockchain, registration of video systems). The jointly developing concept of smart city and one of the pillars of industry 4.0 - blockchain - give hope for improving the functioning of modern cities, the quality of life of their inhabitants and the climate conducive to the development of business within them.

The future areas of research outlined above, as well as the areas of application of blockchain technology in energy, telecommunications and intelligent transport systems, will constitute the pillar of the second part of this article, which will be published as a separate paper. In the opinion of the author of this article, blockchain technology is still an insufficiently appreciated technological invention, the application of which goes far beyond cryptocurrencies perceived as the main use of blockchain. Its advantages can be seen primarily in ensuring trust for supply chain links, public administration units, or any other blockchain users, as well as in ensuring full data transparency. This may contribute to revolutionary changes in the perception of business processes of modern organizations and the functioning of societies around the world.

References

1. Addas, A. (2023). The concept of smart cities: a sustainability aspect for future urban development based on different cities. *Frontiers in Environmental Science*.
2. Al-Azzam, M.K., Al-Azzam, M.B. (2019). Smart city and smart-health framework, challenges and opportunities. *International Journal of Advanced Computer Science and Applications*, 10(2).
3. Aloini, D., Benevento, E., Stefanini, A., Zerbino, P. (2023). Transforming healthcare ecosystems through blockchain: Opportunities and capabilities for business process innovation. *Technovation*, 119, 102557
4. Ante, L. (2020). A place next to Satoshi: foundations of blockchain and cryptocurrency research in business and economics. *Scientometrics*, 124(2), pp. 1305-1333.
5. Chang, S.E., Chen, Y. (2020). Blockchain in health care innovation: literature review and case study from a business ecosystem perspective. *Journal of medical Internet research*, 22(8), e19480.
6. Choi, T.M., Kumar, S., Yue, X., Chan, H.L. (2022). Disruptive technologies and operations management in the Industry 4.0 era and beyond. *Production and Operations Management*, 31(1), pp. 9-31.
7. De Conti, L. (2022). *Blockchain Technology in the Agrifood Sector*.
8. Erol, I., Neuhofer, I.O., Dogru, T., Oztel, A., Searcy, C., Yorulmaz, A.C. (2022). Improving sustainability in the tourism industry through blockchain technology: Challenges and opportunities. *Tourism Management*, 93, 104628.
9. Gupta, R., Shukla, V.K., Rao, S.S., Anwar, S., Sharma, P., Bathla, R. (2020). *Enhancing privacy through "smart contract" using blockchain-based dynamic access control*. 2020 International Conference on Computation, Automation and Knowledge Management (ICCAKM). IEEE, pp. 338-343.
10. Haji, M., Kerbache, L., Muhammad, M., Al-Ansari, T. (2020). Roles of technology in improving perishable food supply chains. *Logistics*, 4(4), 33.
11. Idoudi, H., Val, T. (2021). *Smart systems for E-Health*. Springer International Publishing.
12. Javaid, M., Haleem, A., Singh, R.P., Khan, S., Suman, R. (2021). Blockchain technology applications for Industry 4.0: A literature-based review. *Blockchain: Research and Applications*, 2(4), 100027.
13. Joo, J., Han, Y. (2021). An evidence of distributed trust in blockchain-based sustainable food supply chain. *Sustainability*, 13(19), 10980.
14. Kamilaris, A., Fonts, A., Prenafeta-Boldó, F.X. (2019). The rise of blockchain technology in agriculture and food supply chains. *Trends in food science & technology*, 91, pp. 640-652.

15. Khairi, M., Darmawan, D. (2021). The Relationship Between Destination Attractiveness, Location, Tourism Facilities, And Revisit Intentions. *Journal of Marketing and Business Research (MARK)*, 1(1), pp. 39-50.
16. Lepore, D., Testi, N., Pasher, E. (2023). Building Inclusive Smart Cities through Innovation Intermediaries. *Sustainability*, 15(5), 4024.
17. Mouratidis, K. (2021). Urban planning and quality of life: A review of pathways linking the built environment to subjective well-being. *Cities*, 115, 103229.
18. Patel, D., Sinha, A., Bhansali, T., Usha, G., Velliangiri, S. (2022). Blockchain in Food Supply Chain. *Procedia Computer Science*, 215, pp. 321-330.
19. Radu, L.D. (2020). Disruptive technologies in smart cities: a survey on current trends and challenges. *Smart Cities*, 3(3), pp. 1022-1038.
20. Safiullin, A., Krasnyuk, L., Kapelyuk, Z. (2019). *Integration of Industry 4.0 technologies for "smart cities" development*. IOP conference series: materials science and engineering, Vol. 497, No. 1, p. 012089. IOP Publishing.
21. Singh, S., Sharma, P.K., Yoon, B., Shojafar, M., Cho, G.H., Ra, I.H. (2020). Convergence of blockchain and artificial intelligence in IoT network for the sustainable smart city. *Sustainable cities and society*, 63, 102364.
22. Sodiq, A., Baloch, A.A., Khan, S.A., Sezer, N., Mahmoud, S., Jama, M., Abdelaal, A. (2019). Towards modern sustainable cities: Review of sustainability principles and trends. *Journal of Cleaner Production*, 227, pp. 972-1001.
23. Tcholtchev, N., Schieferdecker, I. (2021). Sustainable and reliable information and communication technology for resilient smart cities. *Smart Cities*, 4(1), pp. 156-176.
24. Treiblmaier, H., Rejeb, A., Strebing, A. (2020). Blockchain as a driver for smart city development: application fields and a comprehensive research agenda. *Smart Cities*, 3(3), pp. 853-872.
25. Ullah, Z., Naeem, M., Coronato, A., Ribino, P., De Pietro, G. (2023). Blockchain applications in sustainable smart cities. *Sustainable Cities and Society*, 104697.
26. Warburg, B., Wagner, B., Serres, T. (2019). *Basics of blockchain: a guide for building literacy in the economics, technology, and business of blockchain*. Animal Ventures LLC.
27. Yusoff, M.M. (2020). *Improving the quality of life for sustainable development*. IOP Conference Series: Earth and Environmental Science, Vol. 561, No. 1, p. 012020. IOP Publishing.
28. Zaczyk, M. (2021). Key areas of blockchain technology application in logistics. *Zeszyty Naukowe Politechniki Śląskiej. Organizacja i Zarządzanie*, 152, pp. 245-261.
29. Zaczyk, M. (2022). Distributed ledger technology for supply chain and public governance as a response for sustainability issues. *Zeszyty Naukowe Politechniki Śląskiej. Organizacja i Zarządzanie*, 156, pp. 539-555.

HOUSING MARKET FACING PANDEMIC COVID-2019

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Purpose: The aim of this article is to present the situation of the housing market in the face of the conditions resulting from the covid-19 pandemic. The research focuses on the phenomena that took place in the individual quarters of the years 2019-2021, i.e. just before the pandemic period, during the restrictive phase of the pandemic and just after the pandemic.

Design/methodology/approach: Data for 16 cities, which are provincial capitals, were analysed. The source data comes from the Central Statistical Office (CSO) and the Report on the Situation on the Residential and Commercial Real Estate Market in Poland in 2019, 2020 and 2021 prepared by the National Bank of Poland. The methodology of the research was based on statistical methods, and a study was made of changes over time in the number of transactions made and average unit prices of residential units and rental rates, as well as the number of dwellings offered.

Findings: The research shows that the market dynamics hardly slowed down during the pandemic period. In all surveyed cities, an increase in unit prices of residential units and a decrease in rental rates were observed in selected quarters of 2020. In 2021, the residential property market in the main cities in Poland was in an expansionary phase. The number of transactions made was strongly influenced by the ability to obtain mortgage loans. During the study period, the interest rate was at a significantly low level. On the basis of the research carried out, it must be concluded that the market that defended itself from the pandemic crisis was the residential market. This supports the finding that residential real estate is perceived as a relatively safe investment of capital, which has so far yielded higher rates of return compared to placing cash in safer assets such as Treasury bonds or bank deposits.

Originality/value: The publication describes the behaviour of the residential property market during and immediately after the COVID 19 pandemic. Demand, supply and prices of residential units are analysed. The publication is aimed at those analysing the impact of pandemics and other unusual events on markets and real estate professionals.

Keywords: housing market, pandemic covid-19, buy-sell, rent-to-rent.

Category of the paper: market research.

1. Introduction

The epidemic incidence of COVID 19 in Poland resulted in an epidemic state from March 2020 to May 2022, according to the regulation of the Minister of Health. In the face of the situation, public sentiment and the so-called uncertainty of tomorrow changed, which had its dimension in the residential real estate market. A time of increased uncertainty in both the economic and social spheres was observed, and entrepreneurs as well as households were forced to exist in the new reality, which undoubtedly affected the demand and supply side of the residential real estate market.

The housing market is a specific segment of the real estate market, which satisfies the basic needs of human beings: livelihood and shelter. At the same time, the realization of these needs can take place not only through sales transactions, i.e. purchases, but also through real estate rental contracts. The behavior of the residential real estate market in the face of such specific conditions as the pandemic arouses great interest, so the purpose of this article is to reposition the actual situation of the residential real estate market under the conditions of the covid-19 pandemic.

The research focuses on the phenomena that took place in the individual quarters of 2019-2021, that is, just before the pandemic period, during the restrictive phase of the pandemic and just after it. The number of transactions made, as well as prices and rental rates, according to a breakdown of purchase-sale and rental transactions in the secondary market in each quarter of each year, were examined. In order to illustrate the situation on the housing market in Poland, data on 16 cities, which are provincial capitals, were analyzed: Warsaw, Gdansk, Krakow, Poznan, Wrocław, Białystok, Bydgoszcz, Katowice, Kielce, Lublin, Łódź, Olsztyn, Opole, Rzeszów, Szczecin, Zielona Góra. The source data comes from the Central Statistical Office (CSO) and the Report on the Situation of the Residential and Commercial Real Estate Market in Poland in 2019, 2020 and 2021 prepared by the National Bank of Poland. The research methodology was based on simple statistical methods, and a study was made of changes over time in the number of transactions made and average unit prices of residential units and rental rates, as well as the number of apartments offered.

2. Survey results

2.1. Number of transactions made

In the real estate market, residential demand always fluctuates more rapidly than happens with supply, which, due to technological processes, is determined for several years. Rapid increases or decreases in demand guided by so-called market sentiment are very often the cause

of instability in these markets, when demand shocks meet stiff supply. Despite the onset of the COVID-2019 pandemic, 2019 saw high demand for apartments in the local real estate markets of all Polish cities (Gajowniczek, 2021). This demand was a consequence of stable economic growth, favorable labor market conditions and the low cost of money. Financing of transactions continued with a significant share of buyers' own funds, while lending accelerated compared to the previous year (Liu, Su, 2021). In the housing market, in addition to consumer demand, investment demand played an important role, which was related to purchases of apartments for rent (Koszel, 2020). Thus, 2019 was another year in which economic factors positively affected the situation of local housing markets. Despite a slight weakening of GDP growth over the year, Poland's economic growth in 2019 was 4.0%. Positive trends continued in the labor market, which, combined with the low cost of credit and the low level of interest rates on bank deposits, continued to provide a strong demand stimulus for housing. It was created by households meeting their own housing needs, but also investment needs. The purchase of a rental unit was still seen as a relatively simple and attractive form of capital investment, providing a favorable rate of return, despite the low liquidity of the apartment and the level of investor risk associated with, among other things, the legal protection of the tenant (Kozicki, Sowa, 2021).

Such a tendency was noted in each of the surveyed cities, and a particularly high number of transactions characterized large Polish cities, viz: Warsaw, Krakow, Wroclaw and Poznan. In 2020, when the Polish real estate market was affected by restrictions related to the 2019 covid pandemic, demand for apartments remained stable.

In the first months of lockdown, many Poles had to postpone their housing plans, a sharp drop in interest in the topic of real estate purchases was noticeable. Observations of the Polish real estate market show that the COVID-19 pandemic has weakened the trend of buying real estate for investment purposes in terms of short-term rentals and has not significantly affected the demand and supply of housing for buyers' own needs (Verhaeghe, Ghekiere, 2021). At the same time, a historically high (highest since 2005) quarterly number of housing units completed was recorded in March 2020. At the same time, the first work-life restrictions were introduced for the entire population, to the point of a total lockdown that few expected. Real estate players involved in buying, selling and renting transactions, such as developers, real estate offices and notaries, had to adapt to ever-changing regulations (Mazurczak, 2021). Most forecasts at the start of the pandemic were pessimistic and the total lockdown caused many people to hold off on investments and the execution of many transactions to be frozen or significantly delayed due to movement restrictions (Najbar, 2021). Analyzing the data, it should be noted that the housing situation in local markets varied (Li, Zhang, 2021). Figure 1 shows the number of completed residential sales transactions in selected cities in Poland in 2019-2021. The study shows that the highest number of transactions was made in 2019 and 2021 with a clear downward trend in 2020.

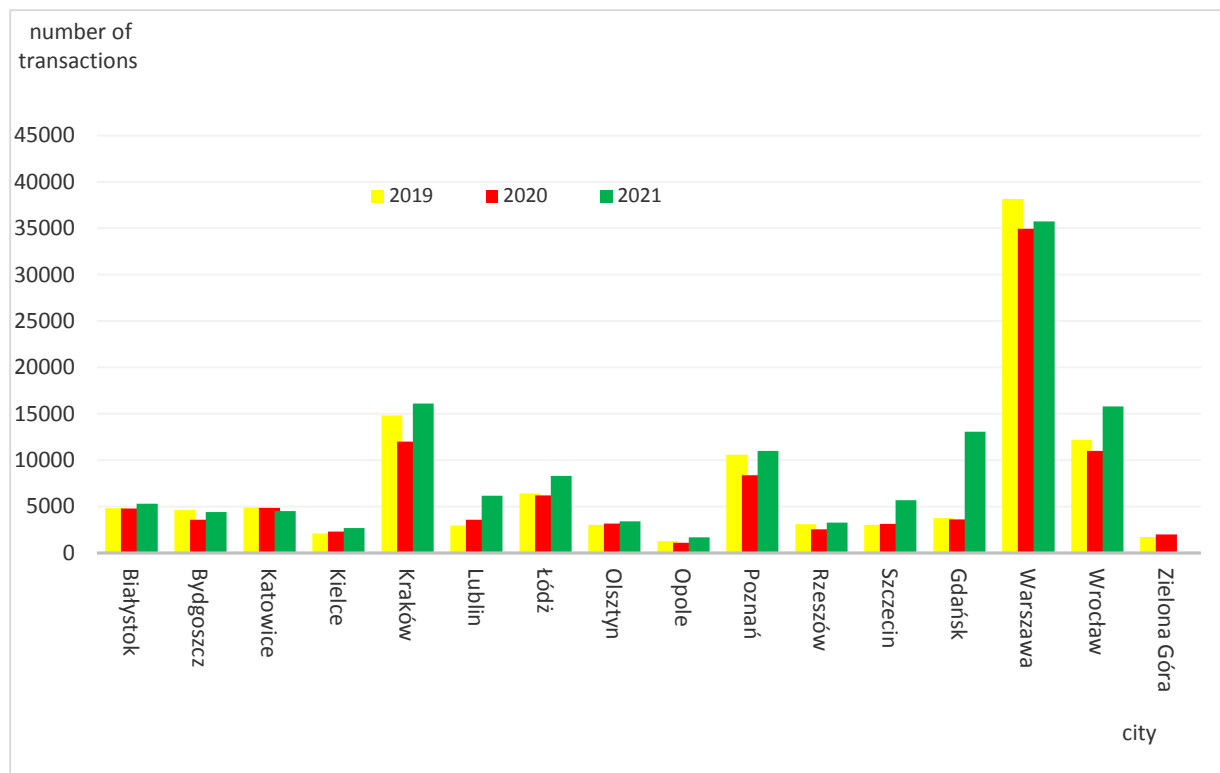


Figure 1. The number of completed residential sales transactions in selected cities in Poland in 2019-2021.

Source: compiled on the basis of data from the Central Statistical Office and the Report on the Situation in the Residential and Commercial Real Estate Market in Poland in 2021 prepared by the National Bank of Poland.

The first two months of 2020 saw record mortgage sales (Czech, Karpio, Wielechowski, Woźniakowski, Żebrowska-Suchodolska, 2020). According to the Credit Information Bureau (BIK), at that time the total value of loans granted was 26% higher than a year earlier. The epidemic situation in the country turned the credit market upside down. The Monetary Policy Council's lowering of interest rates to record levels also played its part, causing loan installments to fall, but banks, fearing hard times, quickly tightened mortgage procedures. They began to analyze the creditworthiness of a potential borrower much more closely (Bolesta, Sobik, 2020). In addition, many lending institutions have decided to raise the required contribution, despite the fact that the Financial Supervision Commission has not issued new recommendations on this issue. In mid-2020, the following phenomena were observed in Poland, for the first time since 2009: a decrease in the credit indebtedness of the non-financial corporate sector, greater than during the global financial crisis, the banking sector's declaration to tighten credit policy. Under such circumstances, the question arose about the possibility of excessive restriction of credit supply by banks, due to the effects of the COVID-19 (Łasak, 2020). Pandemic effects increase likelihood of timely debt service problems (Ostrowska, 2021). The trend of reducing the supply of credit is known as the credit crunch (André, Chalaux, 2023).

In the third quarter of 2020, some banks lowered back the size of the required contribution, and even allowed civil servants to become borrowers. Mainly in the second quarter 2020, the number of transactions in the housing market fell dramatically due to pandemic restrictions,

but also due to significant uncertainty affecting the behavior of economic participants. However, a return of activity in the housing market has already been observed since late 2020. Thus, as early as 2021, high sales of apartments were recorded in the provincial capitals of Poland. The survey shows that residential units in Poland's leading cities were particularly popular. The largest number of transactions in 2021 took place in the capital (Warsaw - 35,740) and four other large cities: Krakow (16,124), Wroclaw (15,800), Gdansk (13,084) and Poznan (11,014). On the other hand, the least transactions took place in Opole (1,693), Bydgoszcz (2,413) and Kielce (2,493). The varying number of completed residential sales transactions in individual cities confirms the locality of the market.

2.2. Prices and rates

Real estate prices are shaped by the market game of supply and demand, while demand and supply are influenced by many factors interacting with varying intensity from period to period, both real and psychological, interrelated in various ways, often in a feedback manner (Malesa, 2022). Inflation, increases in the price of building materials, increases in the price of building services, increases in the price of land for construction, increases in the income of the population, annual increases in the minimum wage, insufficient supply of housing are a set of factors that can significantly drive up prices (Zbyrowski, 2022). Rising interest rates, more expensive credit to buy property, depopulation of the population, uncertainty about the pandemic situation - are a set of factors that could slow down price growth or reduce prices (Kokot, 2022). Table 1 shows the average prices per square meter of a residential unit (unit prices) in the provincial capitals in Poland in each quarter of 2019-2021.

Table 1.

Average unit prices of residential units in selected cities in Poland in each quarter of 2021 and 2022

city	Average price per square meter of residential units (PLN)											
	2019				2020				2021			
	quarter				quarter				quarter			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Białystok	4896	5069	5315	5316	5518	5732	5716	5866	5 892	6 216	6 320	6 552
Bydgoszcz	4601	4914	5050	5095	5297	5456	5611	5698	5 689	5 792	5 861	6 102
Katowice	4438	4521	4749	4895	5106	5327	5278	5376	5 370	5 481	5 728	5 842
Kielce	3968	4067	4345	4453	4578	4774	4770	4867	4 973	5 301	5 377	5 716
Kraków	6912	7286	7404	7657	8162	8469	8620	8847	8 940	9 380	9 695	10 001
Lublin	5095	5176	5371	5565	5747	5884	6485	66331	6 767	6 950	7 176	7 362
Łódź	4616	4596	4708	4870	5011	5245	5613	5522	5 433	5 800	6 075	6 158
Olsztyn	4823	5049	5171	5381	5449	5637	5672	5781	5 690	5 994	6 174	6 281
Opole	4808	4978	5004	5043	5189	5474	5429	5520	5 567	5 605	5 774	6 083
Poznań	6151	6343	6443	6663	6836	7022	7069	7095	6 960	7 408	7 518	7 675
Rzeszów	5546	5697	5708	5713	6313	6611	6516	6713	6 627	6 957	7 033	7 495
Szczecin	5077	5123	5409	5634	5619	5841	6185	6128	6 609	6 830	7 212	7 666
Gdańsk	7351	7823	7767	8364	8391	8509	8960	9042	10 529	10 819	11 156	11 444
Warszawa	8985	9243	9457	9812	10004	10286	10472	10661	10 879	11 218	11 512	11 128
Wrocław	6267	6482	6858	7316	7315	7496	7301	7973	8 057	8 992	9 160	9 327
Zielona Góra	3950	4203	4354	4547	4650	4758	4430	4767	5 174	5 375	5 568	5 719

Data source: own compilation based on the Report on the Situation in the Residential and Commercial Real Estate Market in Poland in 2021 prepared by the NBP.

The construction sector, including real estate development - due to its specific business profile - is of great importance for the entire economy, however, on the other hand, it is very sensitive to changes in it (Zaborowski, 2022).

In 2019, Poland's real estate sector continued its phase of increased activity, which was associated with the accumulation of high demand from the general construction, housing residential and commercial real estate sectors. This situation changed in March 2020, with the emergence of the COVID-19 pandemic. Average unit prices of apartments across Poland increased. In nominal terms, prices in the analyzed cities exceeded the maximum levels recorded during the period of stress during the previous cycle (2006-2008). Specifically, the highest unit prices for apartments were recorded in the fourth quarter of 2019: in Warsaw (PLN 9812), Gdansk (PLN 8364), Wrocław (PLN 7316) and Krakow (PLN 7657), while the lowest were in Kielce (PLN 4453) and Zielona Gora (PLN 4547).

In 2020 and 2021, housing prices in the surveyed cities in Poland continued their upward trend. In the second quarter of 2020, after buyer activity declined due to the pandemic, quarterly price increases became only slightly lower than in 2019. In all quarters, average transaction prices of residential units rose between 8.3% and 14.7% year-on-year. In 2021, prices also trended upward in all analyzed city capitals, with price dynamics accelerating towards the end of the year and even reaching double-digit size in the fourth quarter. The CSO data shows that housing prices grew faster than average prices in the economy. Comparing average unit prices in the first quarters of 2021 to 2019, one should find an increase of 10-40%. The data shows a large spatial variation in unit prices of housing units. The highest unit prices even in double digits are observed in the fourth quarter of 2021 in two Polish cities, viz: Warsaw (PLN 11,444), Gdansk (PLN 11,128), while the lowest prices (below PLN 6,000.) in Kielce, Opole and Zielona Gora. At the same time, it is worth noting that the purchase of 1 square meter of a residential unit in the capital of Poland, on average, is more than PLN 500 more expensive than in Kielce, and we can see such a situation in all quarters of the surveyed years.

Despite fiscal and monetary interventions that avoided the collapse of the economy, Poland's real estate sector was hit by the constraints of the COVID-19 pandemic, with the short- and long-term rental market segment suffering the most. Specific conditions: lockdown, lack of special events, uncertainty in vacation planning and the like, took their toll on the short-term rental market (Gabryjończyk, Gabryjończyk, 2021). In addition, the COVID-19 pandemic has significantly affected popular short-term rental platforms such as Booking.com and Airbnb (Kacprzak 2021). Some apartment owners and some hotels have begun to bail out with medium-term rentals of 1- 3 months. In a situation where it is hard to plan activities and work in the long term, these solutions have allowed many landlords to wait. In addition, a shortage of students and remote work has caused rental interest and rental rates to temporarily drop (Rybka, Wrześniewska-Pietrzak, Wiatrowski, Zagórska, Kołodziejczak, Świerkowska, Wyszynski, 2021). It has been difficult to find takers for longer-term rentals, but after the initial shock of a total lockdown in the spring of 2020, the market has slowly begun to thaw. It can be concluded

that the radical impact incurred by the outbreak of the COVID-19 pandemic has shaped new consumer attitudes toward real estate. Table 2 shows the average rental rates of 1 square meter of a residential unit in each quarter of 2019-2021 for the surveyed cities.

The study shows that in the 2019-2021 period, the apartment rental market saw a dynamic increase in average apartment rental rates in all surveyed cities. Only in 2020 (the period of restrictive pandemic restrictions) we observe a decrease in rental rates in most of the surveyed cities. In local markets in most cities, the growth rate of rents was positive. Certainly, such a situation was related to the rising cost of credit, which reduced the purchasing capacity of apartments and stimulated the rental market, as well as seasonal demand, for example, from students returning to universities (Bryk, 2019). Due to the lack of attractive investment alternatives and the uncertainty generated by the pandemic period, in addition to high inflation not only in Poland, but throughout Europe or the world, the purchase of an apartment as an investment good was often considered by buyers, in many cases regardless of short-term changes in the rental market (Zaniewska, Kobylńska, 2023). Average apartment rental rates in most of the analyzed markets rose as much as 12.6% year-on-year. This acted as a driver for wealthier households to invest in rental housing, even though the onset of the pandemic resulted in reduced interest in renting by, for example, students or foreign workers. The first quarter of 2020 saw a slight downward adjustment in rental rates and deepened in the following quarter. Average apartment rental rates in the analyzed markets declined in the second and third quarters and by the fourth quarter of 2020 had already stabilized. The deceleration in renters' activity was not permanent, because with the loosening of restrictions, students, as well as foreign workers, mostly quickly returned to the labor market and the rental market (Subaşı, Baycan, 2022).

Table 2.

Average unit rental rates for residential units in PLN/sqm in selected cities in Poland in each quarter of 2019-2021

city	Average rent rate of one square meter of residential unit (PLN)											
	2019				2020				2021			
	quarter				quarter				quarter			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Białystok	32,10	32,20	32,90	34,30	32,00	29,60	33,80	35,50	32,60	36,60	37,70	34,90
Bydgoszcz	29,00	35,00	30,00	33,00	31,00	31,00	29,00	30,00	27,00	29,00	35,00	34,00
Katowice	34,30	36,80	38,90	38,00	34,50	34,40	35,00	37,50	36,50	34,30	35,70	33,30
Kielce	28,30	28,00	27,40	27,80	27,00	28,10	27,50	28,60	28,80	29,10	29,30	29,00
Kraków	42,60	47,30	47,60	48,40	41,50	41,60	41,00	39,40	35,90	39,30	42,20	43,90
Lublin	32,00	33,00	33,00	34,00	36,00	37,00	34,00	34,00	34,00	35,70	37,00	39,00
Łódź	35,00	33,60	36,50	36,50	34,70	31,90	29,80	32,40	39,40	43,10	40,00	39,50
Olsztyn	25,20	28,50	27,00	25,90	28,50	28,10	27,80	27,40	26,90	28,60	28,60	31,20
Poznań	40,10	42,00	42,60	45,30	44,70	41,00	41,80	45,60	37,50	36,60	39,30	45,10
Rzeszów	32,80	31,50	32,20	33,60	33,40	32,60	32,00	31,00	31,60	31,50	31,90	33,40
Szczecin	39,00	38,80	40,60	40,70	40,40	40,50	41,90	39,50	41,40	40,30	43,40	44,60
Gdańsk	49,00	50,30	52,20	51,20	52,10	50,04	49,20	46,10	46,30	49,80	54,30	54,20
Warszawa	50,80	52,40	53,20	54,90	50,70	49,20	48,10	48,90	47,40	49,40	50,90	52,70
Wrocław	45,10	47,60	49,30	50,20	47,30	43,90	44,00	43,90	44,80	45,40	48,90	50,90
Zielona Góra	30,10	31,20	31,50	33,00	32,40	32,40	32,90	33,00	32,70	33,60	38,50	38,10

Data source: own compilation based on the Report on the Situation in the Residential and Commercial Real Estate Market in Poland in 2021 prepared by the NBP.

The highest unit rental rates for residential units were formed in the fourth quarter of 2021 in Gdansk (PLN 54.20), Warsaw (PLN 52.70) and Wrocław (PLN 50.40) and were significantly higher than the other locations. The lowest average unit rental prices during the period under review were approximately in Olsztyn (PLN 31.20) and Kielce (PLN 29) and were recorded depending on the quarter. The survey shows that the residential rental market in Poland's largest cities is characterized by a discernible division of cities into the following price groups: Gdańsk, Warsaw and Wrocław with unit rates above PLN 50, Kraków, Poznań and Szczecin with rates above PLN 40 and the remaining cities with rates between PLN 29 and 39.50. In almost all of the surveyed cities, rental prices of residential units showed similar trends with a clear increase in rates especially at the end of 2021 (Table 2).

3. Summary

In the face of the COVID-19 pandemic, the world stood on its head, and all signs pointed to the fact that there would be no recession, a drop in incomes, the emigration of students from academic centers and the collapse of international tourism would effectively discourage real estate purchases in 2020, forcing down prices in the housing market. However, reality has shown how unpredictable the Polish housing market is. The pandemic has caused Poles to fear layoffs, loss of some income or even financial crisis. Along with the closure of numerous industries due to sanitary restrictions, this translated into a 3% drop in consumption compared to 2019. On the other hand, people's incomes increased - the government carried out an exceptionally high increase in the minimum wage, some companies, especially in manufacturing or professional services, even paid the promised increases, and only a few entrepreneurs decided to lay off employees. In addition, many billions of zlotys spent by the government as part of the anti-crisis shield have found their way into the pockets of Poles. As a result, Poles' nominal disposable income was in the first three quarters of 2020, as much as 9.8% higher than a year earlier. The difference between the increase in income and the decrease in consumption increased Poles' savings, further prompting them to look for a place to put them safely. The beginning of 2021 already saw a phase of very high activity related to the accumulation of pandemic deferred high demand in the housing sector. However, since the third quarter of 2021, there has been a gradual reduction in activity in the housing market. The reason for this situation may have been the average creditworthiness of residents resulting from, among other things, the level of average wages and the level of mortgage interest rates. The increase in interest rates (from the third quarter of 2021) did not encourage borrowing and only reduced effective demand for the purchase of housing. The central bank in November 2021 began the process of raising interest rates, which made a big difference, but already in 2022.

The survey shows that market dynamics have hardly slowed down during the pandemic period. In 2020, the dynamics of housing prices in the 17 largest cities admittedly decreased, but much less than expected - in the primary market it amounted to 7.5% year-on-year against 10.6% year-on-year in 2019, and in the secondary market to 11.2% against 11.5% in record 2019. All surveyed cities saw an increase in unit prices of residential units and a decrease in rents in selected quarters of 2020. While rents in many cities, especially academic and tourist cities, fell, they continued to rise nationwide and in January 2021 were 2.1% higher than a year earlier. The data presented shows that in 2021, in major cities in Poland, the residential real estate market was in an expansion phase. A large influence on the number of transactions made was the ability to obtain mortgage loans. According to the CSO data, the largest increase in the number of granted loans (at 17% compared to the previous quarter) was recorded at the end of the first and the second quarter of 2021. During that period, the interest rate was at a significantly low level. Demand clearly slows down only in the third quarter of 2021 mainly due to an increase in the cost of financing (Monetary Policy Council began a cycle of interest rate increases starting in October 2021, raising the benchmark rate in October to 0.5 percent, in November to 1.25 percent, in December to 1.75 percent).

Based on the research, it should be concluded that the market that defended itself from the pandemic crisis was the housing market. This only confirms the fact that residential real estate is seen as a relatively safe investment of capital, which has so far yielded higher returns compared to putting cash into safer assets such as Treasury bonds or bank deposits. Capital holders, faced with inflation and the unprofitability of putting money away in banks or bonds, were looking for alternatives. The choice fell most often on real estate as those assets that would maintain value in the long run anyway, and would also allow them to earn money on rent especially in Poland's thriving cities. Such a trend is a result of the relatively high returns on rental housing relative to returns on other assets at the time, which always drives investment demand. It is important to remember that the preferences and expectations of customers in the housing market are variable. The residential real estate market is distinguished from other markets by the way it behaves. In the long term, it is determined mainly by demand, which is determined by fundamental factors. In the short term, the market struggles with external demand shocks, which force it to activate the mechanism of short-term adjustments. Final housing market decisions can also be influenced by the current economic situation, as well as state interventionism in the form of programs to support the purchase of real estate.

References

1. Adrianowski, D. (2020). Prognozy zmian modeli biznesowych przedsiębiorstw bankowych ze względu na pandemię COVID-19. *Przedsiębiorczość i Zarządzanie*, 21(4), 17–34.
2. André, C., Chaux, T. (2023). Housing prices during the COVID-19 pandemic: Insights from Sweden. *Kwartalnik Nauk o Przedsiębiorstwie*, 67(1), 137–154.
3. Bolesta, K., Sobik, B. (2020). Analiza działań antykryzysowych podczas pandemii COVID-19 w krajach Europy. *Zeszyty Naukowe Polskiego Towarzystwa Ekonomicznego w Zielonej Górze*, 13, 18–30.
4. Bryk, R. (2019). Preferencje zakupu mieszkań w dużych miastach Polski. *Studia Miejskie*, 33, 141–153.
5. Cheung, K.S., Yiu, C.Y., Xiong, C. (2021). Housing market in the time of pandemic: A price gradient analysis from the COVID-19 epicentre in China. *Journal of Risk and Financial Management*, 14(3), 108.
6. Czech, K., Karpio, A., Wielechowski, M.W., Woźniakowski, T., Żebrowska-Suchodolska, D. (2020). *Polska gospodarka w początkowym okresie pandemii COVID-19*. Warszawa: SGGW.
7. Czechowska, I.D., Lipiński, C., Stawska, J., Zatoń, W. (2022). *Potencjał działalności kredytowej sektora bankowego w obliczu pandemii COVID-19*. Perspektywa credit crunch. Wydawnictwo Uniwersytetu Łódzkiego.
8. Gabryjończyk, K., Gabryjończyk, P. (2021). Zmiany stopnia wykorzystania turystycznych obiektów noclegowych w okresie zwalczania pandemii COVID-19 w Polsce. *Turystyka i Rozwój Regionalny*, 15, 43–58.
9. Gajowniczek, K. (2021). Rynek nieruchomości w kontekście pandemii COVID-19. *Przedsiębiorczość i Zarządzanie*, 22(1), 33–58.
10. Kacprzak, K. (2021). Wpływ pandemii na funkcjonowanie platformy wynajmu krótkoterminowego Airbnb w miastach—przeгляд literatury. *Konwersatorium Wiedzy o Mieście*, 34(6), 41–50.
11. Kateryna, V., Marek, S., Anna, K. (2021). *Analiza transakcji na rynku nieruchomości mieszkaniowych*, 41.
12. Kokot, S. (2022). Realne ceny mieszkań na rynku wtórnym w wybranych miastach w Polsce. *Wiadomości Statystyczne. The Polish Statistician*, 67(3), 46–65.
13. Koszel, M. (2020). *Pandemia COVID-19 a rynek nieruchomości w Polsce. W Tendencje rozwoju współczesnego rynku nieruchomości mieszkaniowych* (pp. 109-129). Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu.
14. Kozicki, B., Mitkow, Sz., Sowa, B. (2021). Prognozowanie w obszarze zakupu nieruchomości w Polsce na 2021 rok w aspekcie bezpieczeństwa ekonomicznego

- (Forecasting in the area of real estate purchase in Poland for 2021 in terms of economic security). *Nowoczesne Systemy Zarządzania*, 2.
15. Li, L., Wan, W.X., He, S. (2021). The heightened 'security zone' function of gated communities during the covid-19 pandemic and the changing housing market dynamic: Evidence from beijing, china. *Land*, 10(9), 983.
 16. Li, X., Zhang, C. (2021). Did the COVID-19 pandemic crisis affect housing prices evenly in the US? *Sustainability*, 13(21), 12277.
 17. Liu, S., Su, Y. (2021). The impact of the COVID-19 pandemic on the demand for density: Evidence from the US housing market. *Economics letters*, 207, 110010.
 18. Łasak, P. (2020). *Wyzwania dla polskiego sektora bankowego jako skutek pandemii COVID-19*. *Polityka Gospodarcza w Niestabilnym Otoczeniu–Dylematy i Wyzwania*, 80–93.
 19. Malesa, K. (2022). Mieszkalnictwo w Polsce w latach 2018–2020. *Zarządzanie Innowacyjne w Gospodarce i Biznesie*, 33(2), 85–101.
 20. Mazurczak, A. (b.d.). *Pandemia COVID-19 a działalność podmiotów typu Real Estate Investment Trust (REIT) na wybranych rynkach nieruchomości*. In: *Tendencje rozwoju współczesnego rynku nieruchomości mieszkaniowych* (pp. 130-146). Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu.
 21. Najbar, K. (2021). Świadczenie usług zarządzania nieruchomościami w dobie pandemii COVID-19. *Horyzonty Polityki*, 12(40), 157–177.
 22. Ostrowska, A. (2021). Wpływ pandemii COVID-19 na rentowność sektora bankowego w Polsce. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie*, 993(3), 121–135.
 23. Rybka, M., Wrześniewska-Pietrzak, M., Wiatrowski, P., Zagórska, K., Kołodziejczak, M., Świerkowska, D., Wyszyński, J. (2021). *COVID-19—Czarna seria ciągle trwa, Medialny obraz koronawirusa i jego oddziaływanie społeczno-polityczne*. Poznań: Poznańskie Studia Polonistyczne.
 24. Siemińska, E.H., Krajewska, M. (2019). Czy kończy się boom w sektorze deweloperów mieszkaniowych w Polsce? *Acta Universitatis Lodzianis. Folia Oeconomica*, 3(342), 21–44.
 25. Sopoćko, A. (b.d.). *Nie każdy popyt ciągnie wzrost gospodarczy*. *Procesy zarządzania*, 155.
 26. Subaşı, S.Ö., Baycan, T. (2022). Impacts of the COVID-19 pandemic on private rental housing prices in Turkey. *Asia-Pacific Journal of Regional Science*, 6(3), 1177–1193.
 27. Tajani, F., Liddo, F.D., Guarini, M.R., Ranieri, R., Anelli, D. (2021). An assessment methodology for the evaluation of the impacts of the COVID-19 pandemic on the Italian housing market demand. *Buildings*, 11(12), 592.
 28. Twardowski, A. (2021). *Implikacja kryzysu wynikającego z pandemii COVID-19 na rynek nieruchomości komercyjnych*.
 29. Verhaeghe, P.-P., Ghekiere, A. (2021). The impact of the Covid-19 pandemic on ethnic discrimination on the housing market. *European Societies*, 23(sup. 1), S384–S399.

30. Zaborowski, T. (2022). Propozycja zasad i instrumentów polityki mieszkaniowej jako narzędzia korekty ułomnych mechanizmów rynkowych. *Studia Miejskie*, 43, 27–51.
31. Zaniewska, M., Kobylińska, U. (2023). Wybrane zachowania konsumentów na rynku nieruchomości w okresie pandemii COVID-19. *Akademia Zarządzania*, 7(1).
32. Zbyrowski, R. (2022). Przyczynowość cen na rynku nieruchomości w Polsce. *Metody Ilościowe w Badaniach Ekonomicznych*, 23(3), 67–77.

IMPLEMENTATION OF INDUSTRY 4.0 ELEMENTS AND THEIR IMPACT ON THE ENTERPRISE PRODUCTIVITY

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Purpose: The main incentive for choosing the topic of the study is related to the need to look for solutions to fundamental problems related to the activities of manufacturing enterprises that must meet the requirements of market competition by achieving competitive advantages and increasing productivity. The subject of the study are advanced manufacturing technologies, characterized by a high level of innovation and automation, and their impact on the productivity of a manufacturing company. The aim of the study is to assess the impact advanced manufacturing technologies on the productivity and production quality on the example of a company producing parts and components for rail vehicles.

Design/methodology/approach: the study analyzed the literature on productivity and calculated productivity indicators based on the company's financial data. Moreover, the participant observation method was used to assess the reorganization of the production process, and a survey was conducted for company employees to determine the validity of the implemented technological investments. The case study concerns a company producing parts and components for rail vehicles.

Findings: The level of approval of investments in advanced manufacturing technologies and their impact on the quality and efficiency of the manufacturing process of was determined. The implementation of advanced manufacturing technologies allowed the company to: shortened the manufacturing process by approximately 40%, the number of procedures was reduced from nine to five, and the number of employees participating in it was reduced from ten to five.

Originality/value: assessment of the effects of the use of advanced technologies, the study is addressed to the management of manufacturing enterprises.

Keywords: productivity, manufacturing technologies, production, improvement.

Category of the paper: Research paper.

1. Introduction

Increasing the standard of living of society and economic growth are the main effects of improvement productivity, which affects the availability and quality of services and products offered. Productivity goes hand in hand with competitiveness, contributing to income growth and reducing inflation. Too slow a rate of productivity growth may lead to economic stagnation, and a long-term lack of growth may lead to recession (Marciniak, 2013). The concept of productivity is sometimes perceived in as an indicator of economic phenomena, or in a broader sense, as an activity aimed at the development of innovation, improvement, increase in efficiency, and progress. Focusing on progress is extremely important, but it involves undertaking and implementing difficult tasks that require a lot of commitment. In development-oriented countries, improving productivity is supported by government agencies and organizations (Lis, 1999; Fried, Lovell, Schmidt, 2008).

Productivity is the ratio of the amount of output produced and sold in a given period to the amount of input resources used or consumed. This means that productivity can be interpreted as the efficiency of using the system's input resources - energy, materials, human labor, information capital, time - in the production of goods and services constituting its output. Productivity growth requires classifying the factors affecting it and indicate those that have priority importance for a given organization (Bai et al., 1997; Kosieradzka, Lis, 2000; Fried, Lovell, Schmidt, 2008; Battisti et al., 2018; Xiao et al., 2022).

To cope with this, entrepreneurs should systematically and properly manage productivity. This requires monitoring productivity using objective indicators and taking various actions, including pro-development and investment ones, in order to increase the level of productivity and, as a result, improve long-term competitiveness (Muthiah, Huang, 2006; Kosieradzka, 2012; Gajdzik, 2014; Trojanowska et al., 2018).

The recently noticeable dynamic development of technology, including the expansion of automation and the use of robots in production and the expected development of the use of IoT and AI technologies in production processes, being the basis of the Industry 4.0, is significantly changing the role played by employees in production systems. There is less employee involvement in direct operation of machines and manual control of their work. Human work is now largely limited to supervising and controlling processes. Efficient use of resources and energy is crucial in the search for a better productivity result (Davies, 2015; Tortorella et al., 2021).

Industry 4.0 is a complex process of technological, process and organizational transformation of enterprises, related to changing their business model and integrating the value chain in the overall product life cycle. The condition for this transformation is the advanced use of digital solutions and data resources, and its goal is mass personalization of the production of goods and services in response to individual customer needs (Śledziwska, Włoch, 2020).

The main incentive for choosing the topic of the study is related to the need to look for solutions to fundamental problems related to the activities of manufacturing enterprises that must meet the requirements of market competition by achieving competitive advantages and increasing productivity. The subject of the study are advanced manufacturing technologies, characterized by a high level of innovation and automation, and their impact on the productivity of a manufacturing company. The aim of the study is to assess the impact advanced manufacturing technologies on the productivity and production quality on the example of a company producing parts and components for rail vehicles.

2. Material and methods

The scope of the empirical study has a three points related to the topic of productivity growth through the use of advanced manufacturing technologies that are an element of Industry 4.0.

The first perspective includes an assessment of the impact of the implementation of selected production techniques on the productivity indicators of enterprise X. For this purpose, on the basis of data coming from the company's financial reports and balance sheets from the next four years:

- production volume expressed in net sales revenues,
- employment level in number of people,
- total assets value,
- operating costs,

the following company productivity indicators were calculated:

- asset productivity $P_a = P / T$, where P_a – asset productivity, P – net sales revenues, T – total asset value,
- employment productivity $P_R = P / R$, where P_R – employment productivity, P – net sales revenues, R – employment,
- material and energy productivity $P_S = P / S$, where P_S – productivity of materials and energy, P – net sales revenues, S – consumption of materials and energy,
- total productivity $P_C = P / K * 100\%$, where P_C – total productivity, P – net sales revenues, K – total costs.

The second research problem concerns the analysis of the way the production process was reorganized in the company. This was possible due to the capabilities of the implemented technologies, which allow for improved material flow, improved quality of manufactured products and increased flexibility of the production system. For this purpose, a map of the technological process was presented. It includes the original state and the current state achieved thanks to the new production potential.

The third point contains the results of the survey. It regards the advisability of investing in advanced manufacturing technologies, which was addressed to three groups of company employees. The first group consisted of plant quality control employees, the second group included employees responsible for production management, and the third group included employees directly related to production. The questions concerned the assessment of the appropriateness of investments in advanced manufacturing technologies. 10 people completed the survey questionnaire. The survey was conducted directly, the respondents assessed the theses on a scale of 1÷10, where 1 meant disagreement with the statement and 10 indicated full support.

3. Enterprise productivity results

This part of the study presents the values of selected enterprise productivity indicators over a period of 4 years, in the context of which investments in advanced manufacturing technologies were implemented. There is a systematic increase in asset productivity in the analyzed period (tab. 1). Significant company's investments in advanced manufacturing technologies took place in the first and it was the purchase of a peripheral welding machine and a CNC machine tool. The biggest investment was carried out in the third year, with the purchase of a laser cutting machine and a press edge. Despite high-budget investments, it is growing asset productivity.

The employment productivity index indicates the value of total revenues per employee. The decline in employment productivity in third year was the result increasing employment related to staffing of newly purchased devices. Improvement employment productivity can be observed in last year, where despite a similar employment, the result achieved is much better.

The value of total productivity remained at a similar level in the analyzed period. To sum up, the values of productivity indicators do not clearly confirm the impact of technological investments on the increase of productivity in enterprise X.

Table 1.

Value of selected productivity indicators in enterprise x

Year	1	2	3	4
Productivity indicators				
Asset productivity [PLN]	2,13	2,44	2,52	2,83
Work productivity [PLN]	2,33	2,61	2,63	2,88
Productivity of materials and energy [PLN]	3,57	3,20	2,87	2,80
Total productivity [%]	103,51	103,50	103,30	103,71

Source: own elaboration.

4. Improving the production process - results of the use of advanced manufacturing technologies

The case study concerns a company producing parts and components for rail vehicles. The modernization of production techniques in the analyzed case allowed for significant reorganization of the production process. The results of the comparison of the production process before and after the implementation of advanced manufacturing techniques (automatic welding machine, automatic machining center) are presented in this part of the study. By analyzing the production process of the first part of the pressure vessel, i.e. the operation of preparing the shell, a comparison was made of the current process with the process after the applied modifications. The course of individual processes is presented in the framework diagrams presented in Fig. 1 and 2. The process diagram (Fig. 1) contains 9 technological and logistic operations. Comparison of the diagram from the state before the changes with the diagram of the production process after the changes were applied (Fig. 2) indicates that the introduced process modification reduced the production process by four operations. This translates into a shorter duration of the tank shell production process and a smaller number of employees involved in it.

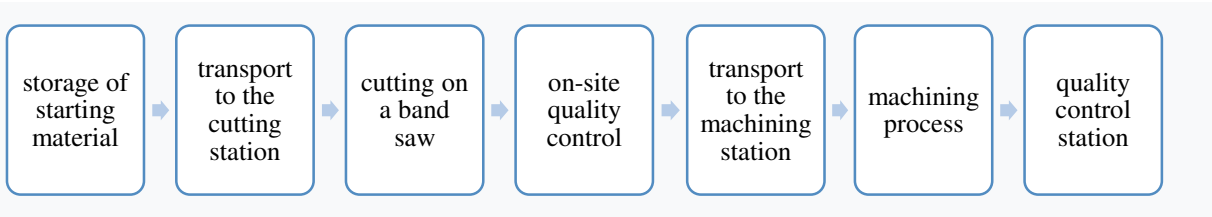


Figure 1. Diagram of the pressure vessel production process before changes.

Source: own elaboration.



Figure 2. Diagram of the pressure vessel production process after changes.

Source: own elaboration.

A comparison of the processes discussed, i.e. the time needed for their implementation and the number of employees participating, is presented in table 2.

Table 2.*Production process before and after modification (comparison for 10 pieces)*

Process flow before changes			Process flow after changes		
Operation number	Number of employees	Operation duration	Operation number	Number of employees	Operation duration
1	1	10	1	1	10
2	2	45	2	1	250
3	1	200	3	1	20
4	1	20	4	1	30
5	1	30	5	1	60
6	1	180	-	-	-
7	1	20	-	-	-
8	1	30	-	-	-
9	1	60	-	-	-
sum	9	595	5	5	370

Source: own elaboration.

In the process comparison, consideration was given to; the number of process operations, the number of employees involved in performing a given procedure and the time needed to perform each of them. The production process after the modernization of production techniques includes 5 operations, whereas before it consisted of 9 operations. It is similar when we compare the number of employees involved in each process - here we managed to reduce the number by half, to five. This is of great importance in the labor market, which is currently an employee's market, due to the large supply of jobs. The changes introduced in the process for individual operations allowed to shorten the entire process time by approximately 40%. This is a very good result, which will significantly reduce the costs of this process and, as a result, will contribute to greater profitability of the production of the compressed air tank. The second operation in improving the compressed air production process is the welding of the bottom-stub assembly.

Table 3.*Production process before and after modification (comparison for 10 units)*

Comparative feature	Manual welding	Automatic welding
number of employees	1	1
staff with high welding qualifications	Yes	no
Possibility of substitutability employee after a short time on-the-job training	No	yes
Consistency of welding parameters through the entire work shift	No	yes
Process efficiency	50 units/8h	200 units/8h
Reproducible high quality welded joints	no	Yes
Adapting to the difficult working environment	No	yes

Source: own elaboration.

A comparison of both welding methods was possible using the comparative analysis tab. 3. This analysis includes 7 comparative features. The first feature is the number of employees needed to carry out the process, and the second feature is information about their welding qualifications. The next differentiators allowed us to determine the quality of welded joints and the stability of the processes. The comparative analysis allowed for a comparison of both welding methods. The knowledge obtained in this way allowed us to determine the suitability of modernizing this operation in the compressed air tank production process. In the welding methods studied, the number of workers performing this task is the same. However, the robotic welding process does not require such high welding qualifications from the operator as in the TIG method. This is particularly important because the demand on the labor market for such employees is high, which is associated with their high financial remuneration. The possibility of replacing an employee in robotic welding is much easier. On-the-job training will allow you to continue working with this device. This is possible because the programmed parameters and attached additional equipment do not require too much operator involvement. The sudden need to replace an employee with extensive manual welding skills is not easy to implement due to the high complexity of this method, which requires extensive practice. Continuity of the process, maintaining high welding parameters and quality throughout the entire work shift is very difficult to achieve during manual welding. The monotony of this activity and the forced body position cause fatigue to increase over time. These ailments do not occur when welding with a welding robot arm. This machine is dedicated to work in a difficult work environment. The levels of production efficiency achieved by both methods clearly support the use of the robotic method. The result achieved is four times higher than manual welding. This makes it possible to use this method to weld other details from the company's product range, and to engage a highly qualified employee with manual welding skills to work on other products.

5. Results of the survey assessing the validity of investment in advanced manufacturing technologies

Employees from three groups of the company's organizational structure participated in the survey. These were: quality control employees (3 people), production managers (3) and production workers (4). The survey was conducted face-to-face. The survey question is as follows: "Investment in advanced manufacturing technologies caused X? The respondents assessed the accuracy of the answers to the adopted thesis on a scale of 1-10.

Table 4.*Assessing the validity of investment in advanced manufacturing technologies survey results*

X - Answer	Control quality			Production manager			Production workers				Mean
	1	2	3	1	2	3	1	2	3	4	
Increased production efficiency	10	8	6	9	10	9	7	7	8	7	8,1
Improving the quality of manufactured products	10	7	7	8	10	9	8	7	8	5	7,9
Reducing the number of defects and non-conformities during production	8	8	9	8	9	7	9	5	5	5	7,3
Improving work safety	5	6	5	9	9	5	7	5	5	5	6,1
Increased competitiveness	10	6	5	8	10	8	6	4	8	5	7
Possibility of establishing cooperation with foreign contractors	5	5	5	8	7	8	9	5	9	5	6,6
Reducing production costs	8	7	4	9	8	4	7	4	6	7	6,4
Increase in prestige enterprises	5	6	3	10	10	5	9	6	10	5	6,9

Source: own elaboration.

The obtained survey results (tab. 4) confirm the thesis about the advisability of modernizing the machinery. The introduction of advanced manufacturing technologies has a beneficial effect on improving productivity and production quality. The highest ratings were given to statements directly related to the term productivity, such as: increase in production efficiency, improvement in product quality, reduction in the number of deficiencies and non-conformities during production. The assessments given by the surveyed employees have a large degree of discrepancy between individual answers.

6. Summary

The process of examining productivity in an enterprise is a very complex process. This is not only due to the various specifics, but also to the complexity of the issues related to productivity.

Analysis of financial data, comparison of production techniques, and a survey conducted among employees are research methods that are a criterion for assessing productivity in the company, which allowed for a substantive assessment of the company's production processes. The adopted hypothesis of the work was to demonstrate the positive impact of investments in advanced manufacturing technologies on the company's productivity. The support for the statement about the beneficial impact of modernizing the machinery on productivity was not clearly confirmed in the analysis of productivity indicators in the examined period of the plant's operation. However, the survey results and comparisons of conventional and advanced manufacturing techniques on the example of a selected product clearly demonstrated the advisability of the plant's technological development.

The prepared summary highlighted differences in time, quality and cost of producing this product. Due to the changes made in the first selected operation, the duration of the procedure was shortened by approximately 40%, the number of procedures was reduced from nine to five, and the number of employees participating in it was reduced from ten to five. The results in the second modified operation allowed for an increase in production efficiency while improving the quality of welded joints. The effect of the proposed changes in the identified problem areas is an increase in efficiency and obtaining higher quality products, which allows for gaining a competitive advantage. Determining and defining weak stages of the process allows you to look for the causes of this condition. Identification of process imperfections becomes a determinant for developing modification and improvement plans.

The conclusions from the research and the assessments obtained from the survey constitute a recommendation for the company's activities in improving production technologies, which may translate into an increase in productivity. As shown in this work, following innovative manufacturing technologies has its justification, and expenditure on the development of advanced manufacturing technologies should be continuous.

References

1. Bai, C.E., Li, D.D., Wang, Y. (1997). Enterprise productivity and efficiency: When is up really down? *Journal of Comparative Economics*, 24(3), 265-280. <https://doi.org/10.1006/jcec.1997.1432>
2. Battisti, M., Del Gatto, M., Parmeter, C.F. (2018). Labor productivity growth: disentangling technology and capital accumulation. *Journal of Economic Growth*, 23, 111-143. <https://doi.org/10.1007/s10887-017-9143-1>
3. Davies, R. (2015). *Industry 4.0: Digitalisation for productivity and growth*, EPRS: European Parliamentary Research Service. Belgium. Retrieved from: <https://policycommons.net/artifacts/1335939/industry-40/1942749/>, 6 Jan 2024. CID: 20.500.12592/6mqvs1
4. Fried, H.O., Lovell, C.K., Schmidt, S.S. (2008). Efficiency and productivity. The measurement of productive efficiency and productivity growth. *Oxford University Press*, 3, 3-91.
5. Gajdzik, B. (2014). Dbłość pracowników o pełną produktywność maszyn i urządzeń – TPM w przedsiębiorstwie produkcyjnym. *Gospodarka Materialowa i Logistyka*, 1, pp. 27-32.
6. Kosieradzka, A. (2012). *Zarządzanie produktywnością w przedsiębiorstwie*. CH Beck.
7. Kosieradzka, A., Lis, S. (2000). *Produktywność: metody, analizy, oceny i tworzenia programów poprawy*. Oficyna Wydawnicza Politechniki Warszawskiej.

8. Lis, S. (1999). *Vademecum produktywności*. Warszawa: Placet.
9. Marciniak, S. (ed.) (2013). *Makro i mikro ekonomia. Podstawowe problemy współczesności*. Warszawa: PWN, 373-374.
10. Muthiah, K.M., Huang, S.H. (2006). A review of literature on manufacturing systems productivity measurement and improvement. *International Journal of Industrial and Systems Engineering*, 1(4), 461-484. <https://doi.org/10.1504/IJISE.2006.010387>
11. Śledziewska, K., Włoch, R. (2020). *Gospodarka Cyfrowa*. Warszawa: Wydawnictwa Uniwersytetu Warszawskiego.
12. Tortorella, G.L., Fogliatto, F.S., Cauchick-Miguel, P.A., Kurnia, S., Jurburg, D. (2021). Integration of industry 4.0 technologies into total productive maintenance practices. *International Journal of Production Economics*, 240. <https://doi.org/10.1016/j.ijpe.2021.108224>
13. Trojanowska, J., Kolinski, A., Galusik, D., Varela, M.L., Machado, J. (2018). A methodology of improvement of manufacturing productivity through increasing operational efficiency of the production process. In: *Advances in Manufacturing* (pp. 23-32). Springer International Publishing. DOI https://doi.org/10.1007/978-3-319-68619-6_3
14. Xiao, Z., Peng, H., Pan, Z. (2022). Innovation, external technological environment and the total factor productivity of enterprises. *Accounting & Finance*, 62(1), 3-29. <https://doi.org/10.1111/acfi.12779>

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