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

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

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# FOREWORD

Presented number of Silesian University of Technology. Scientific Papers. Organization and Management Series. Presented papers contain result of researches conducted by various universities. The number consists of 38 papers.

The papers presented in the number concentrate on many topics connected with organization and management. There are in the number papers about: human resource management, risk management, logistics, customer management, smart city, quality management, production management, the impact of COVID-19 on management, marketing, Lean Management, entrepreneurship, social economy, tourism management, economics, renewable energy, finances, innovativeness, Industry 4.0, and corporate social responsibility.

*Radosław Wolniak*

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# WORK-LIFE BALANCE AND ITS IMPACT ON GENERATION Z'S MOTIVATION TO PURSUE EMPLOYMENT – PART I

Agnieszka BARCIK[1*], Piotr DZIWIŃSKI[2]

[1] University of Bielsko-Biala, Faculty of Management and Transport; abarcik@ubb.edu.pl,
ORCID: 0000-0003-0865-2161* corresponding author
[2] University of Bielsko-Biala, Faculty of Management and Transport; pdziwinski@ubb.edu.pl,
ORCID: 0000-0003-4061-7761
* Correspondence author

**Purpose:** Determining and discussing various aspects for employment motivation among younger generation.
**Design/methodology/approach**: The research method used in the paper is mainly a standardized survey conducted on the basis of a questionnaire containing closed and open questions carried out among representatives of the examined generation. The research process was also accompanied by analysis of source documentation.
**Findings:** Research results verify research hypotheses formulated on basis of the paper's objectives, enabling general conclusions.
**Research implications**: Future research directions should focus on further, expanded research exploration in the area, taking into account a larger number of respondents.
**Practical implications:** The results of the research discussed in the paper have a number of practical implications mainly for the management staff and employers in terms of human resources management and employment policy.
**Social implications**: Building awareness of generational change in the process of managing employment policy.
**Originality/value:** The paper has cognitive value for the development of knowledge, science and quality in terms of employment policy.
**Keywords**: human resources management, employment policy, generational change, workforce planning, labour market trends.
**Category of the paper**: research paper.

## 1. Introduction

The issue of employment has always played a significant role in the lives of adults; however, over time, attitudes toward professional life have evolved, influenced by various factors. Over the years, the geopolitical and market landscape has changed, as have people's

worldviews. Additionally, there has been a technological revolution, the automation of daily life, and the increasing importance of the internet and social media. Today, the labor market consists of individuals from various age groups and generations, each of whom perceives professional life in distinctly different ways.

This paper explores the issue of work from a generational perspective with particular interest in the youngest generation of employees - Generation Z. The purpose of this study is to answer the following questions:

1. How does Generation Z perceive full-time employment?
2. Is this generation motivated and willing to pursue traditional career paths?
3. What opportunities and challenges does Generation Z present to employers?

In order to address these questions an overview of Generation Z will be provided along with an exploration of the relationship between professional engagement and motivation. The concept of maintaining a work-life balance will also be discussed.

The following hypotheses were developed for examination:

1. Full-time employment is perceived as a more stable form of work by members of Generation Z.
2. Non-traditional forms of employment are less frequently considered by Generation Z when contemplating their future.
3. Maintaining a balance between work and personal life is of paramount importance to Generation Z.
4. Generation Z tends to prefer traditional, full-time employment and is less inclined to consider non-traditional employment arrangements.

In order to verify the above hypotheses a survey was conducted among a group of 74 individuals including both Generation Z and members of older generations to highlight generational differences.

The paper was organized in two parts. Part one focuses on the theoretical background of the problem while part two is devoted to the presentation of the research results.

## 2. The outline of the Generation Z phenomenon

There are people of all ages on the labor market so it can be said that the labor market is multi-generational. A generation is a group of people of a similar age. The contemporary sociological approach distinguishes many generations (Kroenke, 2015). The generations that are currently active in the labor market are (Czyczerska, Ławnik, Szlenk-Czyczerska, 2020):

- The BB generation, also called baby boomers, are people born between 1946 and 1964.
- Generation X are people born between 1965 and 1980.

- Generation Y, also called millennials, are people born between 1981 and 1996.
- Generation Z also known as Gen Z are people born between 1997 and 2012.

The above generations show the diversity of people involved in professional life (Defratyka, Morawski, 2019). Sociologists distinguish a variety of features characterizing each of them (McCrindle, Wolfinger, 2009).

This section will provide a detailed description of the last generation Z but it is worth briefly discussing the remaining ones.

The Baby Boomer generation is a generation focused on work, their motto is "we live to work". This is a generation with extensive experience, focusing on their life wisdom and loyalty to employers (Barszcz, 2020). People from the baby boomer generation are mostly people who, after taking up a job, work in a given place for almost their entire lives because this is a generation that feels a strong need for stability, often defends its position in the company and their primary motivator to work is the fear of losing it. Which is probably related to the fact that these are people born in a historically difficult post-war period, where people were looking for stability and strong structures after the chaos of war. This generation considers high education as an important element when taking up a professional career (Dimock, 2019).

The next generation is Generation X, as mentioned above, these are people born between 1965 and 1980. This is a generation that is characterized by an interest in innovation and work ethic at work, while demonstrating great loyalty to their employer (Mahapatra, Bhullar, Gupta, 2022). This is a generation that "works to live". They derive motivation and satisfaction from the position and prestige in the company and are aware of the need to change their professional life while being afraid of losing their position. This generation considers training as an important element of professional activity and career, they want to develop and improve in the context of their work.

The next generation is Generation Y, consisting of individuals born between 1981 and 1996. This generation was the first to recognize the importance of maintaining a work-life balance. Their motto is "live and work – balance." Generation Y is also the first to show less loyalty to employers, believing that changing jobs is an integral part of career development. They are characterized by high professional mobility, adaptability, and openness to new challenges and changes (Ware, 2013). Generation Y is motivated by the rewards they gain while working, which can also be understood as bonuses and well-paid work itself - this generation is team-oriented. Millennials are less willing to recognize authorities than Generation X or Baby Boomers. Additionally, the latest generation of Millennials experienced their childhood with access to the Internet and observed the development of social media, so they are not completely foreign to Generation Y, unlike other generations (Bessant, 2018).

The final generation in the labor market is Generation Z, which will be discussed in more detail here. As previously mentioned, Generation Z includes individuals born between 1997 and 2012, meaning that some members of this generation have not yet reached adulthood. Generation Z is a unique generation because, for the first time, they were fully immersed in

social media during their adolescence. As a result, they are closely associated with the internet, social media, and technology (Benítez-Márquez, Sánchez-Teba, Bermúdez-González, Núñez-Rydman, 2022). Generation Z easily uses the latest technical innovations and understands all the nuances of the technical world. This is a generation that has the ability to be online and offline at the same time, which can often be difficult for other generations. Generation Z is also significantly different from other generations in various aspects, which will be considered below (Lev, 2021). The first of these aspects is the difference in making friends. Because before the invention of social media, people made friends mainly in real life (offline), while Generation Z, which grew up on social media, also makes friends online. That's why people from Generation Z have various friends from almost all over the world. which makes this generation very open, tolerant and willing to understand otherness and diversity. The next aspect worth considering when it comes to Generation Z is time. Due to the fact that Generation Z lives with constant access to the Internet, they want to get everything quickly (Dwivedula, Singh, Azaran, 2019). Information, knowledge or entertainment for Generation Z should be provided immediately, as well as contact and communication (White, 2017). Time and speed are so important for Generation Z that they do not recognize the idea of free career development, therefore they are not loyal and faithful to one company and make changes quite dynamically, mainly guided by remuneration. Generation Z also retrains easily and quickly, changing industries and, consequently, career paths (White, 2017). Another key aspect that characterizes Generation Z is their strong emphasis on work-life balance. This generation places a high value on rest and time away from work. For Generation Z money is seen as a means of self-fulfillment, so prioritizing work is not their main focus. Instead, life outside of work holds particular significance for them (Dolot, 2018).

In summary as rightly emphasized in the literature cited above Generation Z is an innovative generation, largely due to the rapid rise of the internet and social media. This generation stands out from others, demonstrating a greater openness to change and viewing development as a lifelong process of learning. Additionally, they place much more emphasis on rest compared to previous generations. These factors contribute to their entirely different approach to work which will be explored in the next section.

## 3. Generation Z's perspective on the labour market

Generation Z will be fully entering the labor market in the coming years. Therefore a key question is how members of Generation Z will navigate such a specific environment as the labor market. As discussed earlier generations were characterized by loyalty to their employers and job stability with most individuals staying at the same company where they began their careers, often for the entirety of their working lives until retirement (Bieleń, Kubiczek, 2020). However

Generation Z raised in an era of unlimited access to the internet and social media holds different values compared to previous generations. Moreover their situation in the labor market is entirely different from that of older generations. As reality shows flexible employment such as mandate contracts, dominates among young workers. The labor market that Generation Z is entering is unstable and highly competitive (Messyasz, 2021).

Many young people today have completed studies often in more than one field. As a result the phenomenon of "the falling graduate premium" has emerged meaning that as more employees with higher education enter the labor market, they are less rewarded by potential employers as higher education becomes increasingly common. Another aspect is the high level of experience demanded by employers. Members of Generation Z often face the harsh realities of the labor market where employers require work experience, forcing many young employees to take jobs in sectors that don't require extensive experience in order to gain it. Typically these are sectors like retail or hospitality. At the same time, these sectors carry a high risk of job loss, as most young people are employed under the previously mentioned mandate contracts. (McCrindle, Fell, 2019).

The SARS-Cov2 pandemic has additionally made the situation of young people on the labor market significantly more difficult. Currently, the whole world is facing its economic consequences which are still present as of 2025. However the pandemic has also opened up new opportunities for young people (Ang, Shorey, Lopez, Chew, Lau, 2022). During the pandemic, many companies were forced to adopt a new way of working—remote work. This allowed employees in various companies to perform their duties without having to leave home. As mentioned earlier, Generation Z is a highly tech-savvy generation with an inseparable connection to the internet. For this reason, remote work holds significant value for them. However, the issue of securing permanent employment remains a pressing challenge for young people. In 2017 a study was conducted which showed that as many as 44.2% of young Poles aged 15 to 24 worked under a fixed-term contract, this is almost half, the main reason why they chose this form of employment was the inability to find a permanent job (Messyasz, 2021). This was indicated by 54.6% of respondents in the above-mentioned study. However, this study showed that the group that prefers not to be employed permanently has increased, in 2017 it was 14.2%, and in a comparable study only 9 years earlier, in 2008 it was 11.6% of respondents (Messyasz, 2021). Since 2008, the number of respondents preferring flexible forms of employment has also increased - 7.2%, while in 2017 there was an almost 2.5-fold increase, because in 2017 as many as 17.2% of people preferred this form of employment (Messyasz, 2021).

One of the flexible working methods is self-employment. According to Eurostat research, the number of young people—those under 25 years of age—registered as self-employed in Poland was 6% in 2014, which is a relatively small percentage. However, research from 2019 indicated that the perception of self-employment among young people is changing (Workforce View in Europe, 2019). As many as 26.5% of respondents among people under 25 years of age

believed that self-employment is a good way of life and in a comparable study just two years earlier this approach was presented by 19.6% of people. This result should not be surprising considering the fact that due to rising inflation and difficult housing situations, as well as the fact that representatives of Generation Z brought up with access to social media want to live at a decent standard and earn a lot of money which often excludes working full-time. In the "Millennial Survey", representatives of Generation Z identified non-standard forms of employment as a great alternative to the traditional form of employment, which is full-time work, because for many of them the prospect of a higher salary is more important than the social benefits offered by full-time work (Millennial Survey, 2024). It is worth mentioning here that the social insurance and tax burden for employees working full-time is much higher than for running a sole proprietorship. Additionally self-employment means uncapped earnings; in full-time employment, the salary depends on many factors including the lowest national wage, position, education, and industry. Self-employment does not determine the amount of earnings, although it also depends on many factors, all earnings are the owner's capital and it depends on how well a given entity prospers, it is risky from the perspective of life stability but it gives the opportunity to earn a large sum with good management (Messyasz, 2021).

However, Generation Z does not completely deny working full-time, although it might seem that the self-confident and success-oriented generation will deny traditional forms of full-time employment, but for many of them, working full-time has many advantages (Iorgulescu, 2016):

1. Stability of employment, especially when it is a full-time job and an indefinite period of time.
2. The notice period, which after three years of employment reaches three months, and the fact that the employer must provide a reason for terminating the contract, which in many cases may prevent him from deciding to dismiss the employee.
3. Social rights, which include paid holiday, maternity and parental leave. It also includes paid sick leave and an assured place at work after returning from leave or sick leave.

This approach may also result from the fact that Generation Z, as mentioned earlier, is a generation full of anxiety about the future. Young people are well aware of the difficult situation on the labor market and express concern about finding their first job after graduation (Racolţa-Paina, Irini, 2021).

Representatives of Generation Z are also afraid that the work they will take will be just a job for them and not something that inspires and motivates them to continue acting, developing, and being able to be themselves (Racolţa-Paina, Irini, 2021). hey question the value of continuing their studies and obtaining further degrees, believing that the knowledge gained during first-cycle studies does not align with the skills needed in the labor market. Working in corporations has also become an unattractive prospect for many young respondents - they fear being "absorbed" and "stuck" in such environments. Another concern they expressed is the dismissive attitude of employers, who may view them as young, inexperienced,

and disconnected from the realities of work. This fear was shared by the majority of respondents (Racolţa-Paina, Irini, 2021).

Summarizing, the arguments presented by the cited authors are indeed convincing and they should be agreed with. Indeed Generation Z' views on the labor market as a risky and unstable space where securing a job right after graduation may be challenging. They identify numerous risks and uncertainties associated with entering the workforce. While the 21st century offers many opportunities, it also presents several limitations in terms of work and employment. These concerns are further influenced by the dynamic economic and political situation worldwide, shaping Generation Z's expectations of potential employers and presenting challenges for employers in terms of staff management.

## 4. Advantages and disadvantages of Generation Z as employees

Generation Z entering the labor market is highly valuable to employers, as each generation brings a fresh perspective on professional work, offering real benefits to organizations by introducing innovations and new skills. However when discussing Generation Z many HR managers point out several noticeable drawbacks among its employees. The most commonly mentioned disadvantage during the recruitment process is their high financial expectations which are often coupled with limited experience and their young age. HR managers also note that Generation Z tends to have an idealized view of work and the labor market. Some job candidates inquire about additional employment benefits such as a multisport card or extra healthcare. While this demonstrates self-awareness and market orientation, it can pose a significant challenge for employers, particularly smaller businesses that lack the financial resources to offer such additional benefits (Pandita, Agarwal, Vapiwala, 2023).

Employers also complain about employees' quick resignation from work even after a few weeks of work. Even though companies may seem flexible and adaptable to their needs. According to them, young employees from Generation Z are often negatively disposed to working overtime and on weekends and holidays because they have their own priorities outside of work. Many managers also emphasize that young employees often leave overnight, without giving a reason (Waworuntu, Kainde, Mandagi, 2022).

This attitude may be problematic for employers because it is common for them to invest time and resources in training new employees, providing them with the knowledge needed to perform their jobs effectively. If an employee resigns after receiving training, it can be a loss for the company, as a well-trained employee may become a valuable asset for competitors in the same industry. The lack of loyalty among Generation Z employees towards their employer can pose a significant challenge for businesses. It may hinder the motivation process, which

often relies on employee loyalty to the organization, making this a notable disadvantage of Generation Z as a potential asset to companies (McCrindle, Fell, 2019).

However, the lack of proper training can also negatively impact Generation Z employees' willingness to stay with an organization. Human resources managers emphasize that members of Generation Z expect a thorough introduction to their duties and a step-by-step explanation of their daily tasks (Lev, 2021). It is crucial to define these responsibilities in detail as Generation Z employees are quick to express when a task falls outside the scope of their job description. This directness is a key characteristic that sets them apart from Generation Y, who were less likely to be as straightforward. Additionally, employers note that Generation Z employees expect prompt feedback on their work, and at times, they may not accept critical feedback well (Muster, 2020).

Entrepreneurs also emphasize that most young employees have no enthusiasm for work or motivation, which is a big problem for entrepreneurs (Muster, 2020). They notice that employees from Generation Z either have motivation from above, then they are active, go-getters and enterprising, or they do not have it, or their only motivation is the payment, they do not make much effort and their work is only done correctly. Entrepreneurs also point to the approach to work as a disadvantage; young people treat work in relation to the contract they received. If it is work until, for example, 3 p.m., they will not work extra hours. Entrepreneurs emphasize that young employees work as much as they have to and nothing more. Additionally, when they are on sick leave, they are not interested in work and whether their absence will be problematic for the company. This indicates a great sense of separation between private life and work among Generation Z employees (Muster, 2020).

These are obvious disadvantages for employers, but for representatives of Generation Z themselves, especially in terms of awareness of the time frame and content of the duties performed, they may be advantages. The above disadvantages may be a big challenge for employers in the context of human resources management however it is a profitable process in many respects because Generation Z employees are a gigantic resource and have many advantages. Young employees from Generation Z are undoubtedly well-educated and open to novelties and new solutions. Brought up in the era of social media and the Internet, they know these tools perfectly and can perfectly support this aspect of enterprise operations (Wulur, Mandagi, 2023). Because it is certain that most companies, especially in the service and sales industries, cannot function without well-executed advertising in social media and the Internet, because in today's world closely connected with the Internet, operating without social media is almost impossible. Therefore, Generation Z employees are of particular value when it comes to social media and the Internet. Additionally, these are people who have excellent knowledge of IT techniques and use advanced computer programs, because they grew up in the era of general availability of this type of equipment. When talking about their advantages, entrepreneurs also mention the ability to quickly absorb information as well as openness and curiosity about knowledge. Young people are often independent when absorbing new information and looking

for new solutions to problems that arise in everyday life in the company, they are also able to learn from their own mistakes and try again when the attempt ends in failure (Racolţa-Paina, Irini, 2021).

Entrepreneurs observe a significant difference between young employees and those from previous generations. Young employees are not afraid to voice their opinions and driven by curiosity actively seek solutions to problems that arise in their professional activities. In contrast, older generations tend to wait for designated teams to resolve issues rather than attempting to address them themselves. Older workers often lack the curiosity and innovation that are evident in the behaviors and attitudes of younger employees. Employers also notice a strong willingness among young employees to develop and acquire new skills. They are eager to take on new challenges but dislike routine and repetitive tasks, as they are motivated by the desire for constant growth and development (Żarczyńska-Dobiesz, Chomątowska, 2014).

This attitude of young employees can be a valuable asset to the company, as their innovative ideas can positively influence the overall creativity and adaptability of the organization. Another advantage of the younger generation is their language skills. Most members of Generation Z have a functional command of English, with a significant portion possessing advanced proficiency, and many also speak a second foreign language.

It is also important to consider that Generation Z will soon enter the labor market and will become a powerful force, making their management not only a necessity for individual organizations but also a broader imperative. In various publications, representatives of Generation Z highlight their strengths, such as resilience to stress, strong organizational skills, multitasking abilities, and openness to the world and acquiring new skills. Generation Z describes themselves as individuals who do not follow rigid, formulaic approaches. They are not afraid to take risks, despite having been taught to obey and think within structured patterns from a young age. They see themselves as determined individuals, eager to achieve their goals and stand out in the labor market (Wulur, Mandagi, 2023). As mentioned earlier Generation Z is aware of the challenging situation in the labor market. Therefore most members of Generation Z begin their professional activities while still in school or university participating in various extracurricular organizations to enhance their resumes for their first serious job. They aim to gain valuable experience from each professional opportunity, focusing on building their individuality. If needed they are also flexible and open to working abroad to expand their career prospects (Racolţa-Paina, Irini, 2021).

To summarize, as has been correctly pointed out in the literature cited, like every generation before it, Generation Z has both advantages and disadvantages as employees. While the disadvantages may pose challenges in managing Generation Z staff the advantages offer significant benefits to entrepreneurs and organizations. However the advantages of Generation Z far outweigh the disadvantages and effective management of this generation's workforce can enhance these strengths, allowing Generation Z employees to thrive and contribute positively to the company.

## 5. Intergenerational differences in terms of employment and human resources management

Currently, employers, considering generational differences, face many challenges when managing generationally diverse staff. The employers notice significant differences between older generations and Generation Z (Alferjany, Alias, 2020).

Representatives of Generation Z can be difficult to manage due to their approach to work and awareness in many areas. They perfectly understand their value therefore a potential workplace must meet all their requirements. Despite the difficult situation on the labor market, Generation Z is aware of its value and openly presents its main motivators to work. Generation Z largely in terms of motivation, needs respect, opportunities for development, job security and certainty. and treated seriously by their employer, they want to be noticed and appreciated for their skills and they want to fulfill their dreams by doing their job. It can be concluded here that Generation Z, brought up in prosperity, strives for self-fulfillment and development, as well as a job in which they can gain position and recognition (Garg, Mahipalan, 2023).

The representatives of Generation Z, when choosing a workplace are guided mostly by the criterion of a good atmosphere and relationships with people, good location and quick access to work and employment stability, which was the first priority among Generation Y. This shows significant ideological differences between generations and the influence of historical factors on the perception of employment. The possibility of flexible work has also become more important for Generation Z than for older generations. The same happened in the case of the opportunity to acquire new skills, the percentage is much higher than in the case of older generations (Heyns, Kerr, 2018).

Now that we understand the differences between generations, it's important to focus on the aspect of motivation. While traditional employee motivation techniques have been highly effective for older generations, they may pose challenges when applied to Generation Z. Generation Z is highly diverse in the labor market, comprising individuals who have graduated from college with higher education, as well as those who are just entering the workforce. How should these individuals be motivated to achieve organizational goals? Selecting the right leadership style is crucial in this regard.

There are many leadership styles. Leadership itself can be defined as placing emphasis on performing certain activities that are good from the point of view of achieving goals in the organization. Leadership can also be presented as a transactional process. Between the group and the leader, where the leader and group members exchange time and commitment for monetary rewards or social support. A good leader motivates group members to achieve goals that are important to the group. A leader must define his or her leadership style, as mentioned above, there are many concepts of leadership. Popular styles are: autocratic style, democratic style or liberal style (Kraus, 2017).

The first style, the autocratic style, is distinguished by clear and transparent delegation of tasks to the team, isolation of expected results and describing them to employees. This is a style in which the leader decides what a given group does, what actions it takes and what its results are. This leader uses a system of praise and reprimand and does not participate in the process of working on a given aspect. The second style, the democratic style, is slightly different from the autocratic style, while in the autocratic style it is the leader who decides on all aspects of task execution, in the case of the democratic style, the leader agrees on the task with the team and consults with it at all stages of execution. actions. However, the last liberal style is associated with overall freedom of action in the team. In this style, the leader provides the materials needed to complete the task and does not supervise the process. There are also many other leadership styles, which are often a mix of the above-mentioned concepts. A good leader should adapt his leadership style to the unit he leads (Kraus, 2017).

However, referring to the management of Generation Z, there are two factors that determine the leadership style that the organization will choose: competence and commitment (Easton, Steyn, 2022). As mentioned above. Generation Z representatives have varying degrees of education and skills.

When their skills are low and their commitment is high, a directive style should be chosen, in which the employee should be taught and mentored by the leader. In a situation where there are both low competences and low commitment, a coaching style should be adopted, where the employee will be directed to the appropriate paths, trained and supported at every stage of activity. However, when the competences are medium to high and the employee's involvement is variable. A supportive style should be adopted, including praise, listening to the employee's comments and objections, and making it easier for him to perform a given job. However, when there is both a high degree of competence and high commitment, a delegating style can be used, which has identical features to the liberal style, i.e. delegation of responsibility for making decisions (Kraus, 2017). In the motivational aspect, in each of the above situations, an employee can be motivated to act. As mentioned above, young employees expect, above all, respect, forms of self-development and a good atmosphere. They are people who are much easier to motivate when their goals coincide with the goals of the organization. Additionally, feedback is important to them because without it, they feel lost and have the impression that they are not important for the organization and the knowledge needed to perform a given task will not be provided to them. handed over (Easton, Steyn, 2022). Therefore, feedback is a key element in managing Generation Z employees, and the most important and key elements of feedback are praise for a job well done and drawing attention to elements that can be improved in the future so as not to make mistakes while performing the task (Alferjany, Alias, 2020).

In the context of Generation Z organizations are often advised to change their staff management policies. Because Generation Z knows its value in the labor market and is not entirely loyal to one entity. Motivation should also be comprehensive. Where the organization's activities should not be focused only on material motivators but in the case of Generation Z,

emphasis must also be placed on intangible motivators. Because in the long run material motivators may turn out to be ineffective for Generation Z employees and will not determine whether a given employee will remain in the place of employment or change it to another one (Easton, Steyn, 2022).

To sum up, most authors understand and rightly point out that managing and motivating Generation Z employees can present a significant challenge for entrepreneurs. However retaining Generation Z employees within their organizations will bring substantial value in terms of innovation. The above theoretical and epistemological considerations serve as an introduction to the study, the results of which, along with conclusions will be presented at the end of the second part.

## 6. Summary

The above considerations of a theoretical and epistemological nature constitute an introduction to the survey which outcomes are presented in the following paper (part II) and which is the integral part of this work. They provide the conceptual framework and methodological orientation that underpin the research process. The aim is to establish a solid foundation upon which the subsequent analysis can be built. The study itself is divided into two main parts, each addressing specific aspects of the research question in a structured and coherent manner. The major findings together with conclusions are discussed at the end of the second part where the implications of the results are also considered in light of the initial theoretical premises. The theoretical background outlined in part I of the paper serves as a foundation for the design and interpretation of the survey. It formulates the research questions and hypotheses ensuring that the empirical investigation is grounded in a coherent conceptual context.

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# WORK-LIFE BALANCE AND ITS IMPACT ON GENERATION Z'S MOTIVATION TO PURSUE EMPLOYMENT – PART II

Agnieszka BARCIK[1*], Piotr DZIWIŃSKI[2]

[1] University of Bielsko-Biala, Faculty of Management and Transport; abarcik@ubb.edu.pl,
ORCID: 0000-0003-0865-2161
[2] University of Bielsko-Biala, Faculty of Management and Transport; pdziwinski@ubb.edu.pl,
ORCID: 0000-0003-4061-7761
* Correspondence author

**Purpose:** Determining and discussing various aspects for employment motivation among younger generation.
**Design/methodology/approach**: The research method used in the paper is mainly a standardized survey conducted on the basis of a questionnaire containing closed and open questions carried out among representatives of the examined generation. The research process was also accompanied by analysis of source documentation.
**Findings:** Research results verify research hypotheses formulated on basis of the paper's objectives, enabling general conclusions.
**Research implications**: Future research directions should focus on further, expanded research exploration in the area, taking into account a larger number of respondents.
**Practical implications:** The results of the research discussed in the paper have a number of practical implications mainly for the management staff and employers in terms of human resources management and employment policy.
**Social implications**: Building awareness of generational change in the process of managing employment policy.
**Originality/value:** The paper has cognitive value for the development of knowledge, science and quality in terms of employment policy.
**Keywords**: human resources management, employment policy, generational change, workforce planning, labour market trends.
**Category of the paper**: research paper.

## 1. Introduction

Based on the characteristics of Generation Z presented in part I of this paper, its advantages and disadvantages, general approach to the world and after analyzing alternatives to the traditional way of earning money, the question arises: How does Generation Z perceive full-

time work? Is he/she motivated and willing to take up traditional professional activity? Or maybe they want to find an alternative way of earning money that will give them independence and no need to work for someone? And what real opportunities and challenges do Generation Z bring to employers?

In order to answer the above questions, the thesis was put forward that the young generation perceives full-time work in a completely different way than earlier generations, however, it does not deny it in its entirety and to a large extent they are inclined to work in regular way rather than to alternative forms of earnings. This response also included the following hypotheses:

- Regular work is a much more stable form of employment for people from Generation Z.
- Non-regular forms of employment are much less often taken into account in the context of building the future.
- For representatives of Generation Z, it is very important to maintain a balance between work and private life.
- Representatives of Generation Z prefer regular work and are much less likely to think about changing their employment to non-regular form of employment.

The research method that was used to examine Generation Z's approach to full-time work and non-full-time forms of employment is a survey. A method of collecting information from a previously designated group of respondents in order to deny or confirm a given assumption.

The main advantage of this research method is the ease of reaching respondents, most of whom will be representatives of Generation Z, which, as mentioned, uses social media to a large extent, and undeniably anonymity, which will make the answers more honest and truthful. The research group was purposefully selected - representatives of Generation Z and a control group from other generations - it was also intended to reach people of both sexes, working and non-working people, in order to deepen the analysis of the issue.

## 2. Summarized research results

The research method that was used to examine Generation Z's approach to full-time work and non-full-time forms of employment is a survey. A method of collecting information from a previously designated group of respondents in order to deny or confirm a given assumption was used here. The survey was conducted among 74 people, including 60 women and 14 men, mostly aged 18 to 27. The questions were as follows. The first one was about the factors taken into consideration when choosing a workplace.

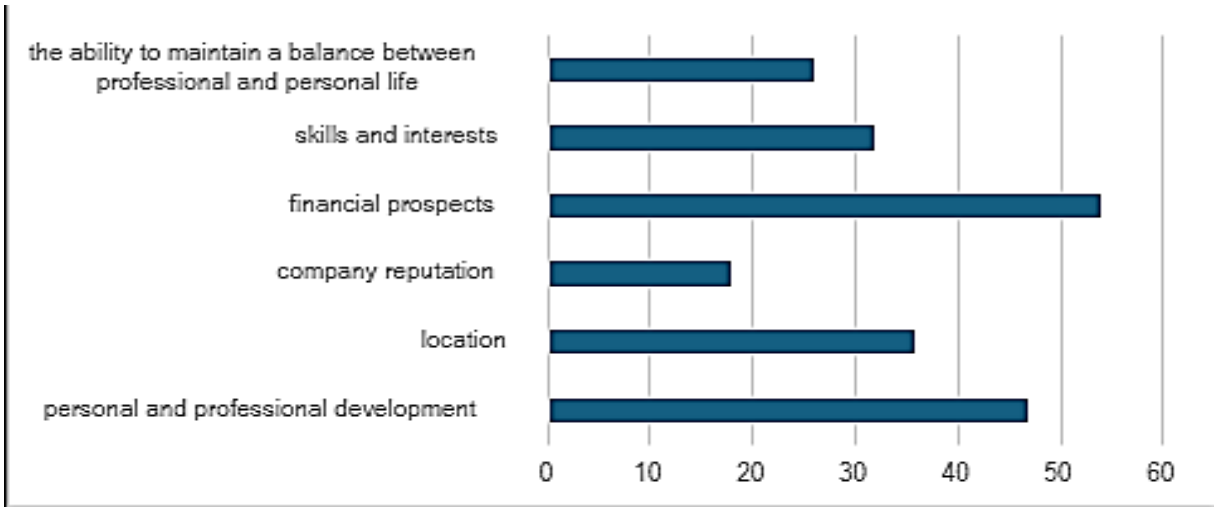



**Figure 1.** Factors which determine the choice of workplace.

Source: own study.

The figure above (Figure 1) presents the factors that influence the respondents' choice of workplace. The vast majority of them indicate that financial prospects are the most important factor in their decision (54 responses). The next most important aspect is personal and professional development (47 responses), followed by location (36 responses). Skills and interests are also significant factors for 32 respondents, while the ability to maintain a work-life balance is important for 26. The least important factor was the company's reputation, with only 18 responses. These results show a strong correlation between financial prospects and professional development, which are the two most crucial factors influencing respondents' choice of future workplace.




**Figure 2.** Factors which determine motivation for work.

Source: own study.

The next question concerns the major motivators for work. The motivators for work indicated by the respondents in Figure 2 were both of material and non-material nature. The top motivator was remuneration and benefits, with 60 respondents selecting it. The second place

was job satisfaction, with 43 responses, followed closely by personal and professional development in third place, with 42 answers. Slightly fewer respondents, 38 people, cited the work atmosphere as a motivator. For 16 respondents, recognition was a key motivator. The least important motivators were pride in belonging to a given organization, with only 6 responses, and wellbeing initiatives at work, which only 2 respondents identified as important. These results indicate that the greatest motivators are remuneration and benefits, followed by job satisfaction and development. While the young generation is also motivated by the work atmosphere, it holds less significance for them.

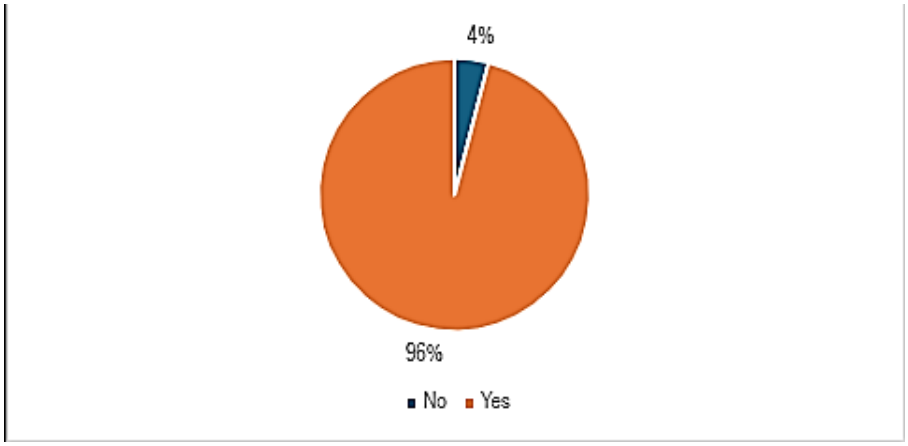



**Figure 3.** Importance of balance between work and personal life.

Source: own study.

The question on importance of maintaining the balance between personal life and work was the next one. As shown in the Figure 3, 96% of respondents stated that maintaining a work-life balance is important to them.

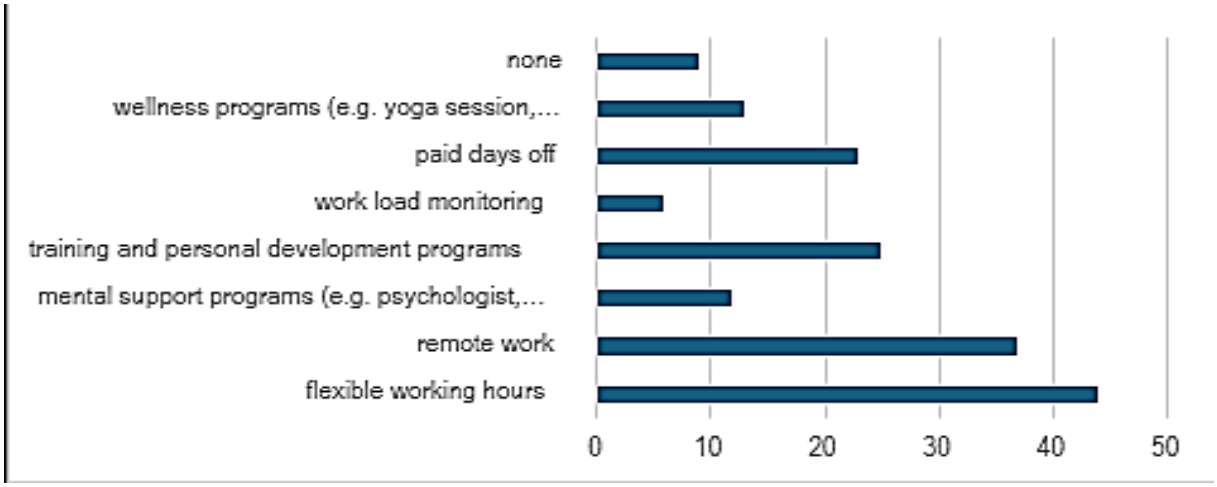



**Figure 4.** Work- life balance in job.

Source: own study.

When asked about the activities their employers have undertaken to maintain a balance between personal and professional life, 44 respondents cited flexible working hours while 37 mentioned remote work. Training and personal development programs ranked third with 25 responses. Paid days off were chosen by 23 people. Thirteen respondents indicated wellness

programs, such as massages, yoga sessions, and fitness activities. Twelve people mentioned mental support programs and 6 noted that their employer uses workload monitoring. However 9 respondents did not report any such activities in their workplace. The results indicated in Figure 4 suggest that most companies are taking steps to support work-life balance, with the most common methods being flexible working hours and remote work.

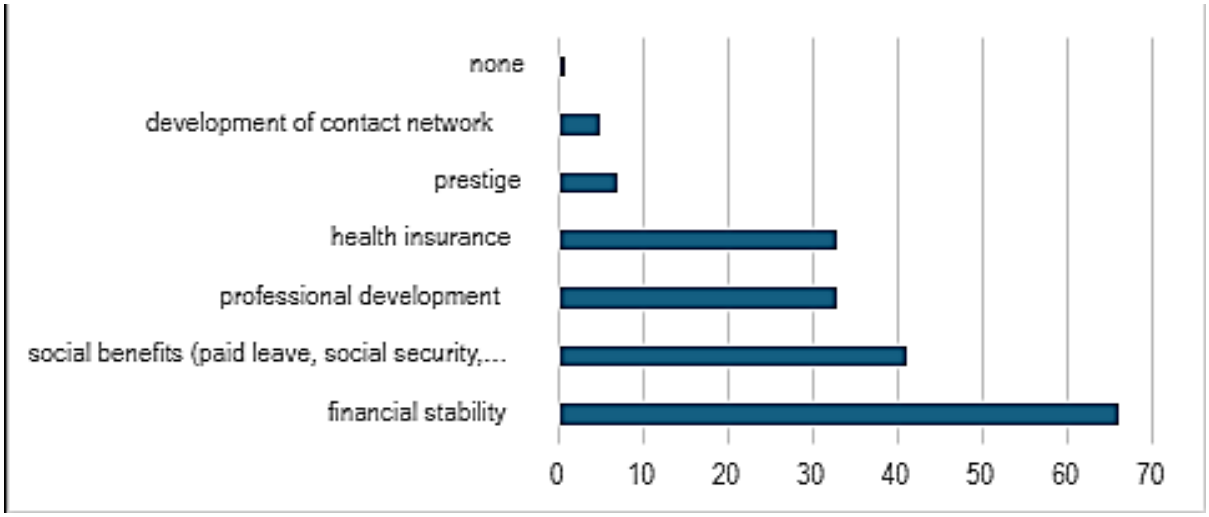



**Figure 5.** Benefit of regular job.

Source: own study.

The respondents were also asked to specify which benefits of a regular job are most important to them (Figure 5). Financial stability came first with 66 responses followed by social benefits such as medical care, paid leave with 41 responses. Professional development and health insurance were important to 33 people. On the other hand things such as prestige (7 people), development of a contact network for 5 people were the least important, and for one of them no benefits were important. This indicates that the most important thing for people working in a regular job is financial stability and benefits related to free medical care.

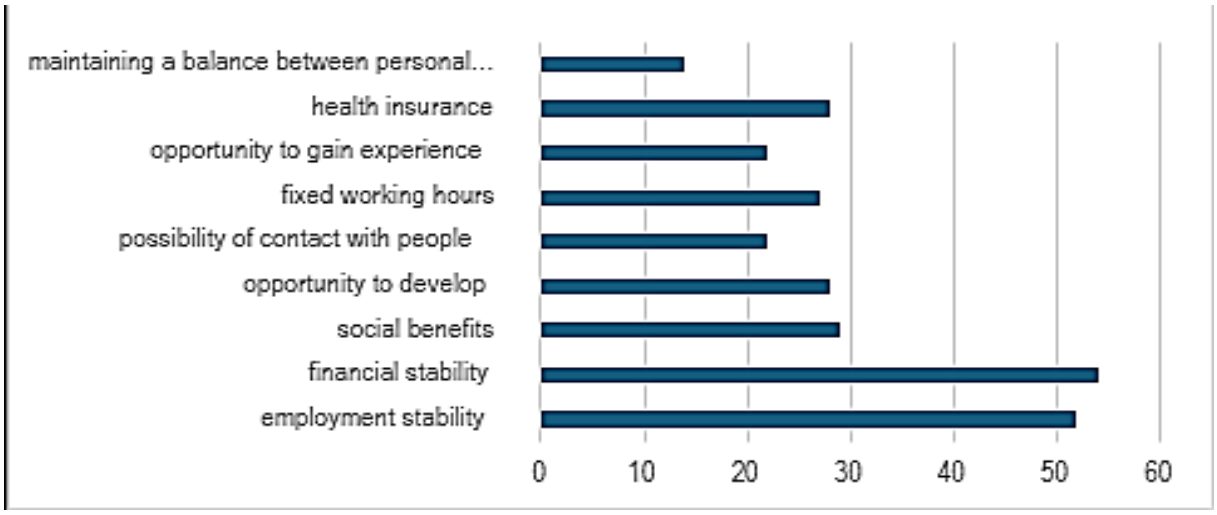



**Figure 6.** Advantages of regular job.

Source: own study.

The respondents were asked about the advantages and disadvantages of a regular job (Figure 6). The graph above presents the advantages. The respondents once again listed financial stability in first place, with 54 people. Then came employment stability with a score of 52 people. The next advantage was social benefits with a score of 29 people, then the opportunity to develop and health insurance, both of which reached a score of 28 answers. Fixed working hours as an advantage are important for 27 people. Possibility of contact with people and the opportunity to gain experience as an advantage were important for 22 people. The smallest advantage with a score of 14 votes was maintaining a balance between personal and professional life. The answers clearly show that a regular job has mainly advantages related to both employment and financial stability.




**Figure 7.** Disadvantages of regular job.

Source: own study.

The Figure 7 shows the disadvantages of regular jobs as specified by the respondents. The biggest disadvantage for them is the risk of routine and monotony with a score of 49 answers, second place was taken by the lack of flexibility, which was decided by 29 people, third place was the answer not very flexible career paths with a score of 28, which could refer to the glass ceiling phenomenon, then fewer earning opportunities for 22 people, lack of individuality for 19, difficulties in achieving balance between personal and professional life for 16 and fixed working hours for 14 because both fixed working hours can be an advantage and a disadvantage. The disadvantages show that working full-time for many can mean limited development and monotony.




**Figure 8.** Advantages of non-regular job.

Source: own study.

Respondents were also asked about the pros and cons of non-regular forms of employment such as self-employment, trading or other forms of work that are not full-time (Figure 8). The above graph lists the pros of such forms. Time flexibility came first with 45 responses, and sense of independence came second with 41 responses. The next advantage is potentially higher earnings, which was supported by 31 people, followed by 30 people who listed greater variety of tasks. For 21 people, the advantage is professional and personal development, and for 20, maintaining a balance between personal and professional life. This shows that a non-regular job can be distinguished by greater flexibility in terms of both time and a sense of independence.

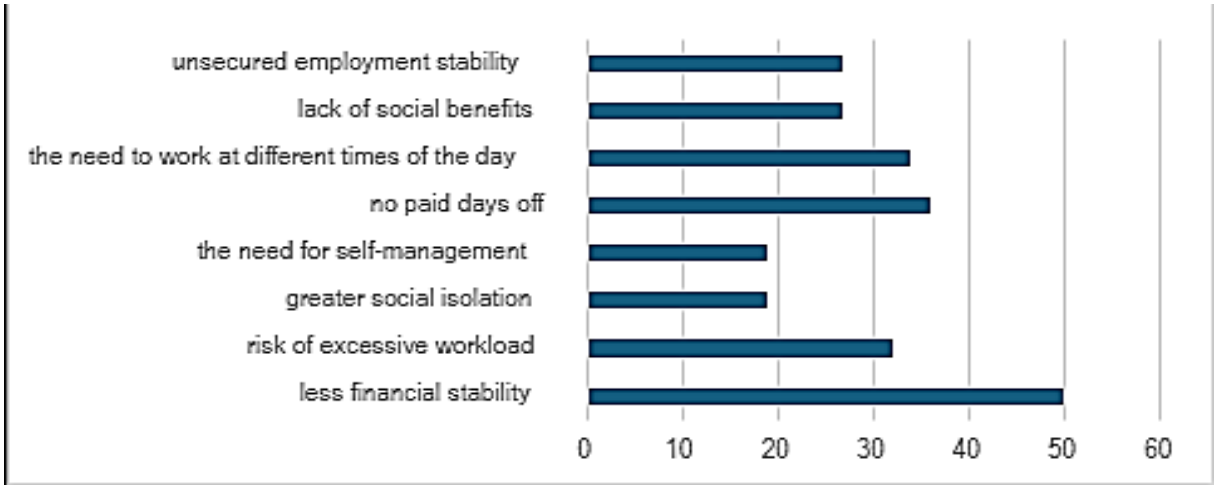



**Figure 9.** Disadvantages of non-regular job.

Source: own work.

The disadvantages listed by respondents include less financial stability with a score of 50 votes, no paid days off voted for by 36 people, the need to work at different times of the day was indicated as a disadvantage by 34 people, the risk of excessive workload indicated by 32 people, lack of social benefits and unsecured employment stability indicated by 27 people, and greater social isolation and the need for self-management by 19 people.

This shows that working in a non-regular system can be financially risky and require a lot of self-coordination (Figure 9).

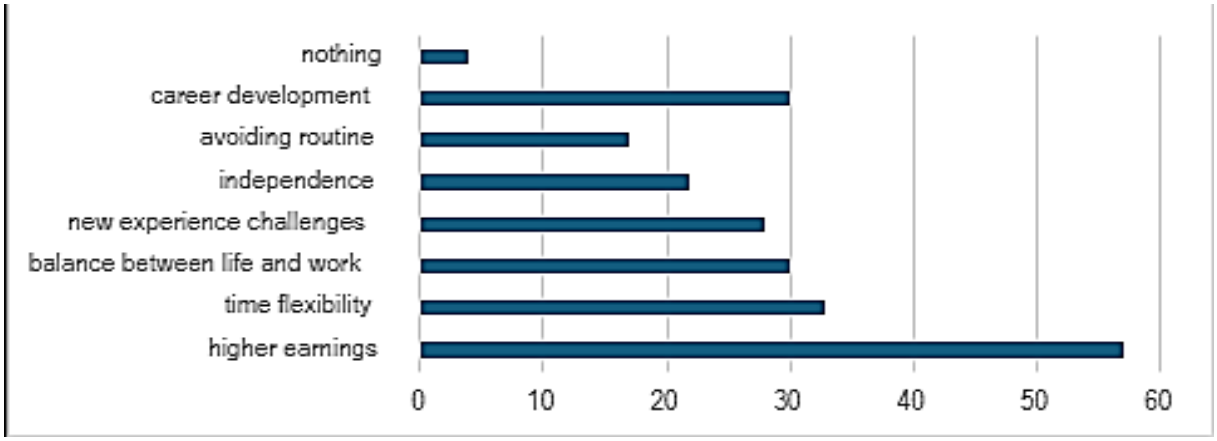



**Figure 10.** Factors which provide the change of work system.

Source: own study.

Then, the respondents were asked about the factors that would cause a change from regular job to non-regular job (Figure 10). The first factor is higher earnings, which was supported by 57 people. Time flexibility would be the reason for such a change for 33 people, while for 30 the reasons could be career development and balance between life and work. For 28 people new experience challenges and for 22 independence. 17 people were in favor of avoiding routine. However, for 4 there would be no such factor. These results show that the main aspect important in such a change would be the amount of earnings.

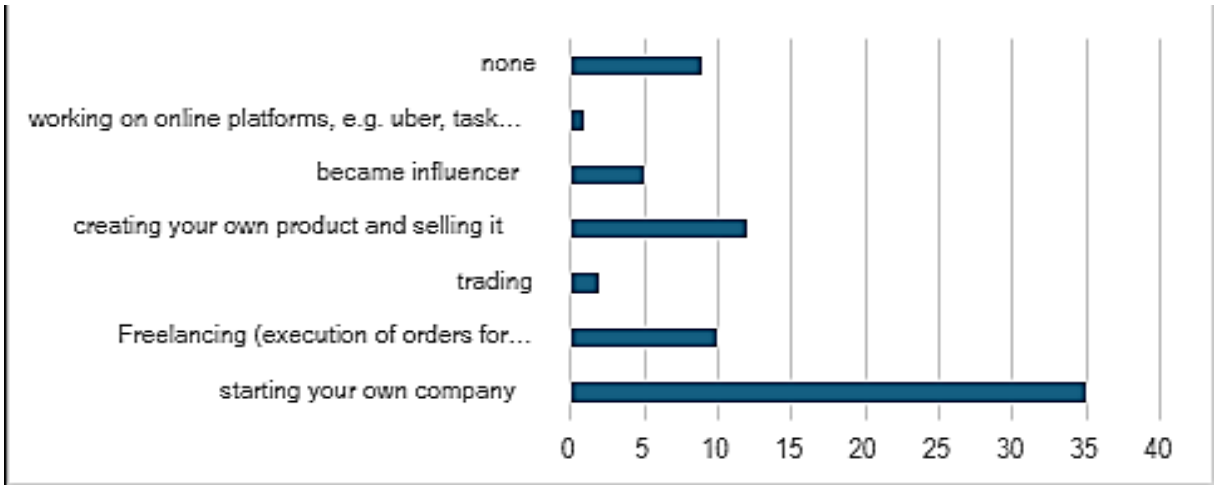



**Figure 11.** Forms of non-regular job.

Source: own study.

Forms of non-regular work that would be attractive to the respondents are in first place starting your own company with the result of 35 people, in second place was creating your own product and selling it with the result of 12 people, Freelancing (execution of orders for acquired clients) with the result of 10 people, became influencer would be attractive for 5 of them,

for 2 trading and for one working on platforms such as Uber. On the other hand, 9 people think that non-regular work is not at all attractive to them (Figure 11).

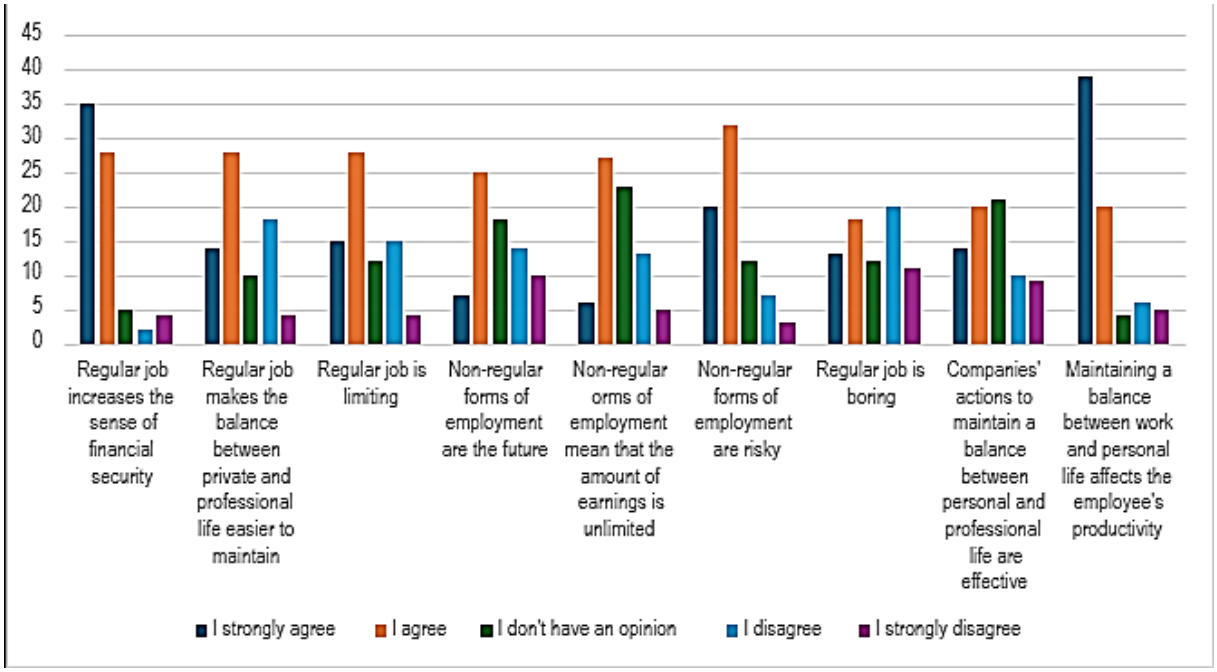



**Figure 12.** Acceptance of the statements.

Source: own study.

At the end of the survey, respondents were asked to agree or disagree with several statements (Figure 12). The first statement, "A regular job increases the sense of financial security," was accepted by the majority of respondents, with "strongly agree" and "agree" being the dominant responses. The next statement, "A regular job makes it easier to maintain a balance between private and professional life," received mixed responses. While 28 people agreed (14 strongly agreed), 18 disagreed with this statement.

Most respondents also agreed with the statement, "A regular job is limiting". Regarding the statement, "Non-regular forms of employment are the future", some respondents agreed, while a significant number either had no opinion or disagreed. Similarly, when asked if "Non-regular forms of employment mean that the amount of earnings is unlimited", many respondents either had no opinion or disagreed, which may suggest that few people have a strong stance on non-regular employment.

On the other hand, the statement, "Non-regular forms of employment are risky", was strongly supported by the majority of respondents. Half of the respondents agreed with the statement, "A regular job is boring", while the other half disagreed, and some were undecided. This likely reflects the varied predispositions and expectations of the respondents.

The statement, "Companies' actions to maintain a balance between personal and professional life are effective", was considered true by 24 respondents, while a large number had no opinion on the subject. This is also evident in the comparison with the previous findings where opinions about companies' actions are ambivalent. However, maintaining a work-life

balance was clearly seen as a priority as the vast majority of respondents affirmed that "Maintaining a balance between work and personal life affects the employee's productivity".

## 3. Summary

It can be concluded that Generation Z does not have a negative attitude towards regular jobs. On the contrary a significant portion of Generation Z sees several advantages in this form of work such as financial and employment stability, as well as numerous benefits like free access to healthcare. Although regular jobs may seem boring and routine to some representatives of Generation Z, they offer far more advantages than irregular forms of employment. Moreover, the prospect of development in regular jobs is much more desirable for Generation Z than the opportunity for growth in non-regular employment. The main disadvantage identified by respondents - the risk of monotony - can be minimized with appropriate management and motivation strategies.

Irregular employment forms present more serious drawbacks for Generation Z, with instability, lack of social benefits and the absence of financial security being major concerns. Generation Z is also uncertain about whether non-regular forms of work represent the future. If respondents were to take on non-regular employment, the majority would prefer to start their own businesses, with other options such as trading or becoming an influencer not being considered by many. This presents a significant opportunity for employers who are interested in recruiting Generation Z to their organizations.

The survey also highlighted the importance of work-life balance for Generation Z. The vast majority of respondents prioritize this balance yet the study found that, despite many companies offering flexible working hours, a large portion of respondents felt that company initiatives were insufficient. This is evident in the number of respondents who did not have an opinion on statements regarding company actions to maintain work-life balance.

The survey confirmed the general assumptions about Generation Z: they are motivated not only by financial factors but also by the need for job satisfaction, personal development, and recognition. Therefore the main research thesis has been clearly confirmed. The hypothesis that regular employment is a much more stable form of work for Generation Z was also supported, as was the hypothesis that maintaining work-life balance is crucial for them, given that this balance is of significant importance to the majority of respondents.

The other two hypotheses were partially confirmed as well: non-regular forms of employment are less frequently considered in terms of building a future and Generation Z prefers regular jobs and is less likely to transition to non-regular forms of employment. Although non-regular forms were seen as less stable some Generation Z representatives considered starting their own business as a viable alternative provided it was profitable.

As noted earlier this is a positive outlook for employers but it is crucial for them to prioritize the work-life balance of their employees, as this is a key value for Generation Z.

When concluding from the employers' perspective some overall implications should also be formulated. In order to attract and retain Z Generation employees, HR departments and employers are advised to undertake some steps which might be as follows: adaptation of flexible working models, investments in customized development and career paths, emphasizing tech-savvy, inclusive and purpose-driven workplace cultures. This will enable organizations to fully leverage the potential of Gen Z employees.

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# RISK DETERMINATS IN INNOVATION PROJECTS –EMPIRICAL RESEARCH IN ORGANIZATIONS

Katarzyna BARTUSIK[1], Jolanta WALAS-TRĘBACZ[2*]

[1] The Cracow University of Economics; bartusik@uek.krakow.pl, ORCID: 0000-0002-3670-5550
[2] The Cracow University of Economics; walasj@uek.krakow.pl, ORCID: 0000-0002-8266-8922
* Correspondence author

**Purpose:** The aim of the article is to identify and analyze the key factors determining risk in innovative projects. The research focuses on identifying significant risk categories for six types of innovative projects implemented in organizations.
**Design/methodology/approach:** The study was based on the analysis of surveys conducted among 87 organizations. The questionnaire included questions about the number and dynamics of implemented innovation projects during the indicated period, types of risks in innovation projects, and the most important external and internal factors determining risks in innovation projects. Data were collected using the CAWI technique. Respondents were owners and managers with knowledge and experience in implementing innovation projects within their organizations.
**Findings:** The results indicate that the greatest activity in implementing innovation projects occurred in the surveyed organizations during the two analyzed periods, especially in the investment, organizational, and technical-technological areas. The greatest increase in interest (dynamics) in innovation implementation was observed in projects related to management systems, research and development, and technical-technological areas. Respondents rated the levels of risk related to costs, time, finances, market, and technology particularly highly. Among external factors, changes in consumer requirements and market fluctuations had the most significant impact on risk in innovative projects, while among internal factors, financial-economic and personal factors were the most influential.
**Research limitations/implications:** The main limitations of the study concern the relatively small number of surveyed organizations, which may reduce the ability to generalize the results. Additionally, the analysis is based on subjective assessments by respondents, which may introduce some measurement errors.
**Practical implications:** The article provides practical guidelines for categorizing risks and identifying factors influencing risks in six types of innovative projects. It can be useful for managers and project leaders in identifying potential sources of risk. Particular emphasis is placed on the importance of identifying risk factors to develop effective risk minimization strategies in innovative projects.
**Originality/value**: The originality of the article lies in its comprehensive approach to risk analysis in innovative projects. The obtained results may inspire further research and support practical efforts to more effectively identify factors determining risks in innovative projects within organizations.

**Keywords:** innovation projects, types of innovation projects, risk, types of risk, risk determinants.
**Category of the paper:** Research paper.

## 1. Introduction

Innovation projects are a key element in the development of organizations operating in a dynamically changing economic environment. However, their implementation is associated with a high level of risk resulting from technological, market, and organizational uncertainties (Catto, Maccari, 2021). The literature emphasizes that risk management in innovation projects requires a comprehensive approach, including the identification, assessment, and mitigation of potential threats (Berglund, 2007; Willumsen et al., 2019; Oehmen et al., 2020). The process of risk identification is a crucial stage in risk management, as it enables the detection and categorization of sources of threats, thus facilitating the implementation of effective preventive measures (Deptuła, Knosala, 2015; Qazi et al., 2020).

The aim of this article is to address the research gap in the area of identifying types of risks and factors determining risk in innovation projects. In particular, it focuses on presenting categories of risks associated with various types of projects: research and development, technical-technological, investment, IT, organizational, and management systems (Salerno et al., 2015; Gorokhovatskyi et al., 2021). Furthermore, the importance of risk identification is highlighted, as it should be conducted at every stage of the project life cycle (Deptuła, Knosala, 2015; Kendrick, 2015). Identifying risk factors enables organizations to anticipate potential obstacles and plan preventive actions accordingly, helping to avoid financial losses resulting from budget overruns or project delays (Becker, Smidt, 2015; Gorokhovatskyi et al., 2021). Precisely determining the level of risk and the factors influencing risk in innovation projects allows for better resource and time management, which translates into project success (Sulejewicz, 2006; Stošić et al., 2016). Identifying risk factors supports informed decision-making regarding the acceptance, avoidance, or minimization of threats (Agarwal, Kansal, 2020). As a result, organizations can better adapt their strategies to changing market and technological conditions (Segal, 2008; Thamhain, 2013; Lou, Hu, 2015). The identification of risk factors is not only a protective tool for organizations but also a foundation for effective innovation project management.

This article consists of three sections, as well as an introduction and a conclusion. The first section discusses the theoretical aspects of innovation projects, risk in innovation projects, and the factors determining risk in such projects. Additionally, this section presents the research problem addressed in the article. The next section is empirical and contains the research methodology, research results, and their limitations. The article concludes with

a discussion and conclusion section, where the main contributions of the study, practical recommendations, and suggestions for future research are presented.

## 2. Theoretical background

### 2.1. Types of innovation project

In recent years, innovation has attracted significant attention from researchers across various fields due to its role in enhancing organizations' competitiveness in dynamic environments (Brook, Pagnanelli, 2014; Shu et al., 2015; Haneda, Ono, 2020; Pomaza-Pomarenko et al., 2023). By engaging in innovation projects, enterprises can strengthen their market position and achieve a competitive edge.

An innovation project is defined as a temporary initiative with a specific organizational structure and resource allocation, aimed at generating business value through the commercialization or application of innovations (Spałek, 2015; Łopaciński, 2018). Such projects often involve novel approaches and are characterized by greater complexity and risk, as well as the generation and implementation of new knowledge (Janasz, Wiśniewska, 2015; Goździewska-Nowicka et al., 2018; García-Quevedo et al., 2018). They may include activities focused on developing new or significantly improved products, processes, or methods within an organization (Wirkus, 2006; Keizer, Halman, 2009).

Barbic et al. define an innovation project as a temporary entity comprising a set of purposively planned and managed knowledge flows between organizational representatives to solve a specific innovation problem (Barbic et al., 2021; Lappalainen et al., 2023).

Innovation projects can be categorized according to their focus - such as technological, research-based, or product development projects - or by the type of change they target: product, process, marketing, or organizational innovations (Entekhabi, Arabshahi, 2012; Oslo/Eurostat, 2018). However, the literature reveals inconsistencies in defining innovation projects due to their diverse nature. These variations arise from factors such as project size, originality, scope, and management requirements. For example, a new product development project may simultaneously be classified as a research initiative or a strategic endeavor.

In summary, innovation projects represent structured efforts to address business challenges through creativity and novel solutions. They are essential for leveraging knowledge to solve practical problems and for achieving sustained growth in competitive markets.

Table 1 presents classifications of types of innovation projects based on the referenced literature and applied in empirical research.

**Table 1**.
*Types of innovation projects*

| Type of innovation project | Explanation of the concept and scope |
|---|---|
| Research and Development (product-related) | Projects with goals that are not always precisely defined often lead to the acquisition of new knowledge about the surrounding reality. Based on the nature of the work conducted and the final outcomes, the following types of projects can be distinguished: soft projects (these include activities such as presenting reports or models and hard projects (these involve tangible results, such as a product represented by a prototype or a finished product). Within hard projects, further distinctions can be made into: scientific-research projects, development projects, implementation projects. |
| Organizational | They concern changes in the organization of the company, its functioning, and work systems. These changes are usually aimed at reorganizing the internal structure, altering work methods, improving efficiency, and streamlining the flow of information. Innovation projects within the organization include initiatives such as implementing JIT (Just-In-Time), controlling systems, new business models, change implementation projects, and designing organizational structures. |
| Technological (manufacturing technology) | Initiatives focus on introducing various technical and technological solutions into different areas of a company's operations, such as manufacturing processes, logistics processes, the introduction of new products and services, process optimization, and performance improvement. |
| Information system | This project aims to create an information system tailored to the organization's needs (hardware, software, human resources). It may involve the creation and implementation of software, the implementation of IT infrastructure, or a combination thereof. |
| Investment-related | An investment project pertains to a specific undertaking that "clearly defines the subject, scope, location, timeline, costs, and expected economic outcomes" and serves as the foundation for conducting investment activities. The goal of the project is to achieve an "optimal combination of all technical and economic elements while minimizing risk". An investment project consists of numerous tasks of varying nature and scope, which can function independently while simultaneously delivering tangible and measurable production or service outcomes. |
| Management systems | Innovation projects in this area aim to discover new, better, and more efficient ways to solve management problems, such as implementing new management concepts and methods, applying artificial intelligence in decision-making, implementing innovation project management methods, creating knowledge bases, and managing experiences. |

Source: own elaboration based on: (Rogowski, Michalczewski, 2005; Belassi et al., 2007; Wojewnik-Filipkowska, 2008, p. 12; Spałek, 2016; Mandziuk et al., 2016; Siewiera, 2016; Kisielnicki, 2018; Nogalski, Niewiadomski, 2018; Müller et al., 2019; Kozlov et al., 2021; Cantarelli, Genovese, 2021; Pietruszyńska, Woźniak, 2021; Chaber, 2023; Matysiak, 2024; Wintage, 2025).

The general classification includes most of the innovation projects with different innovation degree. Taking into consideration the existence of different classifications of an innovation projects, it is reasonable to look at the types of risks involved in their implementation.

### 2.2. Risk and its context in an innovation projects

Innovation projects are inherently risky, as they involve responding to change and dealing with uncertainties that can lead to failure if poorly managed. The primary factors influencing project success or failure often lie in the knowledge, skills, and abilities of project managers. Risk is defined as any uncertain event that could negatively affect stakeholder interests or project outcomes (Sanchez-Cazorla et al., 2017). Engineering projects, for example, are particularly risky due to the involvement of multiple parties such as contractors and suppliers. The success of innovation projects heavily depends on effective risk management (Kupeshova et al., 2016; Alkaissy et al., 2020; Rachmiani et al., 2024).

Risk in innovation projects is influenced by both internal and external factors, which can disrupt goals and profitability. To manage risk effectively, it is essential to identify potential threats (Eskerod et al., 2018; Denney, 2022) and opportunities as early as possible during the project's lifecycle (Pomaza-Ponomarenko et al., 2023). This involves determining which stakeholders will be affected, when risks may emerge, and the potential consequences of such risks (Gorokhovatskyi et al., 2021). Engaging stakeholders during the risk identification phase is widely regarded as a highly effective strategy (Akram, Pilbeam, 2015; Siewiera, 2016; Willumsen et al., 2019).

Contemporary risk management strategies emphasize the importance of exploiting opportunities alongside the mitigation of threats. While traditional risk management focuses on reducing potential losses (threats), more progressive approaches consider risks as pathways for value creation (Hillson, 2016; Farooq et al., 2018). This dual perspective is especially relevant in innovation projects, where, if managed effectively, risks can pave the way for breakthroughs (Browning, 2018).

Risks in innovation projects can be categorized based on their sources and the specific type of project (Abdalah, 2004). Common categories include technical, financial, and market acceptance risks, as well as risks related to organizational culture. Certain project types, such as IT or research initiatives, face particular challenges, including risks associated with intellectual property or intercultural communication (Nasalski et al., 2014; Oehmen et al., 2020). Additionally, IT projects often encounter issues related to data security and shifting customer demands (Yim et al., 2015).

To address these complex issues, risk management methodologies such as PRINCE2 (2009) and PMBOK (PMI, 2017; PMI, 2019) characterize project risk as the likelihood of events that may either positively or negatively impact project objectives. Effective strategies involve early risk detection, continuous monitoring, and the use of advanced tools designed to mitigate or capitalize on these risks (AgilePM, 2012). Incorporating risk management into innovation processes allows organizations to proactively identify potential threats and ensure alignment with strategic goals (Chapman, Ward, 2015; Sanchez-Cazorla et al., 2017; Adler et al., 2016). Managing risk in innovation projects requires a comprehensive approach that balances threat mitigation with opportunity exploration (Deptuła, Knosala, 2015; Shahmansouri et al., 2019).

Table 2 presents a general classification of risks in innovation projects based on the referenced literature.

**Table 2**.
*The general classification of risks in an innovation project*

| Author | Types of risk in the innovation projects |
|---|---|
| A. Ericsson, A. Kastensson (2011), R.F. Miorando, J.L. Duarte Ribeiro, M.N. Cortimiglia (2014) | – internal risk (project management methodology adopted in the organization, the strategy of implementing innovations in the organization, human resources, organizational culture, and knowledge management, business disputes, improper communication),<br>– external risk (global environmental conditions, requirements of state institutions and agencies, environmental conditions, project stakeholders, market and competitors, cooperators, tax regulations, legal changes). |
| R. Muniak (2012) | – managerial risk – the risk of project completion on time and while maintaining other project parameters,<br>– technological risk – the risk of developing new technological solutions and shortening the time of their implementation,<br>– market risk – lack of acceptance for the manufactured product and, as a result, the possibility of generating revenue. |
| W. Janasz (2015) | – risk of research and development activities (in projects there is a high risk resulting from uncertainty and postponing effects in time while incurring current costs),<br>– market risk (is a consequence of the inability to predict how the new project will be received by the market),<br>– investment risk (there is difficulty in determining the correct level of funds allocated to project implementation),<br>– financial risk (e.g. regarding the level and speed of circulation of current assets, it is of particular importance in a global and industry crisis, as the demand for a new project may suddenly collapse). |
| T. Nawrocki (2016) | – economic risk (identified with the sources of financing an innovation project),<br>– time risk (related to continuous technological progress, global and unlimited communication, which translates into a significant shortening of the life cycle of an innovation project),<br>– organizational risk (identified with the way of organizing the work of a team of people implementing an innovation project),<br>– competition risk. |
| K. Becker, M. Smidt (2015) T. Łopaciński (2018) J. Tarapata, J. Woźniak (2022) | Researchers distinguish risks related to: the product, the use of new technologies, the application of design methods, the protection of intellectual property, the uniqueness of the project within the organization, organizational culture, and the required competencies of the project manager. Occupational safety and health during project implementation encompass issues such as product/solution safety, information and data security, the production process, and end-user safety. These risks are associated with potential threats to health and life, as well as cybersecurity concerns. Risks related to the coordination of activities within a project include managing processes and communication between various teams and stakeholders, collaboration with partners and subcontractors, coordination of different project elements, and effective communication. |

Source: own elaboration based on: (Kosaroglu, Hunt, 2009; Ericsson, Kastensson, 2011; Muniak, 2012; Miorando et al., 2014; Janasz, 2015; Becker, Smidt, 2015; Kupeshova et al., 2016; Nawrocki, 2016; Deptuła, Knosala, 2017; Łopaciński, 2018; Bal-Woźniak, 2020; Gorokhovatskyi et al., 2021; Tarapata, Woźniak, 2022; Mannes, Beuren, 2023; Pomaza-Ponomarenko et al., 2023).

As shown in Table 2, various classifications have been presented, highlighting different types of risks occurring in innovation projects. The extent and nature of risk in an innovation project are significantly influenced by factors such as the specific type of innovation project, the market maturity of the new technology, the ease with which customers can adapt to previously used technologies, the capacity to navigate the complexities of patent process transparency, the organization's prior success in implementing internal changes, and the managerial and technical skills of the assigned innovation project manager (Yim et al., 2015).

## 2.3. Factors determining risk in innovation projects

Innovation projects, by their very nature, are subject to a high level of uncertainty and risk. Table 3 presents a comprehensive summary of groups of internal risk factors that should be considered when planning and implementing innovation projects, whereas Table 4 shows a comprehensive summary of groups of external risk factors in innovation projects.

**Table 3**.
*Groups of internal risk factors in innovation projects*

| Group of factors | Description |
|---|---|
| Financial-economic | Risk arising from insufficient financial resources, improper budget allocation, costs exceeding planned expenses, and liquidity problems. |
| Personnel | Insufficient competencies of the project team, lack of motivation, interpersonal conflicts, and difficulties in recruiting suitable specialists. |
| Instrumental | Lack of appropriate tools and technical infrastructure, outdated technologies, or limited access to modern solutions supporting project implementation. |
| Organizational | Inefficient organizational structure, lack of clearly defined roles and responsibilities, communication issues, and absence of risk management procedures. |
| Technical-technological | Risks related to the implementation of new technologies, their integration with existing systems, and unpredictable technical problems during project execution. |
| Marketing | Problems related to communicating the value of innovation to the market, incorrect marketing strategies, or lack of acceptance of the product by target customers. |
| Managerial (leadership) | Insufficient qualifications of management staff, lack of experience in managing innovation projects, and ineffective decision-making processes. |
| Organizational culture | Lack of a pro-innovation organizational culture, low acceptance of change by employees, and insufficient support from leadership for innovation projects. |
| Business model | Inadequate business model for the implemented innovation or lack of a clear strategy for commercialization of the product or service. |

Source: own study based on: (Janasz, Wiśniewska, 2015; Spałek, 2016; Kotler, Keller, 2016; Walaszczyk, 2016; Zhang, Hou, 2017; Spałek, Trzeciak, 2017; Deptuła, Rudnik, 2018; Pawelec, 2018; Sitek, 2019; Wereda, Woźniak, 2019; Taran et al., 2019; Wang et al., 2020; Rane et al., 2021; Pomaza-Ponomarenko et al., 2023; Duan et al., 2023; Richert et al., 2022; Othman, Hussein, 2023; Rachmiani et al., 2024; Zaman et al., 2024).

**Table 4.**
*Group of external risk factors in innovation projects*

| Group of factors | Description |
|---|---|
| 1. Political | Changes in government, political instability, and conflicts of interest affecting regulations, funding availability, and market stability. |
| 2. Legal (regulatory) | Legal regulations governing innovation activities, such as licensing requirements, environmental standards, and tax incentives. Non-compliance may result in sanctions or delays. |
| 3. Competitors | Competitive pressure driving the need for rapid innovation implementation and the risk of competitors gaining a technological advantage. |
| 4. Customers | Risk stemming from difficulties in predicting customer expectations and behaviors toward new products or services. |
| 5. Suppliers | Disruptions in the supply chain caused by financial problems of suppliers or their limited availability. |
| 6. Investors | Investors' expectations for quick returns on investment may limit long-term research projects and affect capital availability. |
| 7. Socio-cultural | Social norms and cultural values influencing the acceptance of innovations and how they are implemented. This also includes issues related to public image, corporate social responsibility, and potential social conflicts associated with the implemented innovation. |

Cont. table 4.

| | |
|---|---|
| 8. Economic | Economic changes (e.g., recession, inflation) affecting companies' ability to invest and demand for innovation products and services. |
| 9. Environmental (ecological) | Environmental protection requirements and growing expectations for sustainable development as challenges for innovation projects. |
| 10. Technological | Rapid technological development and the risk of existing solutions being replaced by new technologies or substitutes. |
| 11. International | Cultural, regulatory, and economic differences between countries affecting international expansion and the execution of innovation projects. |
| 12. Force majeure | Unpredictable global events (e.g., pandemics, wars, natural disasters) disrupting the implementation of innovation projects. |
| 13. Market | Market dynamics, changes in supply and demand, and market size affecting the success of an innovation project. |
| 14. Business partners | Risks related to business partners' financial stability and their ability to fulfill contractual obligations in cooperative ventures. |

Source: own study based on: (Luo, Hu, 2015; Kotler, Keller, 2016; Trzeciak 2017; Łopaciński, 2018; Goździewska-Nowicka et al., 2018; Chopra, Meindl, 2019; Samuelson, Nordhaus, 2020; Bal-Woźniak, 2020; Gorokhovatskyi et al., 2021; Wiedenmann, Größler, 2021; Wang et al., 2022; Suchacka, 2023; Liu et al., 2023; Owolabi et al., 2025).

Among external factors influencing innovation projects, regulatory and legal changes are particularly critical, as they often necessitate adjustments to project requirements, leading to delays, increased costs, or altered assumptions. Examples include environmental protection regulations and product certification standards. Dynamic market trends and competitive actions also play a significant role, impacting the value of innovation and requiring organizations to adapt swiftly to new conditions. Furthermore, geopolitical and climate risks - such as armed conflicts, economic sanctions, natural disasters, or climate change - can disrupt supply chains and limit resource availability, posing substantial challenges in the current era of global instability (Amara et al., 2016; Oehmen et al., 2020; Wiedenmann, Größler, 2021; Liu et al., 2023).

In the case of internal factors, the lack of sufficient financial resources plays a key role. This often results from underestimating the budget or lacking funds for subsequent project stages, which can prevent the achievement of planned objectives. Another significant issue is poor project management and team communication. Weak collaboration within the team, lack of competence in the project manager, and inadequate risk analysis can lead to delays and erroneous decisions. Overly ambitious goals and schedules are yet another factor increasing the likelihood of failure, as adopting unrealistic assumptions regarding timelines or project outcomes often ends in disappointment (Thamhain, 2013; Kadareja, 2013; Amara et al., 2016; Gorokhovatskyi et al., 2021; Abu Kwaik et al., 2023).

Both external factors and internal ones are crucial for the success of innovation projects. Their proper identification and management are essential for minimizing risks and achieving the project's objectives.

### 2.4. Context of the problem addressed

An analysis of the available literature on the determinants of risk in innovation projects reveals several research gaps that require deeper scientific investigation. The most significant identified areas insufficiently explored regarding risk factors influencing the execution of innovation projects include:

1. A gap in risk modeling for innovation projects, particularly the lack of a comprehensive risk management model specifically tailored to innovation projects in the service sector.
2. A gap in risk management methodologies for non-profit organizations, especially in cultural projects, along with a lack of analytical tools adapted to the specifics of such projects.
3. Insufficient integration of risk management processes with innovation processes.
4. Gaps in research on risk determinants across various types of innovation projects, including a lack of in-depth studies on factors influencing risk levels in each type of innovation project and how they do so.
5. Insufficient research on the impact of organizational culture on risk in innovation projects.
6. Methodological gaps in measuring and assessing risk in innovation projects, with a lack of standardized quantitative methods, existing publications predominantly focus on qualitative aspects of risk.
7. A shortage of studies addressing the differentiation of risk determinants depending on the industry, with a lack of comparative analyses between industries and specific risk determinants in particular sectors.
8. Insufficient research on the influence of external factors on risk in innovation projects, including a lack of in-depth studies on how external factors affect risk and how to manage them.
9. A lack of comprehensive research regarding the competencies necessary for effective risk management in innovation projects.

The identification of these research gaps underscores the need for further studies on risk determinants in innovation projects. In particular, there is a need to develop comprehensive risk management models tailored to the specifics of different innovation types and industries, to integrate risk management processes with innovation processes, to establish standardized quantitative methods for measuring and assessing risk, and to investigate the competencies required for effective risk management in innovation projects.

Future research should also consider the dynamic nature of risk determinants within the context of a changing economic and technological environment, which is especially important in the era of digital transformation and the increasing complexity of innovation projects.

# 3. Empirical studies

## 3.1. Methodology

The adopted research methodology aligns with those presented in the literature and commonly used in management sciences (Czakon, 2015; Sułkowski et al., 2021). Due to their practical nature, management sciences largely refer to empirical research (Januszkiewicz, 2016). The methodology was selected to achieve the objectives set in the article, considering the topic and encompassing several stages.

The first stage involved conducting a review of Polish and foreign literature available in four publicly accessible databases: EBSCO, Scopus, Web of Science, and Emerald. A literature review serves as the foundation for formulating research questions (the research problem), which guide the subsequent stages of the research process (Zdonek, Hysa, 2017). The review focused on three key issues (research subjects): innovation projects, types of risk in innovation projects, and risk determinants in innovation projects (Bowers, Khorakian, 2014; Zinn, 2017; Mammadov et al., 2018; Jissink et al., 2019; Zaynullina, 2020; Yuan, 2020). The primary research method at this stage was the analysis of scientific papers published in leading Polish and international journals. This analysis allowed for the identification of research problems addressed by various authors and the recognition of existing research gaps concerning risk in innovation projects (Czakon, 2015).

Additionally, the literature review facilitated the development of a proprietary classification of risk types related to different types of innovation projects. This classification was used to formulate questions in the survey questionnaire, which is one of the most popular quantitative research methods (Sułkowski et al., 2021).

A crucial element of conducting research is the clear definition of its purpose. Research objectives outline the expected outcomes and help address specific questions posed by the researcher (Sułkowski et al., 2021). The main goal of this study is to analyze current trends in Polish organizations regarding risk management in innovation projects, with particular emphasis on one of its key stages: the identification of external and internal determinants of project risks.

The aim of this article is to address research gaps concerning innovation projects, specifically by identifying the key characteristics and types of risks present in such projects across various organizations. The practical objective is to develop conclusions and recommendations that can be utilized by organizational management to enhance the effectiveness of identifying external and internal determinants of innovation project risks (Czakon, 2015; Sułkowski et al., 2021).

To achieve this objective, the following research problems were formulated (Zdonek, Hysa, 2017):

- what are the number and dynamics of activities undertaken in relation to the types of innovation projects implemented in the surveyed organizations?
- what is the level of risk associated with particular categories in the types of innovation projects undertaken by the surveyed organizations?
- what key internal and external factors determine the risks associated with innovation projects?

Defining these research problems enabled the selection of an appropriate research tool (Collis, Hussey, 2013; Zdonek, Hysa, 2017). A diagnostic survey method was chosen for the study (Januszkiewicz, 2016), as it allows for the collection of information on the phenomenon of interest, examination of respondents' views and beliefs, and assessment of their knowledge (Dźwigoł, 2015). A questionnaire was used as the main data collection technique (Czakon, 2015; Matejun, 2016).

The developed survey questionnaire (comprising a demographic section and detailed questions related to the research subject) was verified for the relevance of its questions through pilot studies (Dźwigoł, 2015; Januszkiewicz, 2016) involving interviews with three project management experts and three risk management experts (Denzin, Lincoln, 2013). Suggestions provided by the experts led to improvements in certain questions, enhancing the research instrument (Sandberg, Alvesson, 2011). The revised questionnaire was subsequently used in the main pilot study (Czakon, 2015).

The actual research was conducted from April to July 2023 using a questionnaire administered via the CAWI (Computer Assisted Web Interviewing) method. The sample was purposively selected. The questions targeted owners (in small organizations) and managers involved in the development, implementation, and evaluation of innovation projects. Most questions in the survey were closed-ended. The research was conducted in organizations operating in Poland. Previous research indicated a growing interest in and implementation of various projects, including innovative ones, in these organizations (Bartusik, Walas-Trębacz, 2019). The type of organization was not a significant variable in terms of business nature or size, as respondents could represent organizations engaged in production, services, or trade across any industry.

Based on the collected data, the results were analyzed using the survey method (Sułkowski et al., 2021), and conclusions were formulated in relation to the research problems (Flick, 2020). Additionally, the findings enabled the formulation of recommendations for organizational management and the identification of further directions for empirical research on the topic (Sułkowski et al., 2021).

The results presented in the article are a consequence of the research methodology developed and applied, which allowed the authors to address the research problems identified.

### 3.2. Research results

**Characteristics of the organizations researched**

The study covered 87 organizations, with respondents representing management positions and business owners. Figure 1 presents the basic characteristics of the organisations from which the respondents came, based on the following criteria: period of market activity, number of employees, core activity, sales market and key customers.

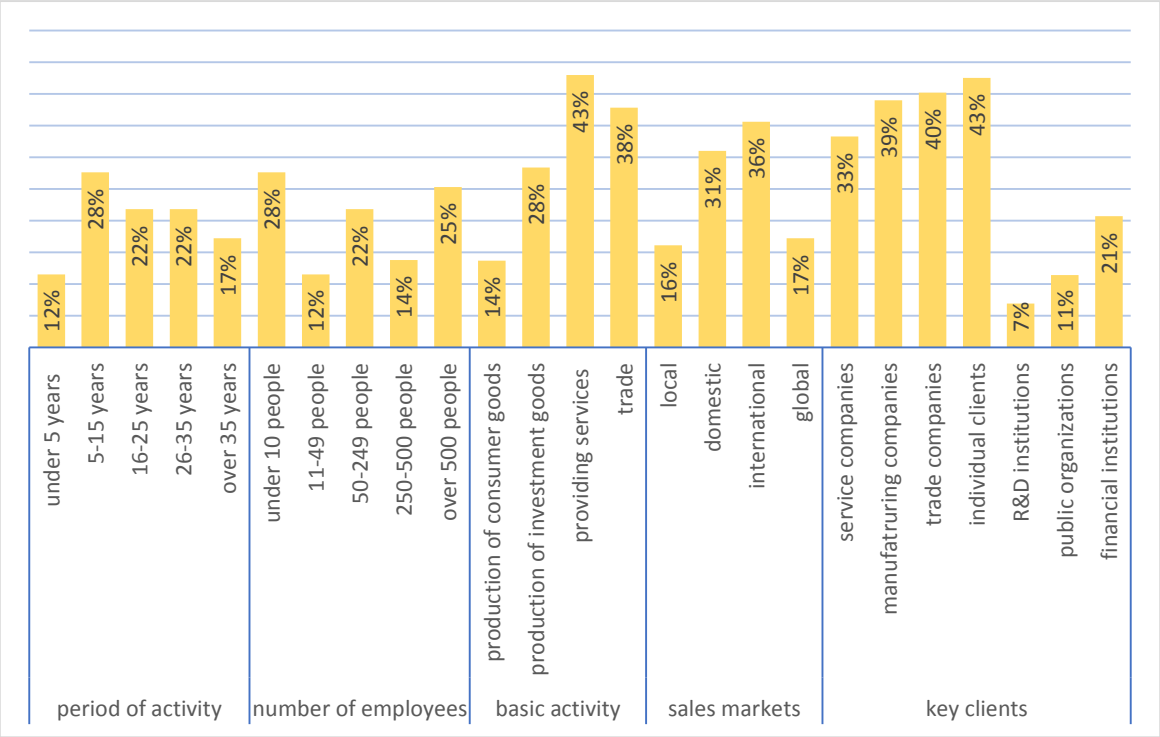



**Figure 1.** Characteristics of the organizations researched.

Source: own study based on research results.

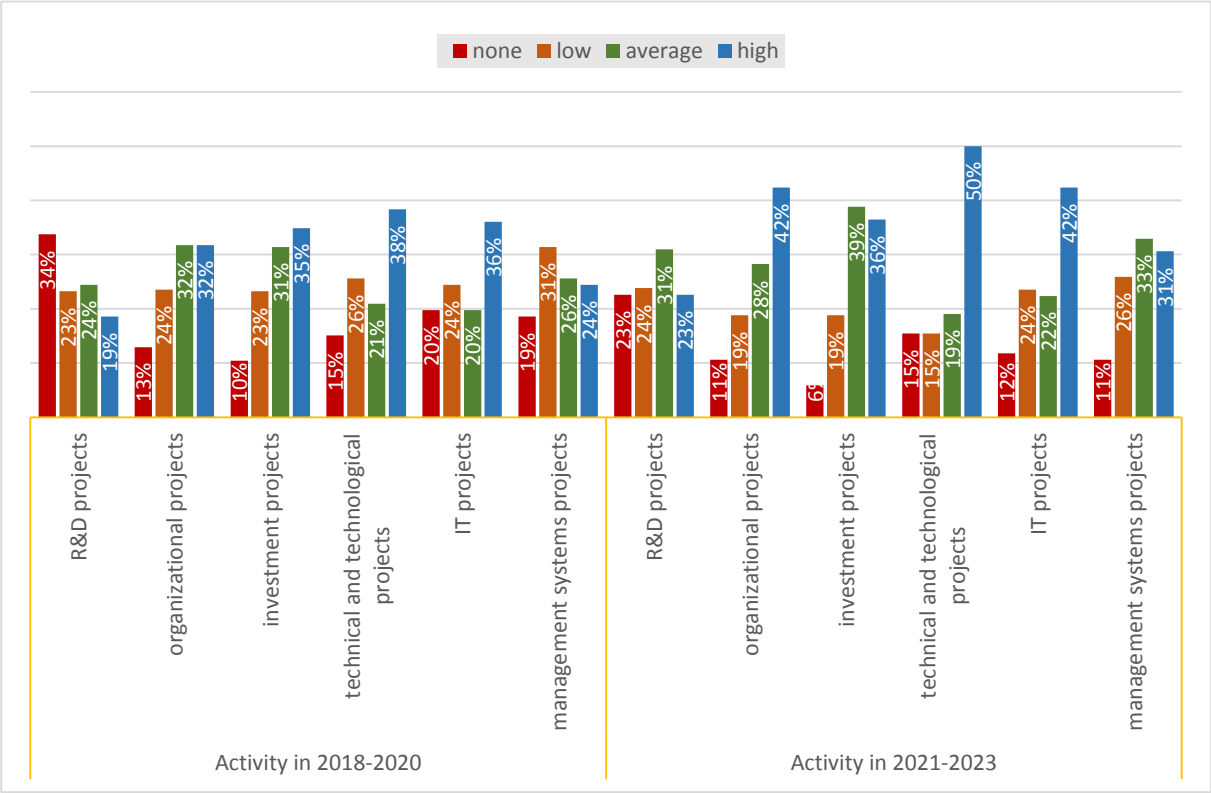
Among the surveyed organizations, the largest percentage shares were as follows (Figure 1): organizations operating on the market for 5-15 years (28%); organizations providing services (43%); small organizations with fewer than 10 employees (28%) and very large organizations with more than 500 employees (25%); organizations selling on the international market (36%) and to individual clients (43%); and trade companies (40%) as key clients.

**Activity in implementing innovation projects**

The research tasks, derived from the topic, included: identifying the key types of innovation projects; determining the activity related to the number and dynamics of innovation projects carried out over two time frames – 2018-2020 and 2021-2023 - in terms of six distinguished types: research and development, organizational, technical-technological, investment, information technology, and management systems. Additionally, an important research objective was to identify the types of risks present in each type of innovation project implemented in the surveyed organizations.

Respondents assessed the level of activity based on the number of each type of innovation project implemented in the two periods: 2018-2020 and 2021-2023.

Figure 2 illustrates the activity of the surveyed organizations in implementing these six types of innovation projects across the two indicated periods.




Scale: 0 – no projects, 1 – low activity (1 project), 2 – average (2-3 projects) and 3 – high activity (more than 3 projects).

**Figure 2.** Activity in the implementation of projects (in 2018-2020 and 2021-2023) in the surveyed organizations.

Source: own study based on research results.

From the data presented in Figure 2, it can be observed that in the researched organizations, the highest activity during the 2018-2020 period was recorded in investment projects (66% - a large number of projects at levels 2 and 3) and organizational projects (64% - a large number at levels 2 and 3). In the 2021-2023 period, the greatest interest was shown in investment projects (75% - a large number at levels 2 and 3), organizational projects (70% - a large number at levels 2 and 3), and technical-technological projects (69% - a large number at levels 2 and 3).

The data also indicate that the most significant increase in interest in implementing innovation projects between the two periods (2018-2020 and 2021-2023) occurred in management system projects (from 50% to 64%) and R&D projects (from 43% to 54%).

The growth in the number of innovation projects in the areas of management systems, research and development (R&D), and technical-technological fields during 2021-2023 (the pandemic period) was driven by accelerated digitization and technological transformation. This process necessitated the implementation of new technologies, process automation,

and adaptation of operational models to remote work. The pandemic also stimulated investments in R&D, particularly in medical technologies, diagnostic tools, and solutions supporting remote work, enabling organizations to address emerging challenges and seize new market opportunities.

Companies had to respond rapidly to changing conditions. Large enterprises (with over 500 employees) invested in projects aimed at enhancing their resilience to crises, while small businesses (with up to 10 employees) implemented flexible management systems to maintain competitiveness. Efforts to optimize costs and improve efficiency were reflected in the enhancement of internal processes and reduction of operational expenses through automation and integration of digital technologies—an especially important factor for companies operating in international markets.

**Risk assessment in innovation projects**

The identification of risk types occurring in innovation projects was based on an analysis of the literature and our own experience. For the purposes of the research conducted, an extensive list of risk categories was proposed for each type of distinguished innovation project. The survey questionnaire included a list of risk categories for each project. Respondents evaluated the level of risks present in each type of innovation project using a scale from 0 to 5, where 1 indicated a very low level of risk and 5 indicated a very high level.

Table 5 summarizes the respondents' responses regarding the assessment of risk levels in each project type.

**Table 5.**
*The highest level of risk in each type of innovation project*

| Type of projects | | | | | |
|---|---|---|---|---|---|
| **R&DP** | **OP** | **TTP** | **ITP** | **INP** | **MSP** |
| – financial (2.86)<br>– time (2.81)<br>– technical and technological (2.69)<br>– implementa-tion difficulties (2.54)<br>– market (2.53) | – time (2.92)<br>– comunnication (2.75)<br>– implementa-tion difficulties (2.72)<br>– financial (2.62)<br>– personal (2.53) | – financial (3.22)<br>– technological (2.92)<br>– time (2.91)<br>– market (2.86)<br>– quality (2.77)<br>– implementation difficulties (2.75) | – financial (3.36)<br>– market (3.0)<br>– time (2.92)<br>– legal (2.81)<br>– technological (2.77) | – financial (3.01)<br>– complexity (3.01)<br>– technological (2.91)<br>– time (2.84)<br>– related to the requirements (2.81)<br>– quality (2.75) | – coordination (2.97)<br>– personal (2.91)<br>– organizational (2.83)<br>– time (2.80)<br>– implementa-tion difficulties (2.70)<br>– financial (2.59)<br>– quality (2.53) |

Legend: research and development projects (R&DP), organizational projects (OP), technical and technological projects (TTP); IT projects (ITP), investment projects (INP), management system projects (MSP).

Resource: own elaboration.

Table 5 presents the highest levels of risk associated with different types of innovation projects. The risks linked to various types of innovation projects are determined by their specific characteristics and challenges, which influence the achievement of project goals. In research and development (R&D) projects, financial risks are the most significant due to the substantial investments required for developing new technologies or products that may not yield the expected results. Uncertainty regarding return on investment and difficulties in accurately estimating costs further amplify these financial risks. Technological risks are also critical, as they arise from

uncertainties about the effectiveness of new technologies and their integration with existing systems. In organizational (OP) projects, time-related risks are predominant because these projects require the coordination of multiple teams and processes. Delays often occur due to ineffective communication or organizational challenges. Communication issues and implementation difficulties are also significant, as they reflect the need for synchronized actions within the organization. For technological (TTP) projects, financial-related risks are paramount, as these initiatives often involve high expenses for implementing new solutions and materials, which may be subject to market price fluctuations. Technological risks are equally important due to the unpredictability of new technologies' performance and their impact on budgets and timelines.

In IT projects, financial-related risks are crucial because of the dynamic nature of technological advancements and market demands, which frequently lead to budget overruns. Market risks also play a key role, as the success of IT projects depends on end-user acceptance and product competitiveness. Investment projects (INP) face the highest risks related to costs and complexity due to their large scale, requiring precise resource and budget management. Technological risks are also significant because of the need to integrate advanced technical solutions. In management system projects (MSP), coordination issues are the most prominent risk factor, as these projects demand synchronization across numerous teams and processes to ensure system consistency. Organizational and personal risks are also critical, stemming from challenges in managing human resources and organizational structures.

It should be emphasized that the highest level of risk among the six types of innovation projects assessed was indicated by respondents in IT and technical and technological projects.

Overall, financial risks emerge as the most significant across multiple project types. Time-related risks are consistently important in all categories. Technological risks are prominent in technology-intensive projects, while coordination and organizational challenges dominate management system projects. These findings highlight the need for tailored risk management strategies depending on the specific type of innovation project.

**Internal and external risk factors in innovation projects**

Respondents were asked to assess the impact of the aforementioned groups of external risk factors in innovation projects using a 0-5 scale. The summarized results of the research are presented in Table 6.

**Table 6.**
*Groupe of internal risk factors in innovation projects*

| Groupe of factors | 0 | 1 | 2 | 3 | 4 | 5 | Average rating |
|---|---|---|---|---|---|---|---|
| 1. Financial-economic | 4 | 7 | 16 | 11 | 23 | 26 | 3.379 |
| 2. Personnel-related | 3 | 8 | 19 | 25 | 22 | 10 | 2.977 |
| 3. Instrumental | 3 | 18 | 25 | 31 | 9 | 1 | 2.322 |
| 4. Organizational | 3 | 10 | 18 | 25 | 26 | 5 | 2.874 |
| 5. Technical-technological | 3 | 9 | 19 | 24 | 21 | 11 | 2.966 |

Cont. table 6.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6. Marketing-related | 6 | 14 | 24 | 23 | 17 | 3 | 2.460 |
| 7. Managerial | 2 | 15 | 17 | 16 | 24 | 13 | 2.966 |
| 8. Organizational culture | 5 | 17 | 20 | 23 | 17 | 5 | 2.517 |
| 9. Business model | 4 | 16 | 20 | 22 | 17 | 8 | 2.644 |

Scale: 0 – no impact; 1 – very low impact; 2 – low impact; 3 – average impact; 4 – high impact; 5 – very high impact (essential factor).

Source: Own work based on research results.

The results presented in Table 6 indicate a varied impact of external risk factors on innovation projects. Analyzing the results allows to identify which areas within an organization are perceived as the most significant sources of risk for the success of innovation projects.

The most important internal risk groups influencing innovation projects were identified by respondents as: financial-economic (3.379), personnel-related (2.977), technical-technological (2.966), managerial (2.966) and organizational (2.874).

The high rating of financial-economic factors reflects the crucial importance of financial stability, availability of funds, and effective budget management for the implementation of innovative ventures. These results are consistent with the literature, which indicates that financial and economic resources are most often cited as the primary condition for taking innovation risks and conducting R&D activities. Personnel, technical-technological, and managerial factors also received high ratings. This highlights the importance of the competence, experience, and engagement of the team, as well as the efficiency of project management and the implementation of new technologies. Staffing shortages, insufficient qualifications, or ineffective management can lead to delays, errors, and failures in the implementation of innovations. The high rating of organizational factors underscores the importance of an appropriate organizational structure, efficient decision-making processes, and flexibility in adapting to changing project conditions.

The risk factors with a medium impact on innovation projects were identified by respondents as: organizational culture (2.517), business model (2.644), marketing-related (2.460) and instrumental (2.322).

Factors related to organizational culture, although rated somewhat lower, remain important for innovativeness. An open culture that supports creativity and collaboration fosters effective innovation implementation. The business model, though rated slightly lower, affects the ability to commercialize innovations and adapt to market requirements. Marketing and instrumental factors (e.g., tools, infrastructure) have a moderate impact, which may result from the belief that while important, they do not directly determine project success if the other key areas are properly secured. Overall, the study emphasizes the critical role of financial and personnel aspects as the most significant risk factors in innovation projects.

Respondents were asked to assess the impact of the above-mentioned groups of external risk factors occurring in innovation projects using a 0-5 scale. The summary of the research results is presented in Table 7.

**Table 7.**
*Groupe of external risk factors in innovation projects*

| Groupe of factors | 0 | 1 | 2 | 3 | 4 | 5 | Average rating |
|---|---|---|---|---|---|---|---|
| 1. Political | 13 | 18 | 26 | 15 | 10 | 5 | 2.069 |
| 2. Legal (regulatory) | 6 | 10 | 17 | 24 | 23 | 7 | 2.793 |
| 3. Competitors | 3 | 12 | 17 | 22 | 23 | 10 | 2.920 |
| 4. Consumers (expectations, behavior) | 0 | 7 | 14 | 27 | 25 | 14 | 3.287 |
| 5. Suppliers | 7 | 16 | 20 | 23 | 13 | 8 | 2.494 |
| 6. Investors | 12 | 12 | 15 | 21 | 15 | 12 | 2.586 |
| 7. Socio-cultural | 15 | 21 | 20 | 19 | 8 | 4 | 1.954 |
| 8. Economic (macroeconomic) | 0 | 10 | 16 | 24 | 18 | 19 | 3.230 |
| 9. Environmental (ecological) | 11 | 19 | 25 | 16 | 12 | 4 | 2.126 |
| 10. Technological (trends, substitutes) | 4 | 11 | 21 | 18 | 20 | 13 | 2.897 |
| 11. International | 16 | 21 | 16 | 14 | 14 | 6 | 2.080 |
| 12. Force majeure (COVID-19 pandemic, war, disasters) | 4 | 6 | 22 | 20 | 20 | 15 | 3.046 |
| 13. Market-related (size, dynamics, demand, supply) | 1 | 6 | 21 | 16 | 25 | 18 | 3.287 |
| 14. Business-related (partners) | 5 | 18 | 17 | 19 | 21 | 7 | 2.621 |

Scale: 0 – no impact; 1 – very low impact; 2 – low impact; 3 – average impact; 4 – high impact; 5 – very high impact (essential factor).

Source: Own work based on research results.

The findings from Table 7 reveal the diverse impact of external risk factors on innovation projects. The risk factor groups influencing innovation projects that were rated the highest by respondents are: consumers (3.287), market-related factors (3.287), economic (macroeconomic) factors (3.230) and force majeure (COVID-19 pandemic, war, disasters) (3.046), competitors (2.920), technological (trends, substitutes) (2.897). High scores in these categories indicate that innovation projects are particularly sensitive to changes in consumer behavior and expectations, market conditions, and the broader macroeconomic environment. Macroeconomic risks and force majeure are difficult to predict but can have a drastic impact on project implementation—emergency scenarios and flexibility in planning are necessary. Risks related to unpredictable events (force majeure) are also considered very significant, reflecting recent experiences with the pandemic and armed conflicts. The importance of competition and technological pressure highlights how dynamic and demanding the environment for innovative ventures is.

The risk factors with a moderate impact on innovation projects were identified by respondents as: legal (regulatory) factors (2.793), suppliers (2.494), investors (2.586) and business partners (2.621). Legal and regulatory risks, although not the highest-rated, are still significant and often cited in the literature as a source of uncertainty for innovation, especially in the context of changing regulations and compliance requirements. Regulations and law remain important, though not dominant factors - their significance increases in highly regulated sectors (e.g., technology, health, energy). The impact of suppliers, investors, and business partners points to the importance of stable relationships in the value chain and the availability

of resources for implementing innovations. Collaboration with partners and investors and the stability of suppliers are important for the liquidity and security of innovation implementation.

On the other hand, the risk factors with the lowest impact on innovation projects were considered by respondents to be: socio-cultural factors (1.954), political factors (2.069), international factors (2.080), environmental (ecological) factors (2.126). Low ratings for socio-cultural and political factors may result from a relatively stable environment in the surveyed sample or from the belief that their impact on specific projects is less direct than, for example, market or technological changes. However, the literature indicates that, in the long term, political and social changes can significantly influence the innovation climate, especially through state policy and regulations.

In conclusion, the results emphasize the critical need to address consumer expectations, market dynamics, and macroeconomic conditions when managing external risks in innovation projects. Additionally, preparedness for force majeure events and technological advancements is essential for ensuring project success. These findings highlight the importance of strategic planning and adaptability in mitigating key external risks.

### 3.3. Research limitations

This study faces limitations related to the quantitative research paradigm. The research was conducted over a short period and had a pilot character, which did not allow for a comprehensive identification of external and internal factors influencing risks in various types of innovation projects. Empirical studies conducted through surveys have certain limitations, including:

1. Subjectivity of responses. Respondents evaluated risk categories and factors determining their levels in innovation projects based on their own judgments, which may lead to biased results.
2. Limited knowledge of respondents. Specialists and management staff from the studied organizations may not have had complete knowledge about risks in innovation projects, potentially affecting the quality of the collected data.
3. Small scale of empirical research. This may have impacted the representativeness of the results and limited the possibilities for generalization.
4. Provision of only general cross-sectional data. The study provides data at a specific point in time, whereas the identification and assessment of risks in innovation projects cover the entire project lifecycle.

Future research should be conducted on a larger sample and with greater contextual diversity (across different countries and sectors), which could contribute to a deeper analysis of the problem. Additionally, conducting research in various countries would enable comparisons, drawing conclusions, and increasing the potential for generalization. The use of mixed research methods, combining quantitative survey data with qualitative interviews or case studies, could allow for better identification and understanding of the impact of multiple internal and external factors on risk levels in various types of innovation projects.

## 4. Conclusions and recommendations

The issues presented in the article demonstrate that, in both theory and practice, there are different approaches to the interpretation of the terms: "innovation project" and "risk in an innovation project". This is due to the existence of various types of innovation projects and numerous categories of risk within these projects. The research problems addressed in the article are not easily recognizable, as the very definitions of an innovation project and risk in an innovation project are not fully explicitly explained and depend on many different perspectives.

The most important conclusions from the empirical research are:

- the highest activity in terms of the number of implemented innovation projects during the analyzed periods 2018-2020 and 2021-2023 occurred in the surveyed organizations in the following projects: investment, organizational, and technical-technological;
- the greatest increase in interest (dynamics) in implementing innovation projects between the periods studied (2018-2020 and 2021-2023) was observed in projects: management systems, research and development, and technical-technological;
- among the various risks to which all types of innovation projects are exposed, respondents rated the levels of financial, time, market, and technological risks as particularly high;
- among external factors, respondents considered consumer demands and market changes to have the strongest impact on risk in innovation projects, while internal factors such as financial-economic and personal factors were deemed most influential.

The highest activity in investment, organizational, and technical-technological projects was also confirmed by the findings presented by Rachmiani et al. (2024), who indicate that technological projects dominate the IT industry due to market dynamics and competition. Richert et al. (2022) emphasize the importance of technological projects in the metal industry. Meanwhile, Spałek (2016) believes that organizational projects are key to market success. The greatest growth in management systems, R&D, and technical-technological projects was confirmed in studies by Haneda and Ono (2020), who analyzed R&D management practices and their direct connection to the success of innovative projects. Sanchez-Cazorla et al. (2017) identified organizational factors as crucial in managing innovative projects. García-Quevedo et al. (2018) demonstrated that financial barriers increase the likelihood of abandoning innovative projects, while Kadareja (2013) listed time and financial risks as the main causes of failure. Rachmiani et al. (2024) identified market and technological risks as dominant in IT projects.

Trzeciak (2017) and Farooq et al. (2018) indicate that personal factors are key determinants influencing risk in innovative projects. Kadareja (2013) emphasizes the importance of customer requirements and market changes as primary external risk factors. García-Quevedo et al. (2018)

highlight budget constraints and lack of management support as internal barriers. Meanwhile, Rachmiani et al. (2024) add competitive pressure as a significant external factor influencing risk in innovative projects. Additionally, Spałek (2016) considers organizational culture to be a crucial internal factor affecting risk in innovative projects.

Based on the research findings, several actions can be proposed for management to more effectively identify risks in innovative projects:

I. Short-term actions include, for example:
   1. Utilizing advanced technologies (e.g., AI and machine learning for risk prediction based on large datasets such as market trend analysis or prototype failures; digital twins for simulating risk scenarios in a virtual environment before implementation; and visualization tools like risk matrices to prioritize threats based on their likelihood and impact). Example sectors: financial (AI and ML are widely used to predict market risks, analyze trends and detect anomalies in financial data), IT (digital twins and visualization tools help simulate cyber threats and test the resilience of systems), construction (IoT and digital twins are used to monitor the technical condition of equipment and predict failures in construction projects).
   2. Applying diverse analytical methods tailored to the specific nature of innovative projects, industry characteristics, and different stages of risk management. Example sectors: healthcare (analytical methods such as scenario analysis or clinical risk assessment are crucial for patient safety and regulatory compliance), industry (FMEA-type analyses or expert analyses are used to assess the risks of product and process innovations).
   3. Implementing monitoring and/or early warning systems, as well as collaborating with external experts to assess the impact of external and internal factors on risk levels in innovative projects. Example sectors: healthcare (monitoring epidemiological threats and cooperation with medical experts allow for a quick response to new risks).

II. Organizing training sessions for management and project teams to enhance competencies in using tools for identifying and assessing risks in innovative projects, fostering a proactive culture of prevention and reporting emerging threats during project execution. Example sectors: IT (building awareness of cyber threats and data security training), industry (training in the use of analytical tools and security protocols is key to reducing accidents and improving efficiency).

III. Long-term actions include, for example:
   1. Adopting an interdisciplinary and holistic approach during the development and implementation of innovative projects by leveraging diverse ideas and experiences through collaboration throughout the project lifecycle. Example sectors: public (innovative projects in public administration require cooperation between departments and external partners to effectively manage risk and implement new

solutions), multi-sector project teams in large infrastructure or IT projects increase the effectiveness of risk identification and management.

2. Developing and consolidating monitoring and early warning systems as a permanent element of innovation project management, with regular review and updating of procedures and tools. Example sectors: financial (monitoring and early warning systems for rapid detection of liquidity threats and market changes), industry (monitoring of equipment and cooperation with technical experts minimize the risk of failures and production downtime).
3. Implementation of programs for the development of managerial and expert competencies in the field of risk management, including long-term training, mentoring and building career paths related to innovation and risk management. Example sectors: financial (extended career paths and certifications, e.g. PRM, FRM, treasury risk management courses that focus on market, credit, operational and strategic risk management), IT (training and mentoring in digital and project risk management, e.g. PMI-RMP courses or specialist cyber risk management programs).
4. Implementing a risk mitigation strategy by establishing long-term strategic partnerships with universities, research institutes and other external entities, implementing phased investments and developing a culture of prototyping and testing solutions before their full implementation. Example sectors: manufacturing industry (partnerships with universities and research institutes support the implementation of innovations and testing of solutions before full implementation), public (public-private cooperation, e.g. in energy projects allows for sharing risks and knowledge), IT (prototyping and phased implementations minimize the risk of failure of large digital projects).

The issues addressed in the article do not exhaust the vast and continuously explored topic by both researchers and practitioners in many organizations. The authors are aware that the scope of the research methods used (especially qualitative methods) and the size of the research sample were not fully sufficient, which may have influenced the conclusions drawn. The topic of innovation project risk is constantly evolving in the context of environmental changes and the emergence of new risk categories and determining factors. Therefore, the authors intend to undertake further empirical research in this area on a much larger scale, also employing statistical analyses and qualitative methods (e.g., case studies), which will allow for a more in-depth and broader examination of the issues related to identifying types of risks and the factors determining risks in innovation projects within organizations (Dandage et al., 2018; Bugas et al., 2019). The combined use of various methods (quantitative and qualitative) can contribute to a better expansion of knowledge on a specific topic (Sułkowski et al., 2021) and provide comprehensive answers to specific questions (Dźwigoł, 2015). It should also be noted

that the selection of research methods depends on the specific research problem and research effort.

In the authors' opinion, it is worthwhile to continue empirical research related to the risks of innovation projects and to set further research objectives, which should include tasks such as: the level of formalization of the risk management system in innovation projects; the level of protection against the occurrence of high risk in innovation projects; the scope of methods and techniques used in risk management in innovation projects, etc.

## 5. Summary

Risk is an inherent element of innovation projects, stemming from their complexity, uncertainty, and dynamic environment. The aim of this study was to identify the key types of risks occurring in six types of innovation projects, as well as the factors that determine them. The research was based on an analysis of pilot study results obtained from 87 organizations.

The findings indicate that the highest activity in the implementation of innovation projects in the two analyzed periods occurred in the surveyed organizations, particularly in investment, organizational, and technical-technological areas. The greatest increase in interest (dynamics) in the implementation of innovations was observed in projects related to management systems, research and development, and technical-technological initiatives. Respondents rated the levels of risk associated with finances, time, market, and technology as particularly high. Among external factors, changes in consumer requirements and market fluctuations had the most significant impact on risk in innovation projects, while among internal factors, financial-economic and personal factors were identified as the most influential.

Therefore, effective identification of risk factors requires the use of appropriate tools and competencies within the project team.

The practical implications of the research highlight the importance of the risk identification process in innovation projects, emphasizing not only an analytical but also a holistic approach, as well as the integration of multiple methods to effectively identify and assess risk levels in order to minimize their impact. Particular attention should be paid to the necessity of building interdisciplinary teams, investing in collaboration, and utilizing modern technologies to support the recognition of various factors determining risks in innovation projects.

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# FOREIGN DIRECT INVESTMENT RISK: A CASE STUDY OF OPOLE VOIVODESHIP

Maria BERNAT[1], Huizheng LIU[2], Mirosława SZEWCZYK[3*]

[1] The Opole University of Technology; m.bernat@po.edu.pl, ORCID: 0000-0003-4520-662X
[2] Beijing University of Technology; liuhuizheng@bjut.edu.cn, ORCID: 0000-0003-4628-5526
[3] The Opole University of Technology; m.szewczyk@po.edu.pl, ORCID: 0000-0002-0969-8973
* Correspondence author

**Purpose:** The aim of the paper is to assess the investment risks associated with foreign direct investment in the Opole Voivodeship from 1991 to 2024.
**Design/methodology/approach**: The methodology combines quantitative analysis, using statistical data (e.g., GDP growth, inflation, exchange rates, and FDI inflows), with qualitative methods, including case studies of key enterprises with foreign capital in the region.
**Findings:** The research identifies several factors that initially deterred FDI in Opole Voivodeship, including macroeconomic instability, competition from larger agglomerations, and socio-political sensitivities.
**Research limitations/implications**: The study is region-specific, focusing on Opole Voivodeship, which may limit the generalisability of findings to other regions with different socio-economic contexts.
**Practical implications:** The study emphasises the importance of leveraging local diaspora networks and cultural ties to attract capital while diversifying the sources of foreign investment to mitigate risks associated with investor monoculture.
**Social implications:** The research underscores the role of socio-cultural factors, such as historical ties and community acceptance, in shaping investment dynamics.
**Originality/value:** This study contributes to the relatively underexplored field of regional FDI determinants in Poland.
**Keywords:** foreign direct investment, investment risk.
**Category of the paper:** Case study.

## 1. Introduction

Foreign direct investment (FDI) offers several strategic benefits to investors (Cohen, 2007; Fernandez, Joseph, 2020; Jankowiak, 2016). Firstly, it allows companies to access new markets and expand their global footprint, increasing their revenue potential and diversifying their customer base (Jankowiak, 2016). Secondly, FDI enables investors to leverage cost advantages,

such as lower labour costs or favourable tax regimes in the host country, thus enhancing profitability. Additionally, establishing a local presence through FDI can provide investors with better control over supply chains and closer proximity to resources or key partners, thereby improving operational efficiency. Finally, FDI may grant investors access to local knowledge, innovation, and skilled labour, further enhancing their competitive edge in the global market (Jankowiak, 2016). However, the potential rewards of FDI are often accompanied by substantial risks (White, Fan, 2006; Yılmaz, 2024; Hayakawa et al., 2013; Mukhopadhyay, Das, 2020; Buckley et al., 2018).

Not even the largest multinational corporations (MNCs) can afford to invest everywhere or accept the risks inherent in choosing overseas production locations in a random, cavalier manner. An important phase of the foreign direct investment cycle is the decision that follows a company's making a commitment to overseas expansion: where the planned foreign subsidiary/ies should be situated. Due diligence is required to avoid costly and embarrassing mistakes in selection of site/s. One of the few valid generalizations about MNCs is that they invest in countries where their inquiries and calculations indicate a relatively high probability that financial rewards will exceed costs and risks by an acceptable margin in an acceptable time frame. The dynamics of those decisions are among the least subjective and least emotional aspects of the FDI/MNCs phenomena. Value judgments and controversy appear in far greater amounts after subsidiaries open for business (Cohen, 2007; Jankowiak, 2016). When assessing foreign direct investment risk, a company must carefully evaluate a wide range of factors that influence the investment's potential success. This evaluation is complicated by uncertainty regarding the accuracy of risk identification and the future evolution of these risks. The assessment process must consider the dynamic interplay between the host country's environment and the enterprise's operational needs, ensuring that the investment remains economically viable (Limański, Drabik, 2017). Consequently, FDI risk assessment is inherently a function of the uncertainty surrounding the evolving conditions of the external environment, as well as the enterprise's ability to adapt to and meet these changing conditions effectively. Understanding and managing these risks is essential for investors, policymakers, and stakeholders to maximise the benefits of FDI while minimising adverse impacts. This article explores the key indicators and measures that are instrumental in assessing FDI risk, offering insights into how these tools can guide investment decisions. The assessment of FDI risk involves evaluating a complex interplay of economic (Jinjarak, 2007; Canh et al., 2020), political (Jiang, Martek, 2021; Jensen, 2008; Beazer, Blake, 2018; Benáček et al., 2012; Rafat, Farahani, 2019), and social (Creţan et al., 2017) factors that can affect the stability and profitability of foreign investments. Economic indicators such as GDP growth rates, inflation, and exchange rate volatility provide a foundational understanding of the economic environment in host countries. Meanwhile, political risks, including government stability, regulatory frameworks, and corruption levels, also play a significant role in shaping the risk landscape. Social factors, such as labour market dynamics and cultural differences, further complicate the

risk assessment process, requiring a holistic approach to evaluation. In addition to these broad categories, specific measures and tools have been developed to quantify FDI risks more precisely. Country risk ratings, for example, offer a composite measure of economic, political and social risks, providing investors with a clear metric for comparing different markets. Similarly, indices such as the World Bank's Ease of Doing Business Index, EY Europe Attractiveness Survey**,** Kearney FDI Confidence Index, and the Corruption Perceptions Index help identify potential challenges in the investment environment. The use of these quantitative measures, alongside qualitative analysis, enables a more comprehensive assessment of FDI risk.

This article seeks to provide an analysis of the key indicators and measures that are most effective in assessing FDI risk. By critically examining the methodologies and applications of these tools, the article aims to contribute to a deeper understanding of how FDI risks can be identified, measured, and managed. Such an understanding is crucial not only for investors seeking to optimise their investment strategies, but also for policymakers striving to create favourable conditions for foreign investment. Accordingly, the aim of the paper is to assess the investment risks associated with FDI in the Opole Voivodeship from 1991 to 2024, exploring both historical and contemporary factors influencing foreign capital allocation in the region.

To complement the macroeconomic and regional analyses, this study incorporated enterprise-level case studies to capture localized risk perceptions and investment responses. The selection of case studies was based on purposive sampling, aimed at reflecting a diverse range of foreign direct investment actors operating in Opole Voivodeship. A key selection criterion was direct exposure to regional risk factors. To ensure the reliability and validity of the qualitative insights, data triangulation was employed across multiple sources. Emerging themes were cross-checked through follow-up communication with interviewees and consultations with local investment advisors and regional development experts. Data were gathered through semi-structured interviews with company managers and local stakeholders, and supplemented by publicly available sources such as company websites, reports, and regional investment bulletins. Press releases were also reviewed to corroborate reported events.

## 2. Dimensions of uncertainty

Foreign direct investment risk can be classified into several key categories that encompass various dimensions of uncertainty and potential challenges for international businesses. These categories include global risk, country risk, industry risk, and enterprise risk (Jaworek et al., 2022), each of which plays a distinct role in influencing the overall risk profile of FDI. Among these, country risk is often the most critical, as it directly affects the investment environment within the host nation.

Global risk in foreign direct investment arises from events with potentially widespread impacts that transcend national borders. This category of risk encompasses natural disasters, such as earthquakes, floods, and droughts; social crises, including pandemics and epidemics; political upheavals, such as wars and conflicts (Soussane et al., 2023); economic downturns, like global recessions; and technical threats, such as cyber-attacks or spreading of computer viruses. Despite the potentially significant consequences of global risk, the existing literature offers limited insight into its direct impact on FDI decisions. However, studies like that of Escaleras and Register (2011) have demonstrated a statistically significant negative effect of natural disasters on FDI, suggesting that such risks are indeed a critical consideration for investors.

Country risk is defined as the possibility of unexpected deterioration in performance indicators or the failure to achieve strategic objectives due to exposure to the policies and conditions of the investment country. This risk category is further subdivided into political, economic, financial, and cultural risks, all of which must be carefully assessed by investors. Political risk, the first component of country risk, refers to the likelihood that the host country's government will be unwilling or unable to provide a stable and favourable environment for business and investment. This risk can arise from sudden policy changes, such as nationalisation or restrictions on capital transfers, as well as from broader issues like political instability, social unrest, or other unpredictable events. Closely related to political risk is economic risk, which involves significant changes in the economic structure or growth rate of the host country, potentially leading to a substantial impact on the expected returns on investment. Economic risk often overlaps with political risk, as both are influenced by government policies and the broader political environment. Financial risk, another component of country risk, is characterised by unexpected changes in the host country's creditworthiness or financial stability. This can include fluctuations in interest rates, currency instability, or changes in the availability of credit, all of which can adversely affect the profitability and sustainability of FDI. Lastly, cultural risk emerges from misunderstandings or misinterpretations related to the host country's cultural norms, business practices, and societal values. Cultural differences can lead to transaction costs, challenges in negotiations, and difficulties in adapting to local market conditions. These risks highlight the importance of a comprehensive and multidimensional approach to assessing FDI risk, ensuring that investors are well-prepared to navigate the complex landscape of international business.

Industry risk in foreign direct investment refers to the potential for adverse effects on key performance indicators or the achievement of strategic objectives due to unforeseen changes within a specific sector. This risk arises from factors such as technological advancements, shifts in consumer demand, regulatory changes, or increased competition, which can significantly alter the operating environment of the industry. Industry risk is particularly relevant for multinational enterprises (MNEs) as their exposure to this risk can vary depending on the sector in which they operate. For instance, industries that are heavily regulated or subject to rapid

technological changes may face higher levels of industry risk. Additionally, the nature of an MNE's industry can influence its exposure to country risk, as certain sectors may be more vulnerable to political or economic instability in the host country. Therefore, a thorough assessment of industry-specific risks is essential for investors seeking to mitigate potential challenges in their foreign investments.

Enterprise risk in foreign direct investment pertains to the potential for negative impacts on an organisation's key performance indicators or the failure to achieve strategic objectives due to unforeseen events or changes in the enterprise's specific behaviour. This risk encompasses a range of factors, including operational challenges, financial instability, and behavioural risks associated with management decisions and organisational culture. Operational risks may arise from inefficiencies, supply chain disruptions, or technological failures, while financial risks could involve liquidity issues, currency fluctuations, or credit constraints. Behavioural risks, on the other hand, are linked to decision-making processes, leadership dynamics, and the overall governance structure of the enterprise. Given its broad scope, enterprise risk is critical for multinational enterprises as it directly influences the ability to adapt to the complexities of foreign markets and maintain competitive advantage. Effective management of enterprise risk requires a proactive approach to identifying and mitigating potential threats, ensuring that the enterprise can achieve its strategic goals in the context of international investment.

## 3. Key Indicators and Measures for Assessing Foreign Direct Investment Risk

Assessing risks in foreign direct investment is crucial for investors seeking to optimise returns while minimising exposure to uncertainties. Basic FDI risk assessment indicators and measures provide a structured framework to evaluate the economic, political, and social conditions of a host country (Table 1). These indicators, which include metrics like GDP growth rates, inflation, political stability, and regulatory environment, allow investors to gauge both the potential rewards and risks of entering a foreign market. Additionally, indices such as the World Bank's Ease of Doing Business Index, World Investment Report, EY Europe Attractiveness Survey, Kearney FDI Confidence Index, Corruption Perceptions Index, Political Stability Index, World Risk Index, and Global Climate Risk Index help quantify and compare these risks across different regions. By integrating these indicators, investors can make informed decisions that align with their strategic goals, while policymakers can use the same tools to create favourable environments for foreign capital inflows. This process not only enhances decision-making, but also mitigates the likelihood of investment failure due to unforeseen risks.

**Table 1.**
*Basic FDI risk assessment indicators and measures*

| Specification | Characteristic |
|---|---|
| Gross Domestic Product | Gross Domestic Product growth measures the economic performance and expansion of a country. High and stable GDP growth signals a thriving economy with expanding markets, making it attractive for FDI. Conversely, low or volatile GDP growth may indicate economic instability, increasing the risk for investors. |
| Inflation rate | The inflation rate is a key indicator of economic stability. Low and predictable inflation supports stable operating costs and profit margins, which is favourable for investment. High inflation, however, can erode returns and increase costs, posing a significant risk to investors. |
| Exchange rates | Stable exchange rates reduce the risk associated with converting profits back into the investor's home currency. Significant fluctuations in exchange rates can impact the profitability of investments, introducing financial risk (Boburmirzo, Boburjon, 2022). Investors generally favour countries with low exchange rate volatility. |
| Public debt | The level of public debt indicates a country's fiscal health. High public debt may raise concerns about the government's ability to service its obligations, leading to potential tax increases or spending cuts. For investors, high public debt represents a risk as it may lead to economic uncertainty and policy shifts (de Mendonça, Brito, 2021). |
| Balance of trade | A positive balance of trade reflects strong export performance, which can stabilise the economy and currency. A negative balance of trade might indicate competitiveness issues and place downward pressure on the currency, increasing risk for foreign investors. A balanced trade position is generally viewed favourably in terms of long-term investment stability. |
| Political stability | Investors consider stability of the government, the likelihood of political unrest, and the potential for abrupt policy changes. Legal and regulatory risks also play a crucial role in the assessment of FDI risk. Investors examine the strength and independence of the judicial system, the enforcement of contracts, and the protection of property rights. A robust legal framework that upholds investor rights and provides clear regulations is vital for mitigating risk. Conversely, countries with ambiguous laws, inconsistent enforcement, or a lack of protection for foreign investors are deemed risky. Countries with a history of expropriation, frequent changes in leadership, or unstable regulatory environments are often seen as high-risk. Additionally, geopolitical tensions, corruption, and weak governance structures can further heighten the risk, discouraging investors from committing capital. Instability or frequent policy shifts increase the risk profile of a country (Hayakawa et al., 2013). The risks to investors include expropriation (Hajzler, 2012; Akporiaye, 2024), host-country restrictions on foreign investors, regulatory interference with the MNC's activities by host-county authorities, limits on profit repatriation (Vandervelde, 2009) etc. Expropriation represents a significant form of political risk in foreign direct investment, where a host-country government seizes or nationalises a foreign company's assets without providing fair compensation (Hajzler, 2012). This risk is particularly prevalent in developing countries with unstable political environments, where expropriation can be used as a tool for economic or political gain. The threat of expropriation serves as a major deterrent to foreign investors, as it undermines the security of their investments and can lead to substantial financial losses. Consequently, investors must carefully assess the political stability and legal frameworks of potential host countries to mitigate the risk of expropriation. High levels of corruption can significantly increase the costs of doing business and complicate decision-making processes (Corruption Perceptions Index**)**. Corruption often leads to a lack of transparency and predictability, deterring foreign investment. Investors seek environments where business operations can proceed without undue influence or risk of unethical practices. Recently, Intellectual Property Rights (IPRs) have increasingly emerged as pivotal elements in investor-state dispute settlement cases, reflecting their growing significance. This shift underscores the critical role that IPRs now play in shaping international trade and investment policies (Mishra, 2022). |

Cont. table 1.

| | |
|---|---|
| Natural disasters | The higher risk of natural disasters such as earthquakes, hurricanes and floods can lead to greater uncertainty and concerns about investment safety (World Risk Index, Global Climate Risk Index). When a region is often exposed to such disasters, companies may avoid investment out of the fears for the lack of protection of their assets and operational stability. On the other hand, regions that effectively manage the risk of natural disasters and have appropriate conservation strategies can attract more FDI, seeing them as more stable and predictable. Thus, it can be said that the risk of natural disasters has a significant impact on foreign investment decisions, affecting the perceived attractiveness of a given country for investors. |

Source: own elaboration.

According to survey data (EY Europe Attractiveness Survey, 2024), the top risks to Europe's attractiveness for foreign investors centre around regulatory, energy, and political factors (Figure 1). First, the increasing regulatory burden poses a significant challenge, with new European initiatives related to carbon disclosure, supply chain due diligence, data protection, and artificial intelligence potentially limiting business flexibility and growth. Investors fear that these regulatory complexities could undermine Europe's competitive edge. Secondly, energy prices and supply concerns, exacerbated by the recent energy crisis, continue to be a key threat, as uncertainties in energy supply could jeopardise operational stability for businesses. Lastly, political instability, fuelled by rising social tensions, political radicalism, and the upcoming European elections, adds another layer of uncertainty for investors evaluating long-term opportunities in the region. These concerns collectively impact the overall attractiveness of Europe as an investment destination, potentially influencing FDI decisions.

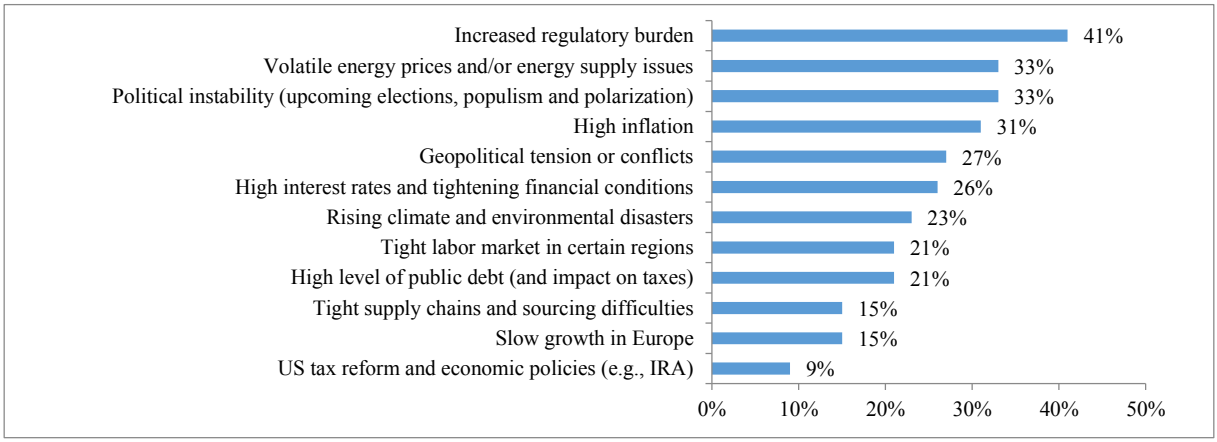



**Figure 1.** What are the main risks affecting Europe's attractiveness over the next three years? Rank up to three.

Source: EY Europe Attractiveness Survey 2024, Retrieved from: ey-attractiveness-survey-06-2024-v3.pdf

The Covid-19 pandemic, Russian aggression against Ukraine, and the ensuing energy crisis have had a profound impact on the global economy (Beri et al., 2024; Contractor, 2021; Lee et al., 2022; Song et al., 2022; Soussane et al., 2024; Zysk, 2025). These events have disrupted global supply chains, heightened geopolitical tensions, and accelerated shifts in trade and investment patterns. In response, many governments have implemented protective fiscal measures, re-evaluated energy dependencies, and introduced new industrial policies aimed at

strengthening economic resilience. These transformations have directly influenced the determinants of capital flows, including investor risk perception, sectoral preferences, and geographic diversification strategies. For instance, heightened geopolitical risk has led to increased scrutiny of investment destinations, particularly in Central and Eastern Europe. Simultaneously, energy security has emerged as a key factor shaping investment decisions. Furthermore, the pandemic underscored the vulnerability of globally integrated production networks. As a result, understanding how these global disruptions recalibrate capital allocation is crucial for designing effective regional investment strategies.

## 4. Assessing Investment Risks in Opole Voivodeship: A Long-Term Perspective (1991-2024)

The market-driven process of foreign capital allocation results in significant regional disparities, with individual areas benefiting from and being exposed to the risks of external capital absorption to varying degrees. While the extensive literature on the role of FDI in the Polish economy primarily addresses the macroeconomic aspects, including structural and technological transformations within specific manufacturing and service sectors, comparatively little attention has been directed towards the determinants of FDI at the regional level. This gap in the literature has prompted the undertaking of a meso-economic analysis focused on Opole Voivodeship.

Opole Silesia is a distinctive region in many respects, particularly in historical, socio-cultural, and economic terms, which naturally influences the volume and structure of incoming foreign capital. However, this distinctiveness does not imply that the region functions as an enclave or anomaly on a national scale, as it is subject to the same processes associated with structural transformations and the broader macroeconomic conditions of the country. Even a cursory examination of the region's economy reveals the significant presence of German capital, as substantiated by the available statistical data. This presence is not merely incidental but reflects deeper historical and economic ties between Opole Silesia and Germany, which have shaped the patterns of foreign direct investment in the region.

The initial reluctance of foreign investors towards Opole Silesia during the early years of the transformation, reflected in a low propensity to undertake large-scale investment projects, can be attributed to three key factors:

- The risk of macroeconomic stabilisation affecting the entire economy (Figures 2-6).
- The priority interest of corporations in large agglomerations such as Warsaw, Poznań, Gdańsk, and Wrocław stems from their strategic advantages as investment locations. These cities offer well-developed infrastructure, skilled labour markets, and greater access to business networks, making them highly attractive to foreign investors.

- Investors' concerns stemming from the complex social situation in Opole Silesia, and the associated risk of a lack of acceptance within the local community.

While the first two factors influenced investors regardless of the country of origin of their capital, the latter set of reasons particularly discouraged German investors. This hesitation was likely exacerbated by the historical context of the region, where socio-political sensitivities and historical memories may have played a role in shaping local attitudes towards foreign, particularly German, investment.

Over time, however, as the region has gradually stabilised and integrated more fully into the national and European economic frameworks, the barriers to investment have diminished, leading to a more favourable environment for foreign capital. This evolution reflects a broader trend of increasing economic integration and regional development, which has helped to align Opole Silesia more closely with the investment patterns observed in other parts of Poland.

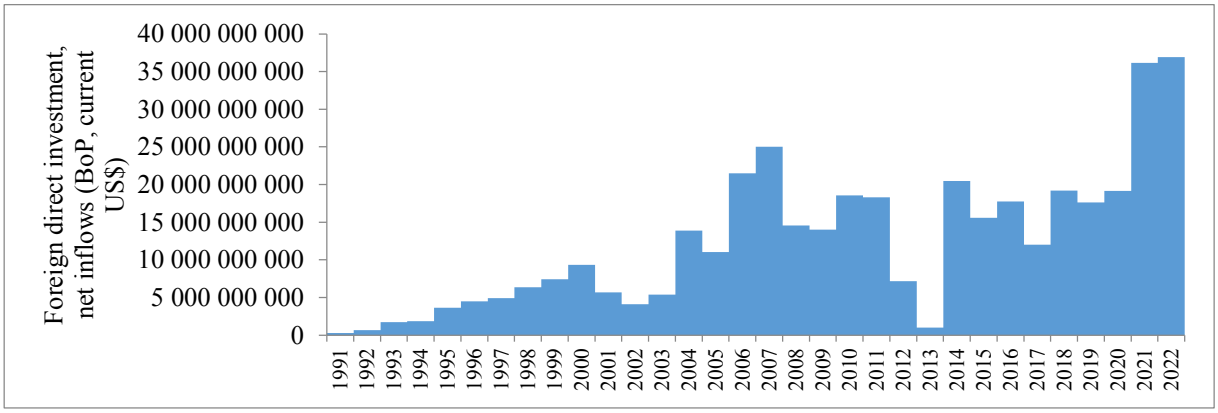



**Figure 2.** Foreign direct investment, net inflows (BoP, current US$), Poland 1991-2022.

Source: World Bank, Retrieved from: https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?view=chart

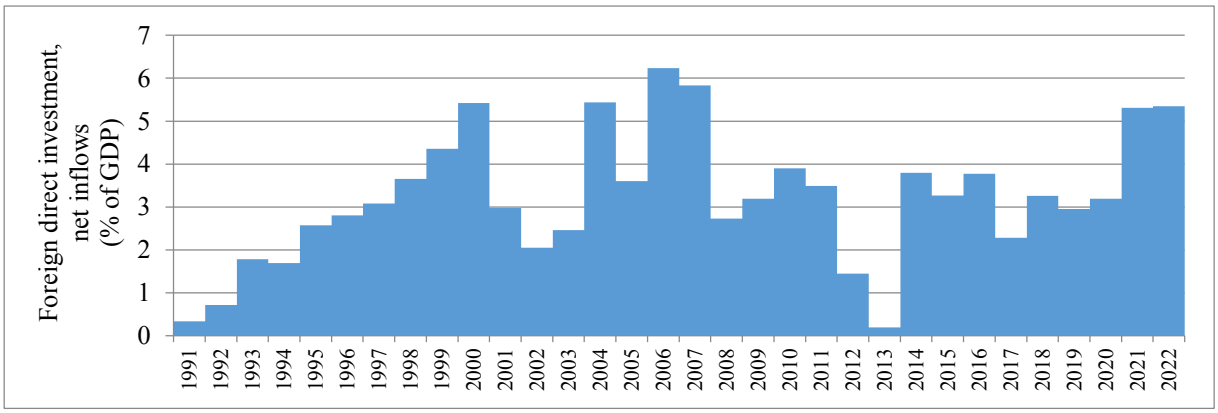



**Figure 3.** Foreign direct investment, net inflows (% of GDP), Poland 1991-2022.

Source: World Bank, Retrieved from: https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?view=chart

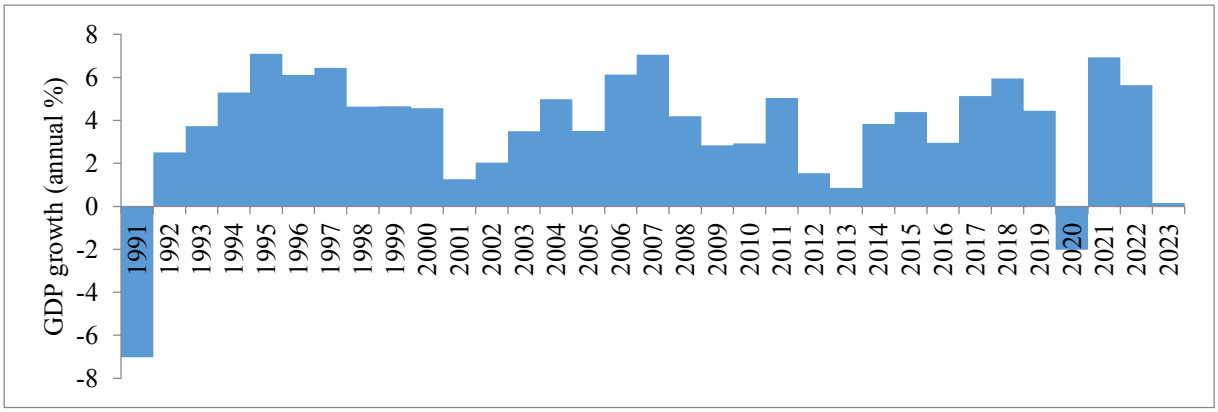



**Figure 4.** GDP growth (annual %), Poland 1991-2023.

Source: World Bank, Retrieved from: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=GR

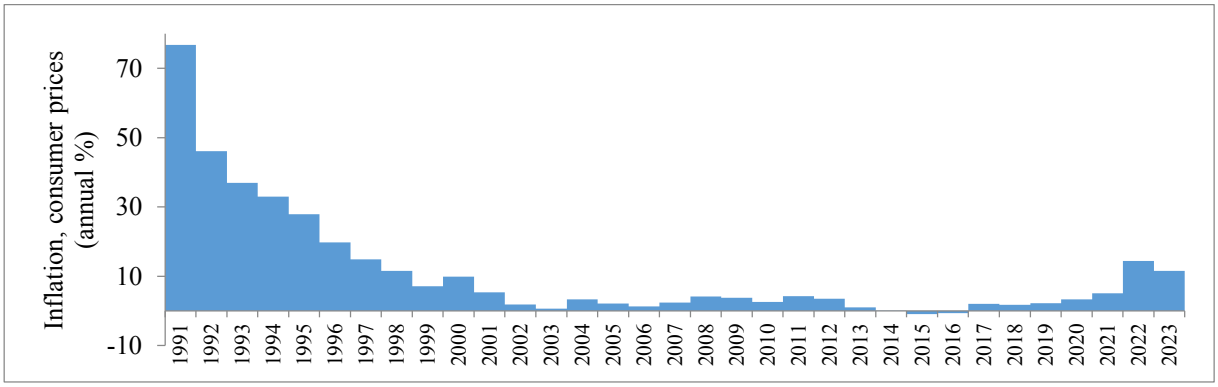



**Figure 5.** Inflation, consumer prices (annual %), Poland 1991-2023.

Source: World Bank, Retrieved from: https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=GR

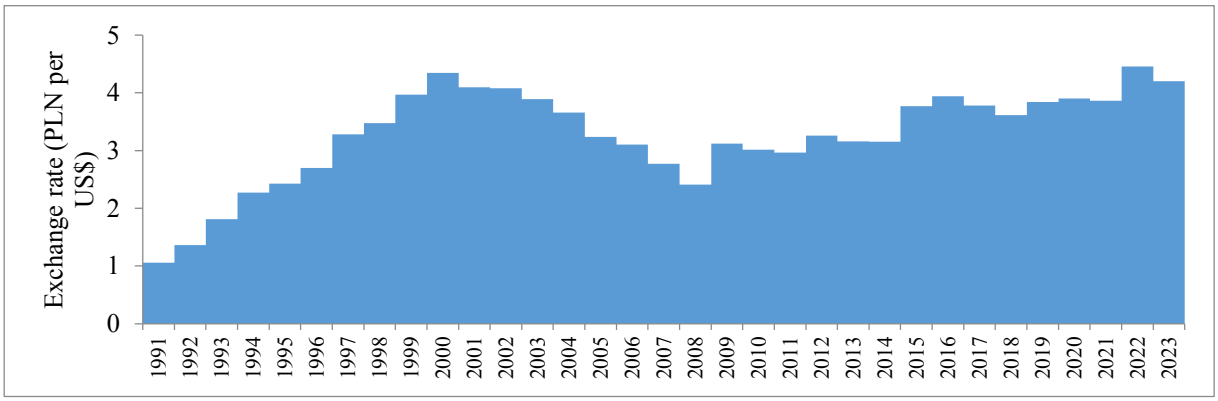



**Figure 6.** Exchange rate (PLN per US$, period average), 1991-2023.

Source: World Bank, Retrieved from: https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=PL

The direct link between investors and the region through origin, family roots, or place of birth, while not widespread, is a noticeable phenomenon that plays a significant role in foreign investment patterns. Municipalities relatively infrequently establish direct contacts with foreign investor communities, which can limit the potential for attracting external capital. However, municipalities that include representatives of the German minority on their governing boards

possess a natural advantage in this domain. Such representation facilitates direct communication with German investors, effectively removing the language barrier, which is a significant obstacle in international business dealings. Furthermore, these connections may be rooted in pre-existing private relationships, thereby serving as a catalyst for the inflow of German capital. Nonetheless, there is a risk associated with this dynamic, as it can lead to an investor monoculture, where the region becomes overly dependent on capital from a single foreign source.

A relatively large number of companies with German capital identify family contacts as their primary source of information about the region during the start-up phase. This phenomenon is particularly prevalent among small and medium-sized enterprises (SMEs), where investors, often the capital owners themselves, have Silesian ancestry. An illustrative example of this type of investment is the "Gościniec" in Dębska Kuźnia, established by individuals who emigrated permanently during the 1980s. Their favourable assessment of the political and economic changes in Poland motivated them to return and invest in the region of their origin. Such investments are often characterised by a unique calculus, where the costs of acquiring information are lower, and the process of navigating administrative procedures is relatively straightforward due to the investors' familiarity with the local environment.

Moreover, this familiarity extends beyond administrative ease; it significantly enhances social assimilation, thereby reducing investment risk. Investors with personal ties to the region often possess a deeper understanding of the local culture and social norms, which facilitates smoother integration into the community. In some cases, these investors are also fluent in Polish, which provides them with an additional advantage over those for whom both the region and the country are entirely foreign. A portion of these returnees possess considerable capital and are inclined to invest it in various business ventures within the region. This trend not only highlights the potential of diaspora capital in regional development, but also underscores the importance of cultural and social factors in shaping investment decisions.

In the case of large multinational corporations, where investment location decisions are primarily guided by global expansion strategies in foreign markets, it may initially appear difficult to attribute these decisions to the private ties of individual investors, particularly given the involvement of international capital. However, as evidenced by several companies operating within the region, the final decision to invest locally can sometimes be influenced, to a certain extent, by the personal connections of certain employees, especially members of the management boards. Similar to smaller enterprises, these personal ties can play a crucial role in overcoming informational barriers, identifying points of contact within the region, and even substituting for the functions typically performed by business environment institutions, which are usually tasked with facilitating such connections.

Notable examples of this phenomenon can be observed in large companies with German capital operating in Opole Silesia, such as Novomex, Rütgers AG, Uwe Eco, Jokey Plastik, and Bischof & Klein. Members of the management boards of these entities, who have roots in

the Opole region, often acknowledge their connections to the area. This personal investment in the region represents a significant asset for Opole Silesia in its efforts to attract capital not only from the Federal Republic of Germany but also from other international sources.

The influence of such personal ties, while important, should not be overestimated, particularly when considering the broader investment climate. Although these connections can serve as an invaluable asset, facilitating entry and integration into the local environment, they cannot fully compensate for deficiencies in fundamental aspects of the investment climate, such as the availability of adequate technical infrastructure, regulatory stability, or access to skilled labour. Thus, while personal ties to the region, often rooted in historical context, may enhance the attractiveness of Opole Silesia to certain investors, they must be supported by a robust and conducive business environment. This underscores the necessity for regional policymakers to address infrastructural and institutional gaps in order to create a more comprehensive and appealing investment climate that can attract a diverse range of investors.

It is often theorised that foreign entities derive greater benefits from tax exemptions compared to their domestic counterparts. Undoubtedly, the statutory measures implemented in Poland during the early stages of the economic transformation utilised tax exemptions as a key incentive to attract foreign investors. These measures were designed to offset the significant investment risks associated with that initial and most unstable period of the transition. Investors active in the region, such as the German conglomerate Heidelberger Cement and the Dutch corporation Numico, took advantage of these exemptions to establish and expand their operations.

The early phase of opening up of the Polish economy was also conducive to the influx of foreign capital of a speculative nature, aimed primarily at exploiting tax privileges and securing quick profits. This trend was largely driven by the high level of investment risk prevalent in the country at the time. A notable example of this is the privatisation of the Osowiec Metal Works, where the investor, the German company Bersch und Partner GmbH, sought to capitalise on these tax benefits. However, the failure of this privatisation transaction had far-reaching consequences. Given the scale and significance of the entity involved, the collapse of the deal not only tarnished the reputation of German investors in the region, but also deepened the scepticism of local authorities towards potential foreign partners.

The negative experience with Bersch und Partner appears to have had a lasting impact, influencing the rejection of German investors in several subsequent privatisation efforts within the region, such as those involving Paczków Pollena and the Zakłady Wapiennicze in Tarnów Opolski. This episode highlights the broader implications of speculative investment during the early transformation period, where the pursuit of short-term gains by foreign entities sometimes undermined long-term economic development and trust between local stakeholders and international investors.

Moreover, the experience underscores the importance of rigorous due diligence and strategic alignment in the privatisation process. Ensuring that foreign investments are not only financially viable but also conducive to sustainable regional development is crucial. This requires a balanced approach, where incentives such as tax exemptions are coupled with stringent evaluation criteria to mitigate the risks of speculative capital inflows that may destabilise the local economy.

Moreover, a significant dispute occurred between the workers and management of the German company Hochtief in Praszka, which involved substantial job cuts. This situation triggered a wave of protests by trade unions in the city, highlighting the tension between foreign management practices and local labour expectations. While these negative experiences associated with foreign investors are relatively rare, they nonetheless have a significant impact on the perception of foreign capital in the region. Such incidents stress the importance of maintaining rigorous standards of corporate governance and adherence to local labour laws. These issues not only affect the immediate stakeholders - such as employees and local authorities - but also have broader implications for the region's attractiveness to future investors. The negative precedents set by companies like Grella Stahlbau and Eurofashion may contribute to a climate of distrust, where foreign investors are viewed with increased scepticism by local communities and regulatory bodies.

When analysing the risks associated with activities of enterprises with foreign capital, it is essential to consider a broader perspective that encompasses the nature of these multinational enterprises. Despite their often considerable economic power, these enterprises are not immune to challenges arising from both global economic conditions and internal issues related to their ownership structures. Consequently, the presence of such investors in a region introduces a degree of risk associated with the potential transmission of organisational problems from their global operations to the local labour market.

For instance, the Korean conglomerate Daewoo exemplifies this dynamic. Daewoo, with its facilities in Nysa and Opole, has experienced difficulties extending beyond the Polish market. In the case of Daewoo, financial troubles and restructuring efforts at the global level led to the bankruptcies of their Opole and Nysa plants. After running into financial difficulties, Daewoo sold most of its assets in 2002 to General Motors for $1.2 billion, becoming a subsidiary of the American company. Daewoo Motors was bought out by General Motors, but overseas manufacturing subsidiaries, such as the Opole and Nysa plants, were not part of the deal.

A mention should also be made of the risks associated with natural disasters. Devastating floods occurred in the years 1997, 2010, and 2024, affecting Opole Voivodeship. One example of a business affected by the 2024 flood is Schattdecor. Schattdecor Group is a global enterprise with 3000 employees across 16 locations worldwide. Its facility in Głuchołazy, which employs 250 people, suffered considerable damage during this calamity.

Devastating floods have left a lasting impact on the local economy, causing extensive damage to both private and public infrastructure. For businesses, such natural disasters not only lead to immediate financial losses, but also contribute to longer-term concerns about future flood events, making the region appear less appealing for investment. The recurring nature of these floods highlights the ongoing vulnerability of Opole Voivodeship, adding an additional layer of risk that companies must carefully consider when deciding whether to invest in the area.

## 5. Conclusion

The reduction in investment risk in Poland, which was significantly influenced by the country's accession to the European Union and the subsequent macroeconomic stabilisation, led to a notable increase in the share of investment by multinational corporations. Poland's accession to the EU not only enhanced its economic stability, but also provided a more predictable regulatory environment, which in turn made it a more attractive destination for foreign direct investment.

The macroeconomic stabilisation achieved through various reforms and policies contributed to a reduction in inflation rates, improved fiscal discipline, and enhanced overall economic growth. These factors collectively lowered the perceived risks associated with investing in Poland, thereby encouraging multinational corporations to increase their investments in the country. Moreover, EU membership granted Polish businesses and investors access to a larger single market, further boosting investor confidence. The alignment of Polish regulatory standards with EU norms facilitated smoother business operations and reduced barriers to entry for multinational firms. This alignment included improvements in legal frameworks, intellectual property protection, and trade regulations, which collectively contributed to a more favourable investment climate. As a result, the share of investment by multinational corporations in Poland saw a marked increase, reflecting the growing confidence in the country's economic prospects and its integration into the European market. This influx of investment has not only bolstered the Polish economy, but also played a significant role in advancing regional development and industrial growth. Poland's accession to the EU and its subsequent macroeconomic stabilisation were pivotal in mitigating investment risks, thereby enhancing the attractiveness of the country to multinational investors.

Relatively scant attention has been devoted to the factors affecting foreign direct investment at the regional level within the country, with a predominant focus in the literature on macroeconomic trends and national-level analyses. This oversight has significant implications, particularly regarding the understanding of investment risks specific to individual regions. While macroeconomic studies provide a broad view of investment environments, they often fail

to address the nuanced risks and opportunities that vary across different regions. Consequently, this gap in research underscores the need for targeted analysis of regional determinants, which can offer a clearer picture of the risks associated with FDI in specific localities and inform about more effective risk mitigation strategies.

At the early stages of economic transformation, foreign investors exhibited a noticeable reluctance to invest in Opole Silesia, primarily due to three significant factors. First, the macroeconomic instability that affected the entire Polish economy posed substantial risks, discouraging large-scale investments. Second, corporations prioritised larger urban centres such as Warsaw, Poznań, Gdańsk, and Wrocław, which were viewed as more attractive and secure investment locations. Third, concerns regarding the complex socio-political situation in Opole Silesia and the potential lack of acceptance from the local community further deterred investment, particularly from German firms. This hesitation was likely intensified by the historical and socio-political sensitivities of the region, influencing local perceptions of foreign, especially German, capital. Consequently, these factors collectively limited the initial flow of foreign direct investment into the region.

The higher risk of floods in Opole Voivodeship poses significant challenges to investors, leading to increased uncertainty and concerns about the safety of their investments. Regions prone to frequent natural disasters, such as floods, create an environment of heightened risk, which may discourage both domestic and foreign companies from establishing or expanding their operations. Companies often prioritise the security of their assets and the continuity of their business activities, meaning that areas susceptible to frequent flooding have to struggle to attract long-term investment. The potential for disruption caused by flood damage to infrastructure, supply chains, and facilities adds another layer of uncertainty, further deterring investors who are looking for stable and secure environments.

By identifying specific risks, investors can gain a deeper understanding of the factors that may impact their operations and adapt their strategies accordingly, ensuring resilience and sustainable growth. A risk assessment enables investors to anticipate potential disruptions and allocate resources more effectively. This proactive approach not only minimizes exposure to localized threats—such as natural hazards or sociopolitical tensions—but also enhances long-term investment performance. Moreover, aligning investment strategies with region-specific conditions can foster stronger partnerships with local stakeholders and institutions.

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# MANAGEMENT OF GOODS FLOW IN HYPERLOOP TRANSPORTATION SYSTEM

Kinga BIENIEK[1]*, Olena STRYHUNIVSKA[2]

[1] Faculty od Management, AGH University of Krakow; kingabieniek@student.agh.edu.pl
[2] Faculty of Management, AGH University of Krakow; olestr@agh.edu.pl, ORCID: 0000-0002-7843-2984
* Correspondence author

**Purpose:** The purpose of this study is to analyze the Hyperloop system in terms of freight transportation management, aiming to improve the efficiency of cargo transport while supporting sustainable development goals. The research evaluates material flow and simulation processes to highlight the advantages of Hyperloop over existing transportation modes.
**Design/methodology/approach:** the study employs advanced simulation tools such as FlexSim and Archicad, commonly used in design and logistics analysis. These tools enabled precise modeling and in-depth analysis of the Hyperloop transportation system, focusing on operational efficiency and identifying potential bottlenecks.
**Findings:** The results demonstrate that the Hyperloop system can simultaneously handle both passengers and cargo according to a predefined schedule. The simulation model revealed the system's capacity, the load on the logistics infrastructure, the integration of passenger and cargo traffic and the key challenges associated with coordinating these flows to minimize potential downtime.
**Research limitations/implications:** while the study provides a comprehensive framework for analyzing the Hyperloop system, it is limited to simulation-based analyses. Future research could include real-world testing and broader integration of various environmental and economic factors.
**Practical implications:** The findings of the study provide practical insights for the implementation of Hyperloop technology in logistics and freight transport. They form a foundation for stakeholders to design efficient, sustainable and reliable transportation systems.
**Originality/value:** This study contributes to the development of Hyperloop technology, highlights its potential to revolutionize freight logistics and provides a methodological framework for future development and research in this field.
**Keywords:** Hyperloop, cargo transport, cargo flow management, transport efficiency, logistics.
**Category of the paper:** Research paper.

# 1. Introduction

The dynamic technological development observed in recent decades responds to the growing needs associated with globalization, urbanization, and increasing demands for speed and efficiency in transportation processes (Guerrero-Ibáñez et al., 2012). In the face of challenges such as congestion in traditional transportation systems and the need to reduce greenhouse gas emissions, the Hyperloop concept has gained particular attention. This innovative transportation system is designed to enable fast, efficient, and eco-friendly movement of both passengers and cargo (Musk, 2013; Ross, 2015). The technology, based on the use of low-pressure tubes and capsules traveling at speeds exceeding 1000 km/h, addresses contemporary challenges in transportation and logistics (TÜV SÜD, 2019).

The efficiency of transportation systems is a critical factor in enhancing the competitiveness of national economies and global supply chains (Porter, 2008). Fast and reliable transportation helps reduce operational costs, improve market accessibility, and increase business flexibility (Rodrigue, 2020). In this context, Hyperloop offers the potential to shorten delivery times and introduce new opportunities for optimizing goods flow by integrating modern technology with existing logistics networks. With its low energy consumption and reduction of carbon dioxide emissions, this system has the potential to set new standards for sustainable transportation (Gkoumas, 2021).

Existing research on Hyperloop technology has primarily focused on technical and engineering aspects, such as infrastructure design, motion dynamics, and energy efficiency. A wealth of important data have been provided in this area, confirming the system's potential and feasibility. However, issues related to managing goods flow within the system, including identifying bottlenecks, forecasting demand, and integrating with existing logistics structures, remain insufficiently explored. Effective management requires a comprehensive approach that considers both technical constraints and operational and economic requirements (Werner et al., 2016).

This study focuses exclusively on freight transportation, with particular emphasis on managing the flow of goods within the Hyperloop transportation system. The research aims to identify key operational challenges, evaluate the system's efficiency, and develop recommendations for its future implementation. The analysis provides both practical and theoretical insights for further research and practical implementation efforts in the Hyperloop domain.

## 2. Literature review

The Hyperloop system is characterized by the use of innovative solutions in the field of transportation, utilizing advanced technologies in near-vacuum conditions. The core component is the capsule, which will travel through tubes with near-vacuum pressure. High speeds will be achievable through the application of a Linear Induction Motor (LIM) and magnetic levitation technology. Additionally, appropriate analyses have been conducted to find the optimal aerodynamic shape of the vehicle, minimizing air resistance that would hinder the achievement of high speeds (Braun et al., 2018; Abdelrahman et al., 2017). Hyperloop capsules are designed for both passenger and freight transport, with significant differences in vehicle construction depending on their intended purpose (Mitropoulos et al., 2021; Opgenoord et al., 2018).

Freight transport capsules feature a simplified internal structure divided into three segments. In the central part, instead of seats, there will be space designated for containers carrying cargo. The vehicle design will accommodate the transport of materials with small or medium dimensions, with a total weight not exceeding 2500 kg (Hyperloop TT, 2023; Nøland, 2021).

Unlike passenger capsules, which are equipped with seating and amenities for travelers, freight capsules focus on maximizing the use of available space. The capsule design incorporates all subsystems, such as propulsion, levitation, and safety systems, which remain identical for both passenger and freight versions (Hardt Hyperloop, 2023; Rodrigue, 2020).

One of the advantages of Hyperloop technology is its ability to utilize existing tube infrastructure for both passenger and freight transport according to a set schedule. This means there is no need to build a separate network for freight transportation, leading to significant cost savings (Mitchell et al., 2010; Hansen, 2020). Freight movement will occur both during the day, alongside passenger traffic, and at night when passenger capsule frequency decreases. During off-peak hours, freight transport capacity can be increased according to demand. The implementation of Hyperloop technology for goods transport represents a significant milestone in improving a country's economic performance and reducing transportation time for specific goods, particularly those requiring rapid delivery, such as medical supplies, food or high-value products (Polak, 2017; Guo et al., 2022).

The application of Hyperloop technology will serve as the foundation for future sustainable transportation systems. Examples of such implementations include the transportation of goods across distant regions at speeds comparable to air travel but with significantly lower costs and a reduced environmental impact (Hyperloop Development Program, 2022).

However, Hyperloop technology requires the development of an advanced transportation system and comprehensive solutions to ensure the safety and efficiency of both passenger and freight transport. The infrastructure includes key components such as transport tubes, passenger and freight stations. Capsules will travel through special tubes with near-vacuum pressure, which, in the original concept, are supported by concrete pylons. Photovoltaic panels are

planned for installation on top of the tubes to capture solar energy for powering the system. This approach aims to reduce infrastructure maintenance costs and contribute to the environmental sustainability of the transportation system. Alternative configurations include placing transport tubes at ground level or in underground tunnels, similar to metro infrastructure. However, due to the desire to reduce costs associated with land acquisition or the relocation of residents along the planned route, the constructing the Hyperloop system on concrete pylons is considered an efficient solution. The tube diameter is expected to range from 3.3 to 4.3 meters and the tubes will be made of steel, ensuring durability and system integrity. The material will be selected to withstand unforeseen weather events, such as floods or tornadoes (Musk, 2013; Rümeysa et al., 2021).

Furthermore, the infrastructure of the Hyperloop freight station should facilitate the efficient flow of goods. A critical factor in the functionality of the freight station is the minimization of downtime and the elimination of potential delays in cargo transportation. Leading institutions involved in the development of the technology have proposed several designs for the freight station and its operational model. One concept suggests that goods will be delivered to a warehouse at the Hyperloop station and then shipped during the night to the destination station. At the destination, the cargo will be received by other carriers, such as trucks, and distributed to its final destination (Rudowski, 2018).

The American research company Hyperloop Transportation Technologies has presented the concept of a freight station known as HyperPort. In this design, containers carrying cargo would be transported above the Hyperloop tracks using cranes and then placed into capsules, which, once loaded, would depart for the destination (HyperPort cargo solution, 2021).

Holvad (2023) describes a scenario in which capsules are dispatched every 70 seconds, providing a capacity of 6 million tons per year, assuming each capsule can carry 10 tons of cargo. However, considering potential system maintenance and repairs, the realistically estimated amount of goods that can be transported is approximately 5.84 million tons.

Munir et al. (2019) assess the operation of the Hyperloop system in Germany over a distance of 300 km, which would allow freight speeds to increase to 1054 km/h, approximately 11 times higher compared to road transport. Factors associated with the implementation of the Hyperloop system, such as reduced operational costs, fuel savings and decreased road traffic, are expected to result in annual savings of approximately 163 million euros.

Freight transportation via the Hyperloop system could thus play a key role in the future of transport, combining speed, energy efficiency and minimal environmental impact (Nowak, Owczarek, 2020).

## 3. Materials and methods

The study focuses on analyzing the flow processes occurring at the freight station. The analysis of freight flow management includes developing the freight station layout using Archicad and importing the design into FlexSim for process simulation. This approach allowed for observing the Hyperloop system's operation and identifying areas requiring improvement. The actions taken aimed to streamline transport system processes and illustrate the functioning of the freight station.

### 3.1. Research tools

The primary tool employed in this study is FlexSim, a software that allows for the precise replication of processes occurring in a given system by creating flow logic. The use of FlexSim is justified by its versatile capabilities in modeling and simulating complex systems, which aligns perfectly with the intricate nature of the Hyperloop transportation system's development. FlexSim provides a powerful and user-friendly simulation environment that can support various stages of a project, enhancing efficiency and accuracy while aiding decision-making processes (Lewicki et al., 2024). The software enables the creation of detailed and realistic models of the entire Hyperloop infrastructure, including freight transport, storage and distribution. The study involves multiple interacting components and dynamic processes. FlexSim's advanced simulation features allow for the representation of time-dependent behaviors, facilitating the analysis of the system's responses to different scenarios and inputs. This enables the modeling of the complete Hyperloop system, analysis of factors such as traffic intensity and the identification of potential bottlenecks in the system (Rumin et al., 2023).

Figure 1 illustrates a diagram of the simulation model development process, reflecting the underlying processes and encompassing key stages from problem formulation to solution implementation. The process is divided into three main phases: conceptual, simulation modelling and model experimentation. The diagram begins with the formulation of the problem, which serves as the basis for setting modeling objectives. Next, the conceptual model is developed, creating a simplified representation of the real system. Concurrently, data collection and analysis activities are carried out to ensure model accuracy. FlexSim provides a user-friendly and intuitive interface, where model construction involves adding selected visual elements, linking them and assigning appropriate input data (Baggio et al., 2021; Blaut et al., 2024).

The next step is model translation, which involves converting the conceptual model into a simulation version. After the model is created, tests are conducted to verify its correctness. If the tests results are positive, the model undergoes validation to assess its credibility. Once validation is successful, the process advances to the experiment planning phase, followed by execution.

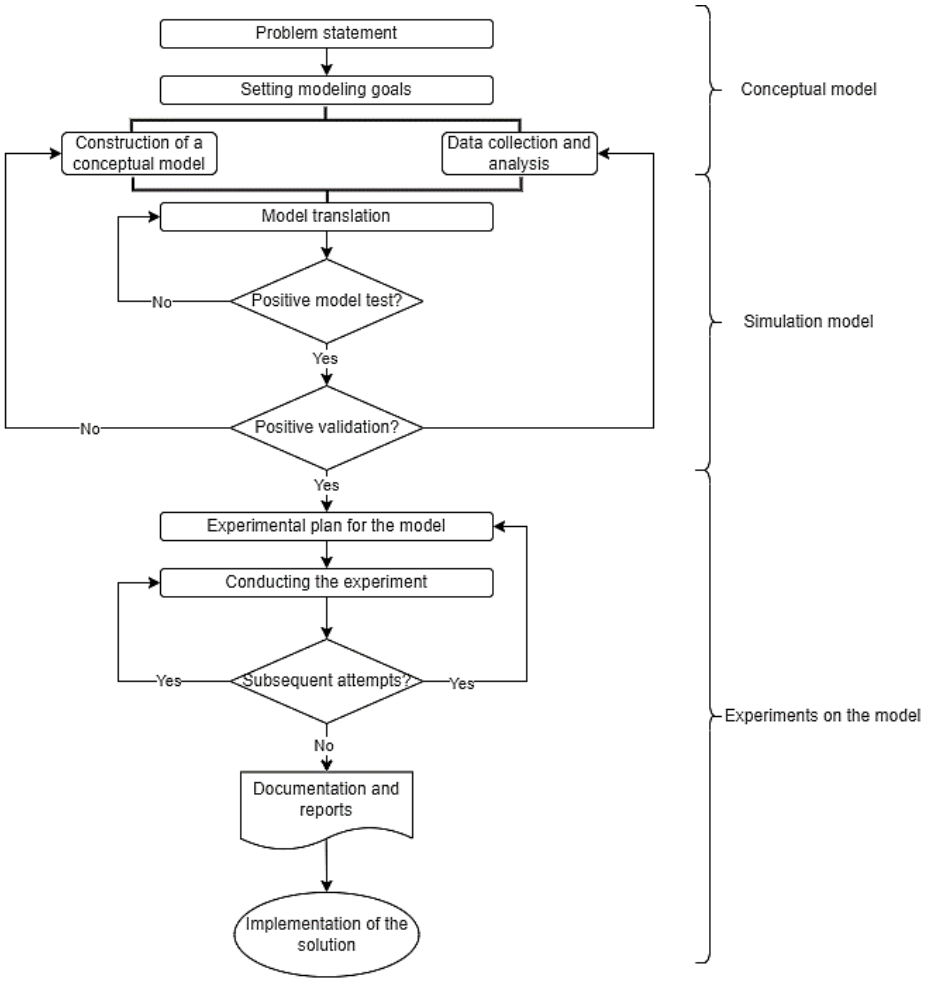



**Figure 1.** Diagram of the model building process.

Source: Own elaboration based on Karkula, 2013.

Simulation results are analyzed and additional trials may be conducted to optimize performance. The process concludes with documentation and report generation, summarizing the results and conclusions of the experiments. Finally, the solution is applied to the real system. The diagram emphasizes the iterative nature of the process, enabling continuous model refinement at each stage until optimal results are achieved (Hamdia et al., 2021).

Another tool used in this work is Archicad, which was employed to create the Hyperloop station model and plan the route to the station. The application of Archicad in the Hyperloop infrastructure development project leverages its exceptional capabilities in Building Information Modeling (BIM), providing a comprehensive collaboration platform for designing, visualizing, managing complex architectural and infrastructure projects. Archicad offers distinct advantages that address the intricate requirements of the project, enhancing collaboration, precision and efficiency during the planning and design phases. The key benefit of Archicad is its BIM- focused methodology, enabling the creation of an integrated and collaborative model for the entire Hyperloop infrastructure (Dallasega et al., 2023). This centralized platform facilitates seamless collaboration among architects, engineers and stakeholders, ensuring a synchronized approach to design and construction.

Furthermore, Archicad supports open BIM standards, enabling interoperability with other software tools used in the project, such as FloWorks and FlexSim. This ensures smooth data exchange across different project areas, maintaining accuracy and consistency throughout the process. Archicad's capabilities include generating detailed construction documentation, which is crucial for providing precise and comprehensive instructions for construction teams, ensuring that the Hyperloop infrastructure is built in compliance with the defined design, regulations and standards (Pękała, Stryhunivska, 2024). By utilizing advanced information management features, Archicad minimizes errors and streamlines communication between different design departments during the project creation phase. The software includes an extensive library of materials and visualization tools, supporting the design of complex structures and forms. This accelerates and simplifies model creation while optimizing spatial planning and solutions (Baporikar, 2024; Parekh, Trabucco, 2024).

### 3.2. Input data

The freight station has been designed to ensure efficient goods flow. It consists of two main sectors dedicated to managing incoming cargo. These areas, referred as 'Delivery of Goods', are located on both sides of the tracks along which the Hyperloop capsules move. A key component of the station's operation is a crane positioned at the capsule parking spots, designed for loading and unloading vehicles. A container storage area has also been included to allow containers to safely wait for subsequent stages of their journey to the destination. The layout and appearance of the freight station are illustrated in Figure 2.

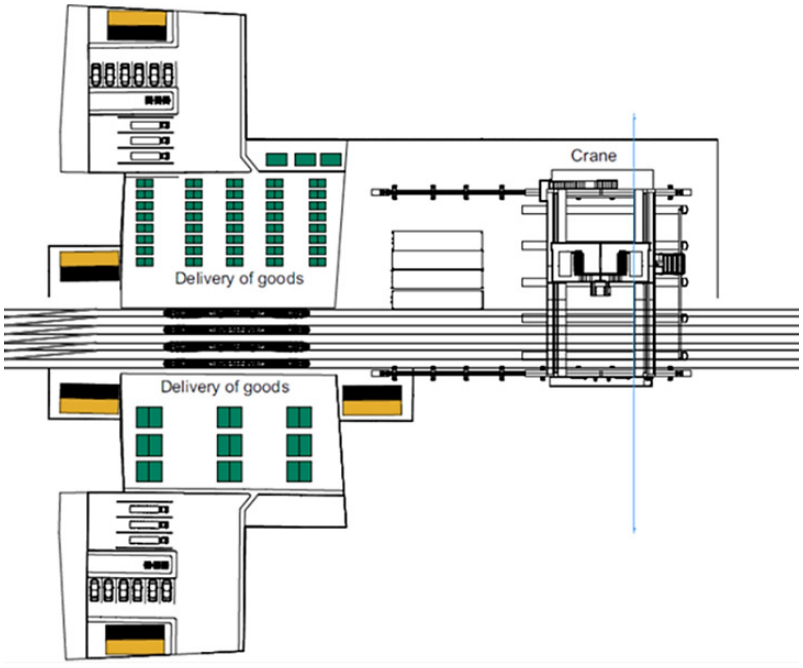



**Figure 1.** The layout of a cargo station.

Source: Own elaboration.

The central part of the freight station consists of tracks dedicated to vehicle movement. They are designed to ensure efficient transport of capsules to the destination station. In addition to cranes used for loading and unloading containers, autonomous guided vehicles (AGVs) will also be utilized to carry containers. These vehicles will transport goods between the warehouse and logistical operation areas located near the capsule. A 3D view of the freight station is presented in Figure 3.

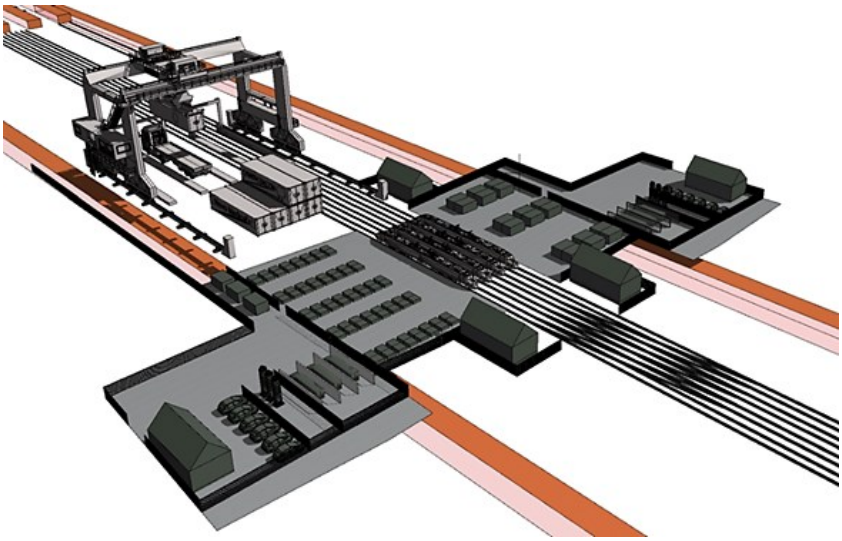


**Figure 2.** 3D model of a cargo station.

Source: Own elaboration.

Based on the Hyperloop freight station model created in Archicad, simulation processes were conducted using FlexSim. These processes are presented in a block diagram that reflects the operations at the station, as shown in Figure 4.

The simulation process was divided into two main paths: container handling and capsule servicing. The first simulation path focuses on container transportation. The primary criteria include the delivery time of the container to the freight station and the frequency of truck arrivals. Next, the time required for container inspection and labeling is considered, followed by placement in the warehouse after approval. The subsequent step involves sorting and arranging containers, followed by their transfer to autonomous AGVs using a crane. The loading time onto AGVs and their waiting time for further logistical operations are also taken into account.

In the next step, the transport time of containers to the loading area is analyzed, where they are transferred onto Hyperloop capsules using a crane. Before the capsule is dispatched, the time required for final inspection and documentation completion is taken into account. The loaded capsule is then directed to the airlock, where the air is evacuated from the tube-a process accounted for in the simulation. Once this procedure is completed, the capsule begins its journey to the destination. Simultaneously with the processes related to cargo reception at the warehouse, operations concerning the capsule's arrival at the station are conducted. Technical inspections of the capsule are performed at the primary Hyperloop vehicle inspection station, covering both periodic and additional technical checks.

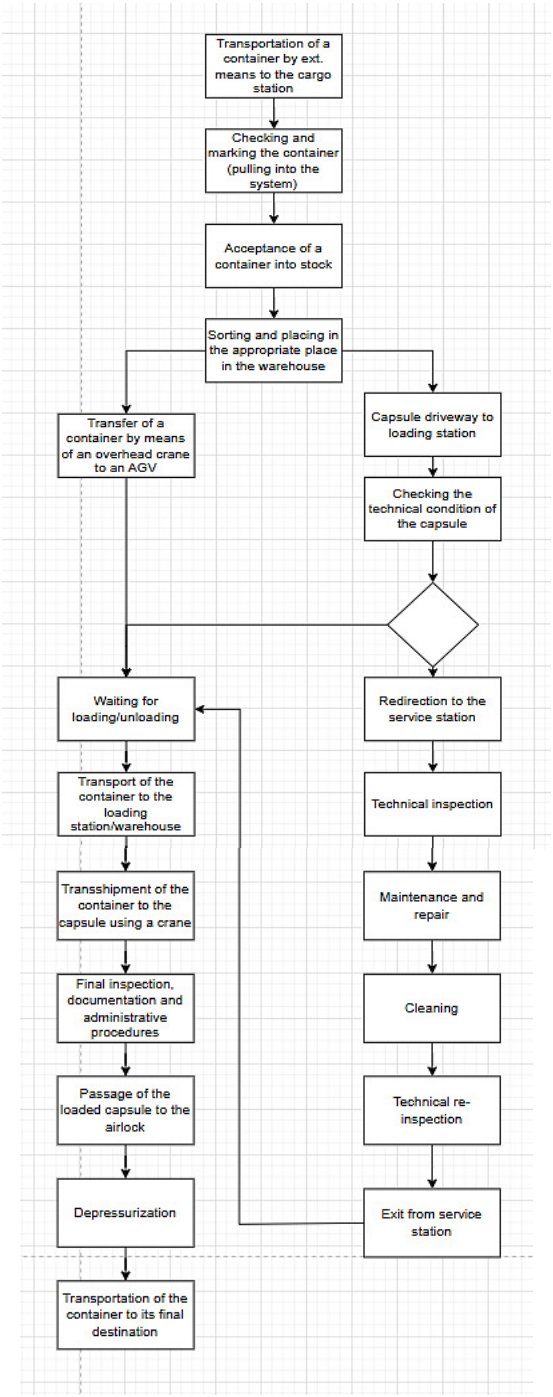



**Figure 4.** Block diagram of logistics processes taking place at a goods station.
Source: Own elaboration.

Before departure, the capsule undergoes a technical inspection to detect any potential faults and prevent issues during transit. If no repairs are needed, the capsule proceeds to the loading area, ensuring smooth operations during the journey. If repairs are necessary, the capsule is directed to the Hyperloop vehicle inspection station located within the freight station. The time required to direct the capsule to the inspection station is also accounted for. If defects are detected, the capsule is redirected to the service station. At the service station, a comprehensive technical inspection is conducted, including maintenance, repairs and cleaning of the capsule.

Once the service work is completed, the capsule undergoes a follow-up inspection. If no issues are found, the capsule leaves the service station and is ready for further use. The entire process, illustrated in Figure 4, highlights the key stages of container transport, logistics at the freight station and the comprehensive technical servicing of the Hyperloop capsule.

Before starting the simulation, the appropriate input data for the operations at the Hyperloop freight station were defined. This is a critical step to ensure accurate results and support further analysis of the system's performance. Examples of input data include the duration of specific loading and unloading operations of capsules, transport times between the warehouse and the crane and the speed of AGV movement. All parameters entered into the simulation model are summarized in Table 1.

**Table 1.**
*Input data for a cargo station simulation*

| **Cargo station** | | |
|---|---|---|
| **Parameter** | **Value** | **Unit** |
| Capsule acceleration | 4,5 | $m/s^2$ |
| Velocity increment | 222,22 | m/s |
| Time to exit from the airlock | 41,5 | s |
| Time to pump out air in the airlock | 60 | s |
| Capsule transit time to the airlock | 41,5 | s |
| Time to load container onto capsule (crane transfers container) | 120 | s |
| Time to transport container AGV to loading station where the capsule is located | 400 | s |
| Distance from AGV cart pickup point to loading station | 200 | m |
| Loading/unloading procedure time from container arrival at warehouse to placement on AGV | 1800 | s |
| Distance capsule must travel to reach maximum velocity | 10287 | m |
| Safe AGV cart speed | 2 | m/s |
| Maximum speed | 750 | km/h |

Source: Own elaboration.

Considering the actual operating conditions of the Hyperloop system, it should be assumed that freight capsules will travel on the same tracks as passenger capsules. Therefore, effective organization of both types of traffic is essential to ensure smooth and efficient operations. For this purpose, passenger traffic intensity was analyzed throughout the day. Based on a study conducted on the Nanjing metro, specific time periods for both passenger and freight traffic were identified. The simulation also accounted for peak hours in passenger transport. Figure 5 illustrates the distribution of passenger traffic intensity in the Nanjing metro over a 24-hour period, showing variations in passenger flow throughout the day (Yu et al., 2019).

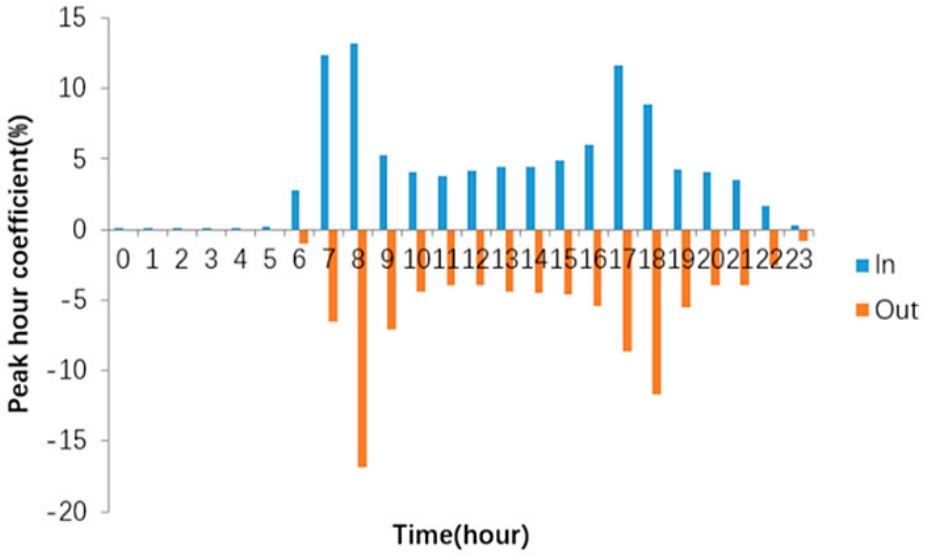



**Figure 5.** Distribution of passenger traffic in Nanjing metro area.

Source: Yu et al., 2019.

The horizontal axis represents the hours from 12 p.m. to 11 p.m., while the vertical axis shows the peak hour factor expressed as a percentage. The chart is divided into two categories: "In" and "Out." Blue bars represent entrances to the metro, labeled as "In," while orange bars represent exits from the metro, labeled as "Out." During the morning rush hour, between 7 a.m. and 9 a.m., there is a noticeable increase in the number of passengers entering the metro, as indicated by the blue bars rising above the horizontal axis. At the same time, there is a marked decrease in the orange bars, indicating that many people are exiting the metro as they reach their destinations, typical of commuting patterns to work or school. Another peak in traffic occurs in the afternoon and evening, between 5 p.m. and 7 p.m., when passengers once again enter the metro to return from work or other activities. During this period, the "In" factor increases, while the orange bars reflect a higher outflow of passengers leaving the system. Outside these peak hours, between 10 a.m. and 3 p.m. as well as from 8 p.m. to 11 p.m., the peak hour factor values are significantly lower and passenger traffic appears more balanced. No significant differences are observed between entrances and exits, indicating lower traffic intensity during non-peak hours.

Based on the above analysis, the simulation model assumes that passenger traffic operates between 6:00 a.m. and 11:00 p.m., while the freight station operates from 11:00 p.m. to 6:00 a.m. This method of traffic organization helps avoid potential conflicts that may arise when both types of capsules travel simultaneously. An estimate of the number of freight capsules, determined by their dispatch frequency, is presented in Table 2.

**Table 2.**
*Cargo station capacity.*

| Station operation | | From | To |
|---|---|---|---|
| | | 23:00 | 06:00 |
| Capsule release frequency | Unit | Number of capsules per 1h | Number of capsules during station operation hours |
| 10 | s | 360 | 1800 |
| 20 | s | 180 | 900 |
| 30 | s | 120 | 600 |
| 45 | s | 80 | 400 |
| 60 | s | 60 | 300 |
| 120 | s | 30 | 150 |

Source: Own elaboration.

The study assumes that freight traffic will take place between 11:00 p.m. and 6:00 a.m. The schedule for passenger and freight capsule movement is presented in Figure 6. This schedule also provides the flexibility to adjust time periods during which the traffic occurs, enabling the testing of different transportation organization scenarios.

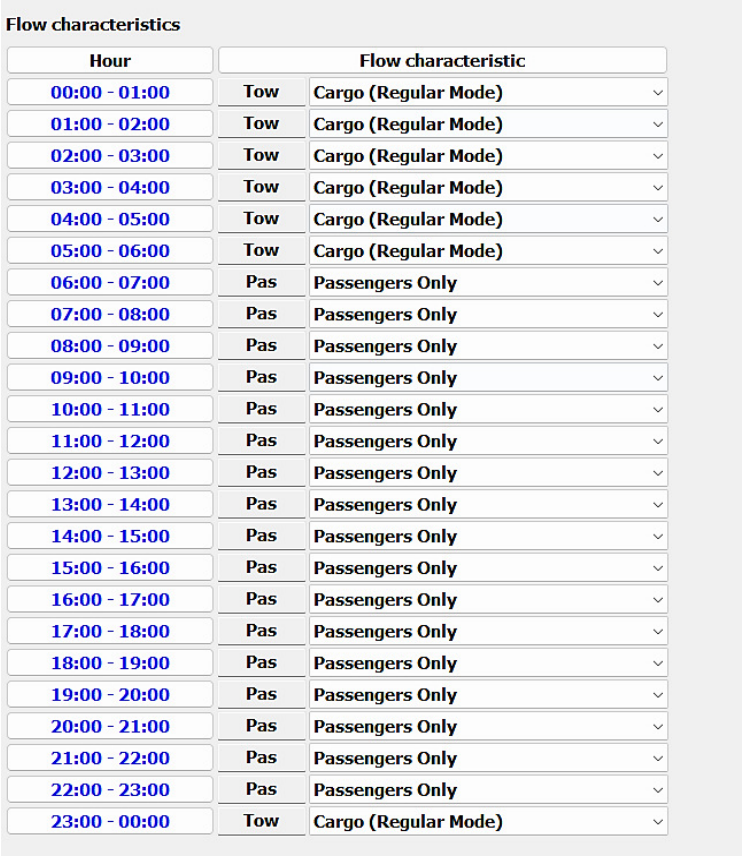



**Figure 6.** Schedule of transport mode by simulation time period.

Source: Own elaboration.

The simulation model reflects the connections between seven key cities in Poland from both a logistics and economic perspective. These cities include Kraków, Katowice, Warszawa, the Transport Hub CPK in Baranów, Wrocław, Łódź and Gdańsk. The specific locations are presented in Figure 7.




**Figure 7.** Locations of the cities included in the simulation.

Source: Own elaboration.

## 4. Results

The simulation was conducted over a 24-hour period, allowing for the observation of the full system operation and the collection of final data related to infrastructure capacity. The results confirm the system's ability to handle a large number of passengers and freight containers, while accounting for infrastructure constraints and the traffic schedule. During the simulation, over 42,000 passengers were served, with the average capsule travel time of approximately 9000 seconds. This result highlights the potential for effective passenger flow management within the Hyperloop system. The travel time represents the average transport duration between all locations considered in the simulation. Additionally, during the freight traffic operation, 183 containers were transported, further demonstrating the system's cargo-handling capacity, which is a crucial aspect of its functionality. Figure 8 presents the simulation results regarding the performance of the Hyperloop transportation system over the analyzed period.

| | |
|---|---|
| Total Number of Passengers Serviced per Day | 42173.00 |
| Minimum Loop Time [s] | 7696.55 |
| Maximum Loop Time [s] | 10801.97 |
| Average Loop Time [s] | 9042.29 |
| Delivered Containers | 183.00 |

**Figure 8.** Analysis of simulation results.

Source: Own elaboration.

According to the simulation results, the shortest time required to complete a full cycle is 7696 seconds, while the maximum time reached 10800 seconds, which may indicate potential disruptions or system overloads at specific points. The average full cycle time is 9042 seconds, reflecting the standard cycle duration for most operations. The simulation results regarding the performance of the Hyperloop transportation system during the analyzed period confirm the system's efficiency in managing both passenger and freight transport. At the same time, the differences between the minimum, maximum and average full cycle times highlight areas that may require further investigation. These parameters can form the basis for additional analysis and optimization of the system's operation.

Additionally, the model also provides results illustrating the load at individual freight stations in terms of crane and autonomous guided vehicle utilization. These data for the Kraków station are presented in Figure 9.

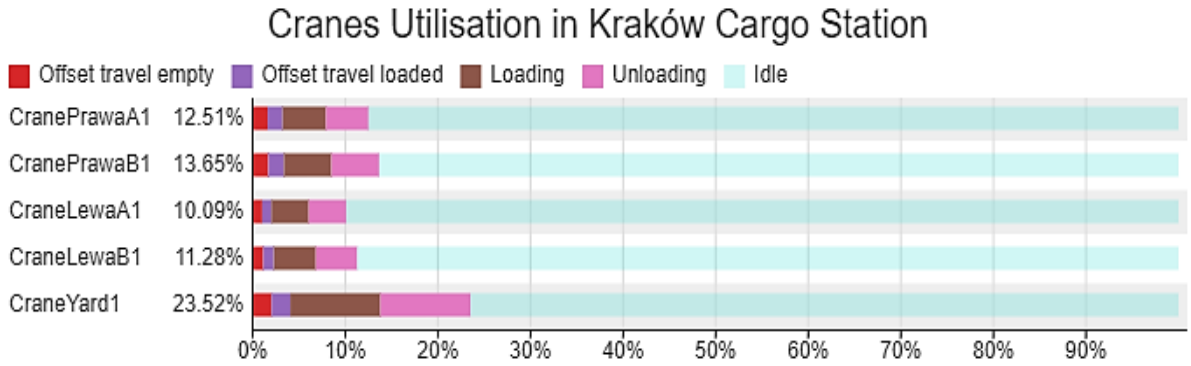



**Figure 9.** Cranes utilization in Krakow Cargo Station.

Source: Own elaboration.

Figure 9 illustrates the percentage breakdown of operation time for five cranes, considering different operational states. Five categories are highlighted: empty transit time, transit time with cargo, loading time, unloading time and idle time. The most efficiently used crane is CraneYard1, which achieved a 23% utilization rate. In its case, there is a noticeably higher proportion of time dedicated to loading operations compared to the other cranes. The load data for autonomous forklifts is presented in Figure 10.

The charts related to crane and autonomous forklift utilization compare the usage of these components throughout the entire duration of the simulation. As a result, the percentage values appear relatively low, since these elements are utilized only during the operation of the freight station, which occurs during the nighttime period. However, noticeable peaks in activity during container loading and unloading operations indicate potential local infrastructure overloads. Similar analyses were performed for the other cities involved in the simulation. The load on the cranes and AGVs at the Warsaw station, presented in Figure 11, is comparable to the results observed in Krakow. This suggests that the current model assumptions are sufficient to handle the projected traffic. Variations in system load across different locations may result from differing transportation demands at each station.

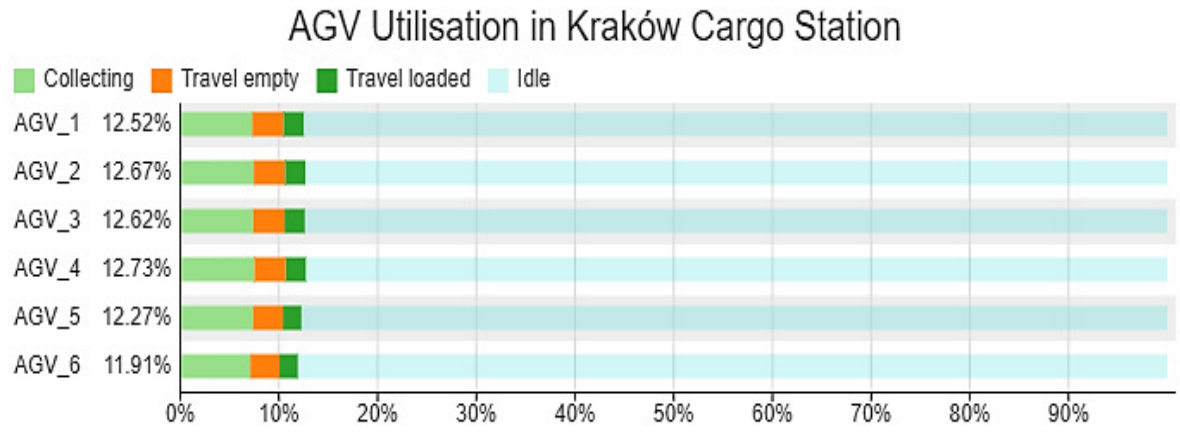



**Figure 10.** AGV utilization in Krakow cargo station.

Source: Own elaboration.

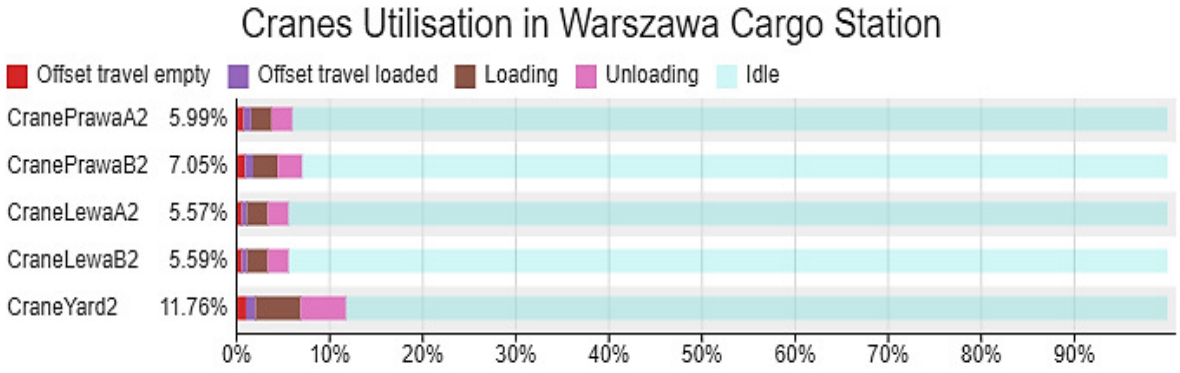



**Figure 11.** Cranes utilization in Warsaw Cargo Station.

Source: Own elaboration.

Due to changes in traffic operations at 6:00 a.m. and 11:00 p.m., freight capsules departing at these times must wait in line to enter the tube through the airlock. This situation represents a bottleneck in the Hyperloop transportation system, as the air evacuation and re-inflation process for the airlock requires time. Such delays impact overall transport operation times. Figure 12 illustrates the increased number of capsules waiting for access to the tubes during transition periods. This result emphasizes the need to optimize the traffic schedule to minimize waiting times for freight capsules and ensure smooth operations.

The simulation model enabled a detailed analysis of the system's operation, offering valuable insights into its dynamics and performance. However, further research and development are required to improve the accuracy of the results, especially concerning the system's capacity and the potential application of the technology in freight transport.

Future research may focus on refining model parameters, incorporating more detailed real-world constraints and investigating innovative technological solutions. Implementing these measures will support a comprehensive understanding of the system's capabilities, considering both its operational efficiency and adaptability to evolving logistical challenges.

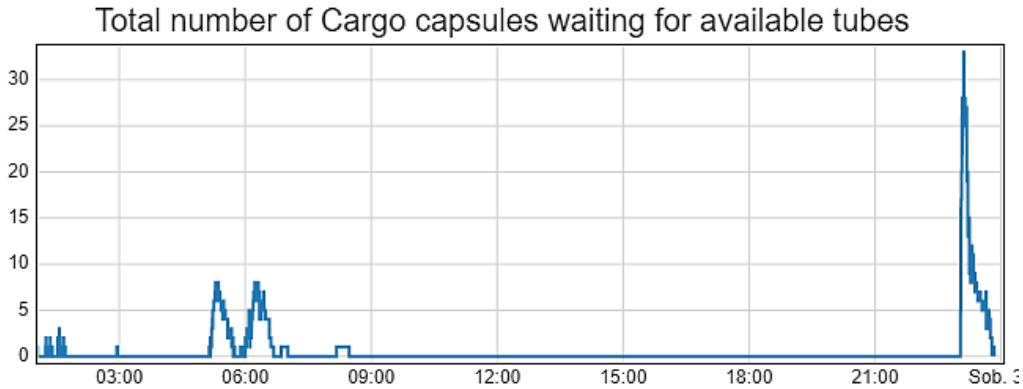



**Figure 12.** Total number of cargo capsules waiting for available tubes.
Source: Own elaboration.

## 5. Discussion

The Hyperloop system, with the assumed operational parameters, demonstrates the capability to handle a significant number of passengers and transport containers during the nighttime operations, positioning it as a promising alternative to traditional transportation methods in the context of sustainable development. These results effectively address the research question concerning the system's ability to manage passenger and freight flow both efficiently and sustainably.

The research findings have been contextualized within the existing literature, which demonstrates that traditional transportation methods are less efficient than Hyperloop technology in terms of energy consumption and time. The conclusions drawn from the simulations support these claims, while also emphasizing the potential of Hyperloop to integrate seamlessly with existing logistical infrastructure. The system distinguishes itself through its ability to deliver rapid transport and high throughput, aligning with the trend of environmentally friendly technologies that meet global transportation demands.

One of the unexpected results of the study was the identification of bottlenecks in the system's operation, particularly at 6:00 a.m. and 11:00 p.m., when freight capsules must wait for access to the airlocks. The process of pumping air into and out of the tubes is time-consuming, resulting in delays in transport operations. This limitation underscores the need to optimize airlock operation schedules or to implement more efficient technologies that could reduce downtime and improve overall system performance.

It is important to emphasize that the study was conducted in a simulation environment, which entails certain limitations in fully reflecting real-world operational conditions. The simulations do not consider random variables, such as technical failures or external factors, that could influence the results. Moreover, the assumed operational parameters, such as the

frequency of capsule departures, may differ in practice, highlighting another area that warrants further investigation.

The conducted analyses also suggest potential directions for future research, which could include more detailed operational modeling that accounts for random variables and the impact of disruptions on the system's performance. Further studies could also focus on optimizing work schedules, improving airlock operations and integrating Hyperloop with other transportation modes. Such research would provide a deeper understanding of the technology's impact on global logistics networks. The findings demonstrates that Hyperloop has the potential to become a key component of future transportation systems, offering a combination of efficiency, speed and minimal environmental impact.

## 6. Conclusion

The results of the conducted simulations confirm the potential of Hyperloop technology as an innovative transportation system capable of handling both passengers and cargo. The simulation model enabled the analysis of the system's capacity, the load on logistics infrastructure and the integration of passenger and cargo traffic. The obtained data indicates that, under the assumed operational parameters, the system can accommodate a significant number of passengers and cargo according to the planned schedule.

Passenger transport throughout the day facilitated the movement of 42000 passengers, highlighting the system's high efficiency. Cargo transport, which enabled the delivery of 183 containers, demonstrates the significant potential of utilizing nighttime time slots to optimize cargo flow. The analysis also identified key challenges related to coordinating passenger and cargo traffic to ensure safe travel and minimize potential downtime.

The load on the additional infrastructure used in cargo transport, such as cranes and autonomous AGV vehicles, was balanced, indicating the potential for further intensification of cargo movement. Developing an optimal schedule for the operation of logistics equipment is crucial, taking into account the varying demand between stations to prevent system overload and ensure smooth and efficient operations.

The conclusions drawn from the analysis highlight that the Hyperloop system has the potential to become a key element of future transportation, thanks to its combination of high speeds, operational efficiency and minimal environmental impact. To fully leverage the capabilities of this technology, further research is necessary to refine the traffic schedule, integrate dynamic management systems and conduct detailed analyses of potential failures and maintenance interruptions that could affect the system's operation.

Future actions should focus on improving the precision of operational models and adapting them to real-world conditions in both passenger and cargo transport. Further optimization of logistical infrastructure, along with an analysis of long-term economic and environmental benefits, will support better utilization of the Hyperloop technology's potential as a new transportation standard.

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# POST-PURCHASE CUSTOMER REGRET: RESULTS OF THE PILOT STUDY

Grzegorz BIESOK[1*], Jolanta WYRÓD-WRÓBEL[2]

[1] University of Bielsko-Biala; gbiesok@ubb.edu.pl, ORCID: 0000-0002-4987-5823
[2] University of Bielsko-Biala; jwyrod@ubb.edu.pl, ORCID: 0000-0001-6018-9755
* Correspondence author

**Purpose:** The main objective of this paper is to present the results of a pilot study on customer regret in a negative purchase situation. The paper presents the context of regret, the causes of negative emotions, how people react afterwards, and suggests themes or relationships worth exploring in more depth in future studies.
**Design/methodology/approach**: The study took an exploratory, qualitative and quantitative approach. Data was collected through a survey using questionnaires with closed and unstructured open-ended questions. A snowball sample of 70 participants was used to describe the purchase context, emotions experienced and subsequent actions taken.
**Findings:** The study found that the most common and strongly felt emotions after an unsuccessful purchase were disappointment, dissatisfaction, anger and regret – with regret reported by over 75% of respondents. The main causes of negative experiences were poor product quality, misleading descriptions, delivery problems and poor customer service, most commonly related to online shopping. Strong feelings of regret made it difficult for participants to accept the situation and some reported changing their shopping habits as a result.
**Research limitations**: Although it is a pilot study, the main limitation of it is the small sample size. Additionally the open-ended questions make it difficult to analyse the data and generalize findings.
**Practical implications:** Organizations, retailers and marketers should pay attention to key triggers of negative emotions (as poor product quality, misleading online representations, and inadequate customer service) and introduce improvement and preventive actions in these areas.
**Originality/value:** The paper is based on own surveys and data analyses.
**Keywords:** consumer regret, post-purchase behaviour, negative consumer experiences, negative emotions.
**Category of the paper**: research paper.

## 1. Introduction

The decision-making process is inherently characterized by uncertainty, primarily due to the consumer's perceived risk. This risk perception is fundamentally linked to the consumer's concern about the potential for erroneous decisions, which may result in unpredictable adverse outcomes. The magnitude of risk undertaken by consumers during purchase decisions varies significantly and is contingent upon multiple factors. These include the price point of the product, the consumer's familiarity with the product, brand reputation, pre-existing expectations regarding the product, and the emotional context associated with the purchase.

Emotions are integral in the decision-making process. Consumers engage in thousands of daily decisions, frequently selecting products and services that fulfil their specific needs.

A review of the current literature reveals that there has been little attention paid to the study of regret from the customer's perspective. The role of emotions in decision making is well established, with affective reactions proposed to mediate the relationship between decision outcomes and subsequent consumer behaviour. However, gaps remain in fully explaining the complex interactions between individual differences, situational factors and the intensity of regret experienced.

Regret is a negative emotion experienced by consumers during the purchasing process, particularly in the post-purchase period. A number of factors contribute to this phenomenon. Perceived risk is one such factor, with the assumption being that as perceived risk increases, the consumer will experience greater regret for their purchases. Conversely, the consumer's regret affects their intention to repurchase (Ayidin et al., 2016).

The main objective of this paper is to present the results of a pilot study on customer regret in a negative purchase situation. Based on qualitative and quantitative analysis, the paper presents the context of regret, the causes of negative emotions, how people react afterwards, and suggests themes or relationships worth exploring in more depth in future studies.

## 2. Customer regret as a negative purchase experience

Emotions play an important role in decision making. Consumers are making thousands of decisions every day. They most often choose products and services that meet their specific needs. Each of these decisions entails some consequences, i.e. satisfaction or dissatisfaction, accompanied by various feelings, both positive and negative. Sometimes, consumers experience negative feelings after purchase. As notice Akci et al. (2016) this dissatisfaction can also be called regret. Nevertheless, these two emotional states diverge in a number of ways, and distinguishing between them is crucial for comprehending decision-making and emotion

regulation. Zelenberger and Piters (2004) argue against incorporating emotions such as regret and disappointment into a general (dis)satisfaction measure (i.e., the valence-based approach), and in favour of a specific emotions approach to customer dissatisfaction. Regret is typically associated with self-blame (Zeelenberg, Pieters, 2004), whereas disappointment is linked with attributing blame to external factors or circumstances beyond one's control (Zeelenberg et al., 1998; Nicolle, 2010).

The aversive nature of regret drives individuals to invest in information that mitigates its occurrence, even at the cost of diminished learning from errors and the potential for heightened regret over the long term (Nicolle, 2010). Empirical research indicates that regret exhibits a positive correlation with dissatisfaction; however, it does not significantly influence switching intention or the propensity for negative word-of-mouth (Lee et al., 2023). As noted by Lee et al. (2023), regret serves as a principal determinant of switching intention, whereas disappointment emerges as a significant predictor of negative word-of-mouth.

Regret is a complex emotional and cognitive phenomenon that has been defined and interpreted by various scholars across disciplines (table 1). Zeelenberger and Pieters (2007) observe that, in contemporary research, regret is studied across a wide range of fields. Examples include marketing, law, organizational behaviour, medicine, cross-cultural psychology, economic psychology, health psychology and neuroscience.

**Table 1.**
*Definitions of regret*

| Autor | Definition |
|---|---|
| Sugden (1985) | "the painful sensation of recognising that 'what is' compares unfavourably with 'what might have been'" |
| Landman (1993)<br>Patrick et al. (2003) | "a more or less painful cognitive and emotional state of feeling sorry for misfortunes, limitations, losses, transgressions, shortcomings, or mistakes" |
| Lee, Cotte (2009) | "regret is a comparison of individual's assessment of the outcomes between what has been bought and what could have been bought" |
| Patrick et al. (2003) | "unusually cognitively-laden or cognitively-determined emotion" |
| Akçi et al. (2016) | "a negative emotional state, characterised by regret, may emerge when an alternative that has been forgotten by an individual due to uncertainty or lack of knowledge is compared to the chosen option" |
| Zeelenberg, Pieters, (1999) | "is the emotion that we experience when realizing or imagining that our current situation would have been better, if only we had decided differently" |

Source: own, based on cited literature.

Undoubtedly, feelings like regret are accompanied by negative emotions such as:

- anger, irritation, upset, frustration and disappointment (Biu et al., 2009),
- guilt, shame, self-punishment, depression (Burnett, Lunsford, 1994; Zeelenberger, Pieters, 2004; Biu et al., 2011),
- anhedonic depression, anxious arousal (Roese et al., 2009),
- increased depressive symptoms and self-blame, self-recrimination and reduced self-worth (Sugden, 1985; Lee et al., 2023).

Even if regret can have a range of detrimental consequences for consumers and companies, there are strategies for minimizing its impact and promote emotional wellbeing.

It can be understood through examination of consumer regret maximize customer happiness, minimize post-purchase dissonance, and build long-term trust with buyers.

In considering the perception of regret from a philosophical, economic, and psychological perspective, Landman (1987) has reached the following conclusions:

- Regret, like other emotional experiences is characterised by a substantial cognitive component.
- Regret is associated with higher-order cognitive processes, including critical judgement, induction and decision-making.
- Regret cannot be reduced to cognitive processes alone. It is therefore necessary, though not sufficient, to define regret as a cognitive phenomenon.

The occurrence of consumer regret can be influenced by a number of factors which were presented in Table 2.

**Table 2.**
*Factors of regret*

| General classification | Regret factors | Autors |
|---|---|---|
| Decision-related factors | Perceived risk – fear of making the wrong choice | Ayidin et al. (2016) |
| | Perceptions of scarcity – Pressure from limited availability | Nasiry, Popescu (2009) |
| | Decision time – Time constraints affecting judgment | Lee, Cotte (2009), Gilovich et al. (1998) |
| | Type of product – Influence of product category on regret intensity | Sameeni et al. (2022) |
| | Level of commitment to purchase – Higher commitment leads to stronger regret if dissatisfied | Ayidin et al. (2016) |
| | Sense of responsibility – self-blame or a desire to make better decisions in the future | Zeelenberg, Pieters (2007) |
| Outcome evaluation factors | Forgone outcome – Awareness of a potentially better alternative | Zeelenberg (1999) |
| | Outcome reviews and process reviews – Assessing both the decision-making process and the result | Barta et al. (2023) |
| | Alternate outcomes – Comparing actual results with hypothetical scenarios | Dankwah (2024), Qingwei Jin et al. (2022) |
| | Counterfactual comparisons – Mental simulations of better possible outcomes | Nicolle (2010) |
| Psychological and emotional factors | Self-blame and responsibility – Holding oneself accountable for the decision | Nicolle (2010) |
| | Internal guilt, external guilt – Feeling personal remorse or societal pressure | Barta et al. (2023) |
| | Trust violation – Regret triggered by perceived deception or betrayal | Sameeni et al. (2022) |
| | Rumination – Repetitive thinking about the regretful decision | M'Barek, Gharbi (2012) |
| Behavioral factors | Impulse purchase – Regret stemming from rushed or emotionally driven decisions | Barta et al. (2023) |
| | Negative reviews – External feedback reinforcing regret | Barta et al. (2023) |
| | Under-consideration regret – Feeling regret due to insufficient deliberation | Lee, Cotte (2009) |
| | Personality factors – risk aversion, impulsivity, perfectionism, or emotional resilience | Vahedi Moakhar et al. (2018) |

Source: own, based on cited literature.

Components showed in table 2 interact to shape the intensity and duration of regret, influencing future decision-making and consumer behaviour.

It is also important to acknowledge the reciprocal relationship between regret and dissatisfaction. Dissatisfaction can give rise to regret as a consequence of the discrepancy between expectations and reality, which prompts comparisons with rejected options. Conversely, regret can result in diminished satisfaction due to the fact that the evaluation of the purchased product is not solely based on expectations, but also in comparison to the rejected alternatives (M'Barek, Gharbi 2012).

Even if regret is not something pleasant we can indicate its positive aspects. It can encourage individuals to learn from their missteps and to make more informed decisions in the future (Zeelenberg, Pietrs, 2007; Sijtsema et al., 2022).

## 3. Customer regret – results of own pilot study

The issue of consumer regret (as well as other negative customer perceptions) is present in research, but not yet adequately exploited. In order to take a closer look at this phenomenon in basic research, we conducted a pilot study. The aim of the study was suggesting research areas and relationships that might be interesting and productive for future research.

Our preliminary study took the form of a questionnaire, in which participants were asked to recall a recent purchase that triggered negative emotions — such as regret, anger, disappointment, or general dissatisfaction. They were free to choose any shopping situation that came to mind, without any restrictions. Respondents then described the context of the purchase, explained what motivated them to make it, identified the emotions it evoked, and shared whether they took any actions afterward. At the end, they were also asked whether they could find any positive aspects in the experience, despite the discomfort it caused.

Questions about these issues were open-ended and unstructured, which allowed us to gather a wide range of responses and uncover conceptual categories that could be useful for further research.

The questionnaires were distributed using the snowball sampling method. In total, we collected 70 fully completed responses. The majority of respondents were women (64.3%), and most were individuals who did not were running a household on their own. The basic characteristics of the sample are presented in Figure 1.

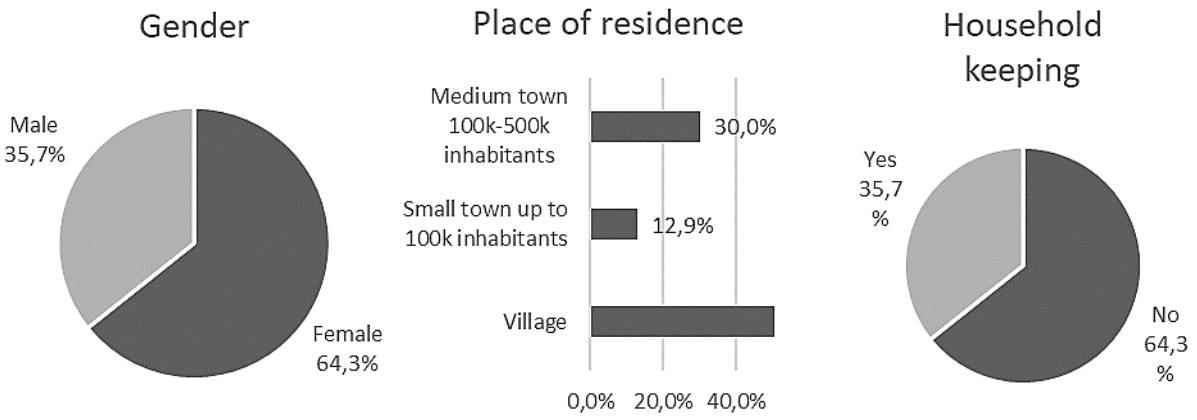



**Figure 1.** Main characteristics of the sample.

Source: own.

One of the questions in the questionnaire was about the feelings respondents were experiencing after an unsuccessful shopping situation. Respondents were given a choice of 10 feelings: such as dissatisfaction, regret, anger, frustration, disappointment, embarrassment, discomfort, fear, feelings of guilt, helplessness. In relation to each of these feelings, the respondents were asked to indicate whether it accompanied them after a failed purchase and, if so, how strong it was (strength was rated on a scale of 1 weak - 5 strong). The results obtained are presented in Figure 2.

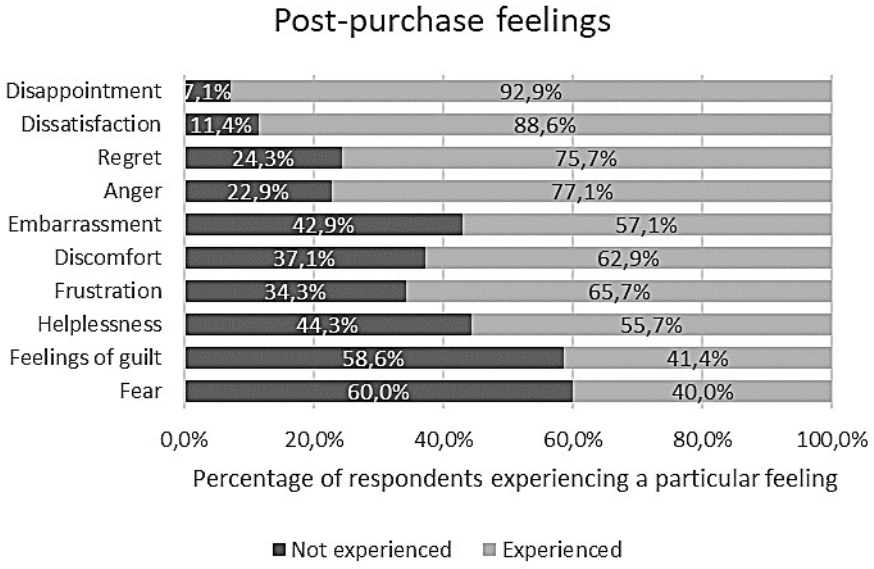



**Figure 2.** Feelings after a negative purchase situation.

Source: own.

The emotions most frequently reported by respondents in the aftermath of an unsuccessful purchase were disappointment, dissatisfaction, anger and regret. The latter sentiment was expressed by just over 75% of respondents.

By allowing the respondents to rate the strength of their feelings on a scale of 1-5, it was possible to calculate an average score for the intensity of the feeling. The results are presented in Figure 3. The results show that the most strongly felt feelings were similarly disappointment, dissatisfaction, regret and anger. It can therefore be concluded that these four feelings were most frequently experienced by the respondents and that their intensity was the highest.

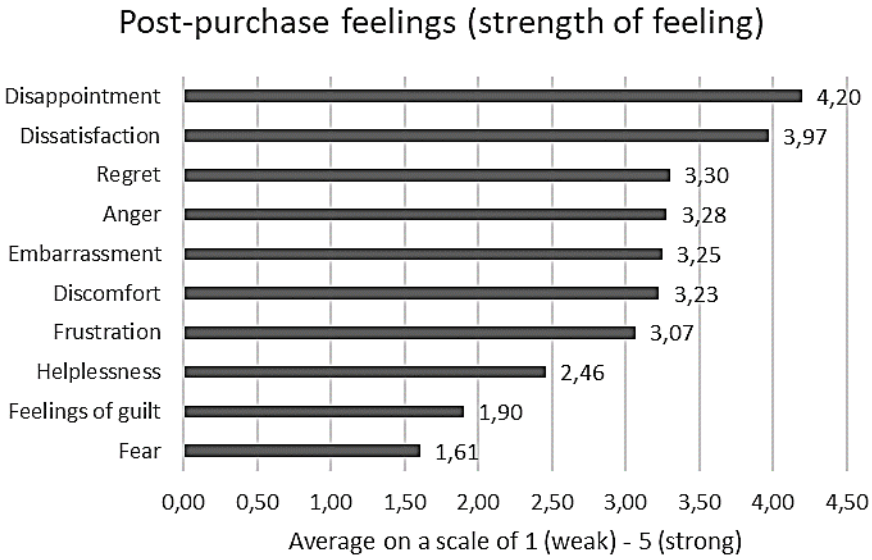



**Figure 3.** Strength of respondents' feelings after a negative purchase situation.

Source: own.

The majority of respondents (32.1%) rated their level of regret as moderate, 28.1% as strong and 17% as very strong (Figure 4). We decided to take a closer look at the group of customers who declared that they were accompanied by a strong regret related to a failed shopping situation (4-5 on the scale). This sub-sample comprised 24 people (or 34.3% of the total surveyed).

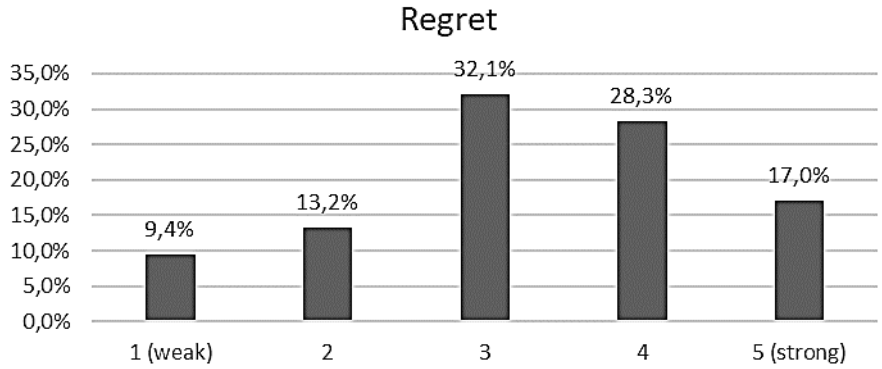



**Figure 4.** Level of perceived regret according to respondents.

Source: own.

Almost half of these people, 45.8% of the unsuccessful purchase was recent, up to a month, and a sizeable proportion of respondents up to a year. This may suggest that an unsuccessful shopping experience, not far removed in time, may compound the evaluation of negative shopping feelings. The main product categories for these purchases were clothing and electronics, as well as household appliances. Although the respondents were free to choose the item and the purchasing situation, it was these product groups that were most often chosen. The category other, located in third position, included specialised technical or hobby products, among others (Figure 5).

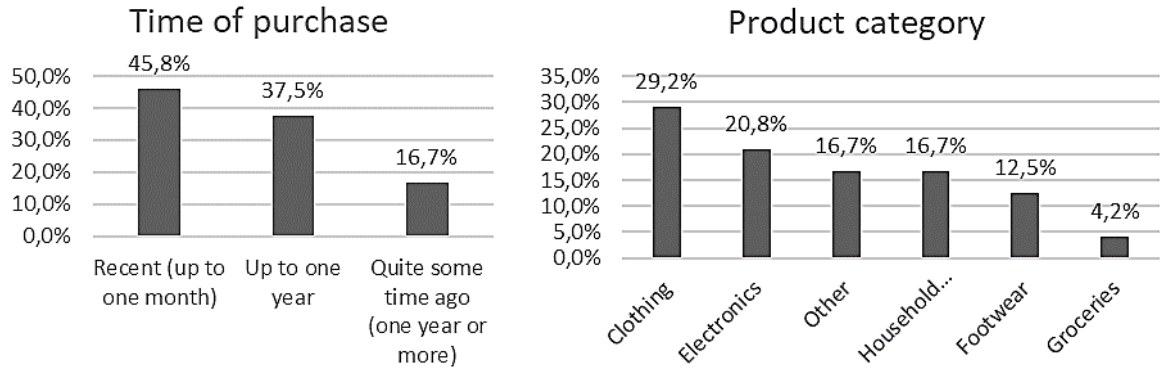



**Figure 5.** Purchase situation of respondents with strong sense of regret.

Source: own.

Looking at the data illustrated in Figure 6, it can be summarised that this was a product of a brand familiar to the respondent, rather normally priced, and importantly purchased online. Nearly 70% of the respondents in our survey chose a negative shopping situation related to an online purchase to complete the questionnaire.




**Figure 6.** Purchase situation of respondents with strong sense of regret.

Source: own.

We asked respondents about the reasons for their negative feelings. This was an open question and they were free to shape their statements here. The respondents' answers can be grouped into several categories:

- Quality problems – many products had visible defects (e.g., glue stains, scratched surfaces, damp smell, loose seams), clothing and footwear were often of poor material or construction (falling apart after minimal use).
- Misleading product representation – several respondents complained the actual product looked different from online photos, and was not worth the price, some did not match the description, leading to disappointment or did not meet advertised specifications (such as a lamp that only lit up in one colour or a GPS watch with poor signal reception).
- Delivery and order problems – delayed or cancelled deliveries, lost packages, causing confusion and frustration.
- Failing customer service – respondents described being misinformed, ignored, or even scolded when defects were present, returns and refunds were often denied, especially for used items, even when defects were present.
- Misleading recommendations — in one case, a pharmacist recommended a product unfit for use, resulting in additional costs and inconvenience.
- Price aspects – several customers felt the price was too high for the quality received.

These causes of negative emotions are summarised in Figure 7.

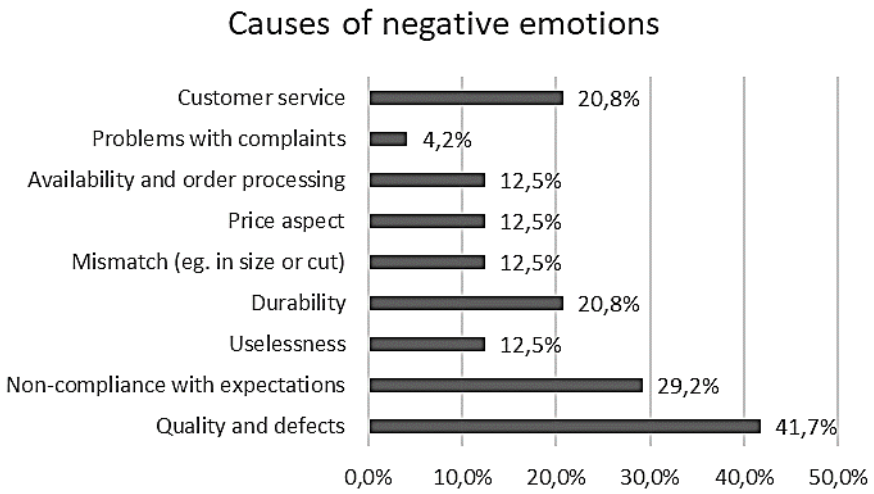



**Figure 7.** Summarized causes of respondents' negative emotions.

Source: own.

A negative shopping experiences causing feelings of regret allowed some respondents to draw conclusions, positive lessons and insights. These conclusions can be grouped as follows:

- Increased caution and awareness – many respondents reported that the experience made them more cautious and reflective, they plan to think more carefully before buying, some will check product quality more thoroughly (e.g. "I will look at shoes 5 times before I wear them"). They intend to read more reviews, verify sellers, and pay closer attention to product descriptions.
- Lessons about specific brands or product categories – respondents will to be wary of specific brand, product origins or specific vendors.

- Change in shopping habits – several participants expressed changes in how they will shop in the future, e.g. preference for shopping in physical stores, avoiding foreign websites or unknown platforms.
- Better understanding of personal needs and expectations – some of survey participant learned more about their own expectations or needs (e.g. knowing which features matter in a sports watch).
- Becoming more aware of the type and quality of products they want to invest in.
- Consumer rights – acknowledging that product failure wasn't their fault, and feeling validated by receiving compensation or apologies.

Unfortunately some respondent (29.2%) did not see any positive outcomes. This information in quantitative terms is collected on Figure 8.

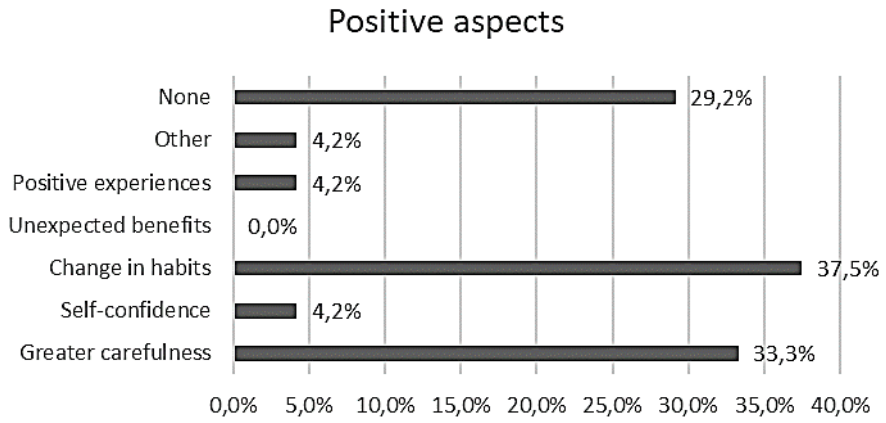



**Figure 8.** Positive outcomes of the described purchase situation.

Source: own.

In the last question, we asked respondents to declare on a scale from -3 (not at all) to +3 (completely this one) to what extent they accepted the described negative purchasing situation. The results are presented in Figure 9.

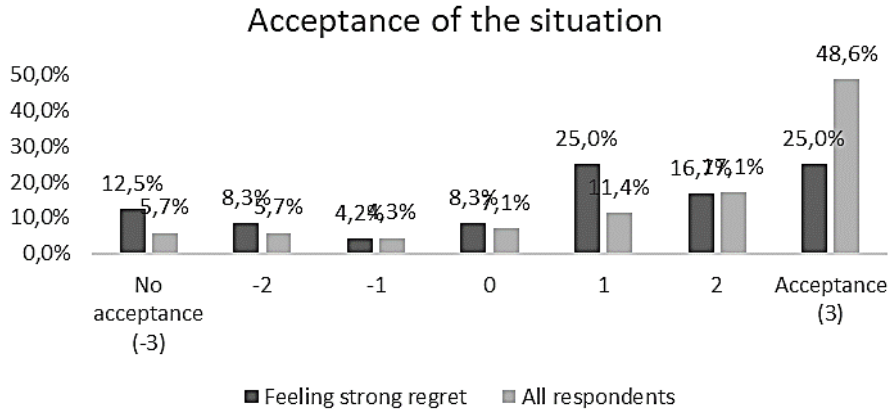



**Figure 9.** Acceptance of the the situation in the group of people declaring strong grief compared to all respondents.

Source: own.

At point -3 (no acceptance), regret declaring respondents constitute 12.5% of the sample, in comparison to a 5.7% of all respondents. Conversely, 25% of the strong-regret group fully accepted the situation (score 3), in contrast to nearly half (48.6%) of all respondents who reported full acceptance.

This suggests that respondents who experienced strong regret over their negative shopping experience were twice as likely to not accept the situation at all and half as likely to fully accept it compared to the broader group. This finding underscores the notion that strong emotional reactions, such as disappointment or frustration, hinder the process of rationalising or accepting a negative consumer experience.

## 4. Findings and conclusions

Regret encompasses both cognitive and affective dimensions, involving self-recrimination, guilt, and the realization that a different choice could have led to a better outcome. It involves evaluations of both the outcome (missed opportunities, changing significance) and decision-making process (insufficient or excessive consideration). Regret can be anticipated or experienced, and it involves personal responsibility and comparisons between options. Regret has both maladaptive (emotional distress) and adaptive (learning-driven) components, influencing future decision-making and personal growth.

The key findings of our study show that the most common and intense emotions following a negative shopping experience were disappointment, dissatisfaction, anger and regret, with regret reported by over 75% of respondents. These negative experiences were most commonly associated with online purchases of clothing, electronics and home appliances, typically from familiar brands at normal prices. The main causes of regret included poor product quality, misleading product representations, delivery problems, ineffective customer service and unmet expectations of price and value. While many participants reported increased caution and changes in shopping behaviour as positive outcomes, nearly 30% found no benefit from the experience. Importantly, those who felt strong regret were less likely to accept the situation, suggesting that high emotional intensity hinders rationalisation and acceptance of negative purchase outcomes.

Future studies should deeply explore consumer regret across different contexts, measure the relationships between specific causes of regret and consumer behaviour, such as return rates or brand switching, show how regret influences consumer decision-making and whether this influence is permanent or whether it changes, e.g. fades, over time.

These findings can be valuable for wide range of stakeholders. Retailers can understand what triggers strong negative emotions can improve product quality, enhance the accuracy of online presentations, streamline delivery logistics, and optimize after-sales service. Online

marketers and sellers should be aware that regret often emerges when products do not live up to their online depictions. Improving the accuracy of online presentations can build more trustworthy digital environments and foster a better shopping experience. For consumer behaviour researchers and scholars our work provides a framework for exploring consumer regret in future. The results of this preliminary research can inspire the exploration of new research areas related to customer regret and the formulation of regret models in these areas.

Presented finding offer some practical implications. Organizations, retailers and marketers should pay attention to key triggers of negative emotions (as poor product quality, misleading on-line representations, and inadequate customer service) and introduce improvement and preventive actions in these areas. Furthermore, the findings show the importance of building proper relations in online shopping, suggesting that transparent communication, easy return policies, and reliable delivery can significantly reduce negative emotion, like regret.

To make the results presented more practical, we can suggest several implementation strategies. Retailers and sellers should train customer service teams to proactively reach out to customers after purchase, especially for higher-value items or categories where problems are common, such as clothing and electronics. As research has shown, problems in these areas mainly escalate to consumer regret. Internet detailers should improve product representation in the online environment by using high-quality images, videos and detailed descriptions that accurately represent products. They should include customer reviews and FAQ sections to provide a comprehensive view of the product. It is important to improve and develop return policies – simplify the returns process, provide clarity on terms and conditions and consider offering free returns for faulty or misrepresented products. Clear and fair return policies can alleviate customer grief and build trust.

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# THE EVOLUTION OF EXTERNAL STOCK IMBALANCES IN CENTRAL AND EAST EUROPEAN COUNTRIES

Ewa BILEWICZ

University of Szczecin, Faculty of Economics, Finance and Management; ewa.bilewicz@usz.edu.pl,
ORCID: 0000-0003-0155-506

**Purpose**: The primary purpose of this paper is to examine external stock positions of Central and Eastern European (CEE) economies from the viewpoint of external sustainability risks in the aftermath of global financial crisis (GFC).
**Design/Methodology/Approach:** Research method applied in this study includes the overview of theoretical concepts, literature review and a comparative analysis based on statistical data.
**Findings:** The results of research show that since the end of the GFC stock imbalances of CEE countries has fallen towards safer levels. As a result, the external sectors of these economies appear more resilient to sudden stops in external financing. However, external sustainability concerns remain about external debt levels, especially in Hungary and Romania.
**Practical Implications:** Identifying potential risks to external sustainability is essential for designing appropriate economic policies that can prevent excessive foreign indebtedness and strengthen the resilience. The research results can be used to formulate economic policy, which influence the scale and the composition of external assets and liabilities, both in gross and net terms and help to minimalize external sustainability risks.
**Originality/Value:** While the analysis of external stock positions is well-documented in the literature for the euro area, similar studies focusing specifically on CEE countries remain limited. This paper aims to fill this gap by providing a comprehensive assessment of the external asset and liability positions in this region.
**Keywords:** stock imbalances, international investment position, CEE countries.
**JEL classification:** F34.
**Paper type:** Research study.

## 1. Introduction

Significant imbalance in external position of a country is a key channel through which financial crises can arise, in both developed and developing countries (Monastiriotis, Tunali, 2020). The dramatic increase in international financial integration in the last decades caused, that counties are much more vulnerable to cross border financial shocks, than in earlier periods.

The frequency and costs of crises stimulated interest in methods to assess whether a country's external position can be regarded as sustainable.

This issue has become particularly relevant after the global financial crisis, due to rapid accumulation of current account (flow) imbalances and large net external positions (stock imbalances) prior to the crisis. In the aftermath of the GFC flow imbalances were reduced in most countries, but stock imbalances still remain a major vulnerability in some countries (Pierluigi, Sondermann, 2018; Alberola et al., 2020). The process of sustainable rebalancing is essential for economies in order to prevent future crisis and ensure long-term stability.

Diagnosing post-crisis trends in external positions is important for identifying potential risks to external sustainability, particularly because external sectors have been strongly affected in recent years by the impact of the pandemic crisis and more recently Russian-Ukraine war. It has also policy implications, as policy makers need a clear understanding of external imbalances to design effective policies that can prevent excessive foreign indebtedness and strengthen resilience of economy.

The aim of the paper is to examine external stock positions of selected Central and Eastern European economies, from the viewpoint of external sustainability in the aftermath of GFC. Two key research questions are formulated in this study: (1) are current NIIP levels are prudent from the viewpoint of external stability risks? (2) which instruments and sectors lie behind most of the dynamics of the NIIP? For this purpose an investigation of international investment position (IIP) data for the five CEE economies, that are members of European Union, but not of euro area (Bulgaria, Czech Republic, Hungary, Poland and Romania) in the years 2010-2023 was carried out. While the analysis of external stock positions is well-documented in the literature for the euro area, similar studies focusing specifically on CEE countries remain limited. This paper aims to fill this gap by providing a comprehensive assessment of the external asset and liability positions in this region.

## 2. An overview of the literature

Traditionally assessing country's external balance on the basis of current account and corresponding net financial flows was sufficient (Lambert, Laurent, 2002). In the context of the growing openness of countries to international capital flows evaluating external sustainability solely on the basis of the current account balance does not reflect all the problems associated with ensuring external balance. The current account balance reflects the net flow of fund, but it does not capture accumulated external liabilities. As financial flows in the net category are typically significantly lower than in the gross category, a country may have balanced current account but accumulate large net external liabilities over time, increasing vulnerability to external shocks.

The experience of the 2008-2009 GFC proved that balanced current accounts were not the correct benchmark for external sustainability (Lane, Milesi-Ferretti, 2012). In the years leading up to the GFC, expansion of current account deficits resulted in a high level of net foreign liabilities of countries, that borrowed heavily (Lane, Milesi-Ferretti, 2012). As a result, an approach that has been increasingly used to assess a country's external sustainability (i.e. its vulnerability to sudden stops) is through the net international investment position (NIIP) (Pantelopoulos, 2024). The usefulness of the international investment position data in assessing the external balance of the economy stems from the fact, that it provides comprehensive information of a country's stocks of cross-border claims and liabilities and allows the analysis of both net and gross figures, as well as the their composition (Lambert, Laurent, 2002), thereby offering a more complete assessment of potential instability.

According to literature large net foreign liabilities can be a threat to external sustainability (Zorell, 2017). Countries with large net liability positions are more exposed to external sustainability risks. In times of global uncertainty, investors may withdraw funds quickly, leading to financial instability (Obstfeld, 2012). (Binici, Ganioglu, 2020) found that the net external position of a country significantly affects the likelihood of a systemic crisis. For countries with low to moderate financial development, being a net foreign creditor implies that a country could significantly reduce the risk of banking crises. NIIP in relation to GDP is one of fourteen scoreboard indicators applied by the EU's Macroeconomic Imbalance Procedure (MIP), which aims to identify, prevent and address the emergence of macroeconomic imbalances, that could adversely affect economic stability in the EU. The reference value is set at -35% GDP (The Maroeconomic Imbalance, 2016). Empirical studies show that when net external liabilities exceeds 50% GDP and is higher than 20% of the country specific historical mean, the risk of external crises rises sharply (Cato, Milesi-Ferretti, 2014). The results of (Harms et al. 2022) suggest that low-income countries face external sustainability risks at less negative NIIP levels than richer countries and creditor countries do not run external sustainability risks.

Another strand of literature, has focused on the composition of external assets and liabilities. Some authors pointed out that not only the level of the NIIP, but also its composition pose a variety of risks for external sustainability (Zorell, 2017; Catão, Milesi-Ferretti, 2014; Lane, Milesi-Ferretti, 2012). Vulnerabilities may be related to size of external assets and liabilities, excessive debt, sectoral distribution, currency mismatches, maturity mismatches or reliance on volatile funding sources (Zorell, 2017).

The prevailing view is that debt liabilities are a less stable source of financing than equity (Harms et al., 2022). They require fixed interest payments, regardless of the borrowers' economic situation, whereas the transfer of income from equity and foreign direct investment (FDI) liabilities depends on the profits achieved from economic activity and the macroeconomic situation of the country. Cato, Milesi-Ferretti (2014) found that only foreign debt instruments are a robust indicator of external crises in contrast to equity assets and estimated a threshold for

net external debt liabilities (NED) around 35% GDP (Galstyan, Herzberg, 2018). In contrast, (Reinhart, Rogoff, 2010) highlighted the role of gross external debt (GED) as a source of vulnerability vis-a-vis the rest of the world. They estimated a threshold of 60 % GDP above which the likelihood of crises increases. Also (Blanchard et al., 2010) showed that large external debt positions were an important predictor of output losses during the global financial crisis. (Boukef et al., 2017) distinguished among the gross stocks of foreign assets and liabilities to determine how debt and the components of equity differ in their impact on the occurrence of banking crises. Their results indicate that FDI liabilities reduce the probability of a crisis, while debt liabilities increase the likelihood of such crises. Portfolio equity seems to have little or no effect. In addition, lowering overall financial or political risk partially offsets the impact of debt liabilities on the incidence of the banking crises. Joyce (2017) examined the determinants of equity and debt liabilities on external balance sheets in a sample of 21 emerging market economies and 20 advanced economies over the period of 1981-2013 and found that, the composition of the external liabilities of emerging market economies switched from primarily debt to equity in recent decades and that countries with higher economic growth rates have larger amounts of equity liabilities. The development of domestic financial markets is also linked to an increase in equity liabilities, and in particular, portfolio equity. Similarly (Faira et al., 2007) found that shift towards equity financing is stronger among larger, more open economies with a better institutional quality score. As far as structure of assets is concern (Cato, Milesi-Ferretti, 2014) found that exchange reserves reduce the likelihood of crisis more than other foreign asset holdings.

The vulnerabilities created by debt can be further magnified by the presence of maturity mismatches (Bruneau et al., 2017). The share of short-term liabilities in debt is particularly important, as in the event of a "sudden stop", the repayment of these liabilities could be difficult. Analysing sectoral composition can also lead to a better understanding how each sectors' holdings are associated with the NIIP (Cian, 2019). The value of net external liabilities of particular sectors can vary greatly, which can also have implications for external sustainability. When a specific sector becomes too dependent on foreign capital, a sudden stop can trigger steep drops in asset prices and cause widespread financial instability. Banks dependent on foreign funding are especially vulnerable to rollover risks, currency risks, and global interest rate shock. Additionally, liabilities in foreign currencies heighten the fragility of domestic banks when exchange rates depreciate (Boukef et al., 2017). External liabilities concentrated in the public sector may create risks of sovereign default, particularly if government debt is high and foreign investors hold a large share (Boukef et al., 2017). Finally, the share of foreign liabilities denominated in foreign currency in total foreign liabilities exposes countries to exchange rate risk, since currency depreciation increases the burden of servicing and repaying foreign currency debt (Afonso et al., 2017).

## 3. Research methods

Research method applied in this study includes the literature review and a comparative analysis based on statistical data. The methodological approach is descriptive in nature, aiming to highlight structural differences and common trends within the region. The analysis focuses on the composition and dynamics of international investment positions, across selected CEE economies in time period from 2010 to 2023. The time frame of the analysis 2010-2023 allows for examining the changes that occurred in the post GFC years and during COVID-19 pandemic and post-pandemic recovery. In order to maintain comparability of data, the study was conducted on the basis of data from the Eurostat database, ensuring consistency and comparability across countries and time periods. For certain countries and variables, the data cover a shorter time span given their availability.

## 4. Results and discussion

The evolution of NIIP in relation to GDP of CEE countries is shown in Figure1. All countries were net debtors in the analysed period. Theirs' NIIPs in relation to GDP surpassed prudential benchmark, used in the scoreboard of the EU's macroeconomic imbalance procedure, for most of the years in the period under review. Since the GFC, the region has substantially reduced its net foreign liabilities, supported by strong GDP growth that helped narrow the negative NIIP-to-GDP ratio across all countries. Bulgaria and Hungary (countries with the largest negative positions at the end of 2010) stand out in the magnitude of the net declines. From 2010 to 2023, theirs' net foreign liabilities improved by 85 and 70 percent of GDP respectively. Despite the outbreak of the global COVID-19 pandemic in early 2020, this pattern continued in the region, except Romania and Hungary. In these two countries the NIIP position slightly deteriorated during the pandemic, but it significantly improved by the end of 2023. However, despite rebalancing efforts Romania and Hungary had negative NIIP in excess of 35% GDP at the end of 2023. Achieving the NIIP to GDP ratio that ensures external sustainability would require substantial and sustained improvements in current accounts of these countries.

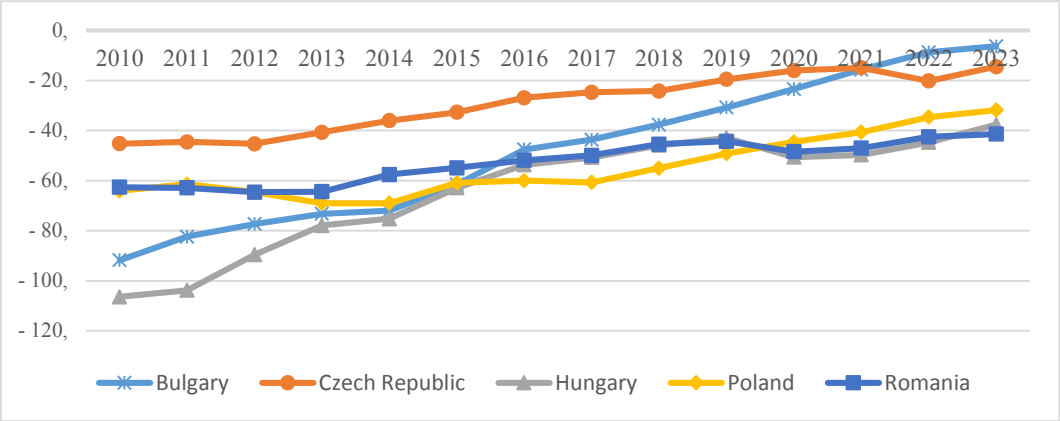



**Figure 1.** Net international investment position of CEE countries (as a percentage of GDP).
Source: Eurostat data: https://ec.europa.eu/eurostat/databrowser/view/bop_iip6_q/.

Table 1 reveals changes in the composition of NIIP by debt and equity instruments in relation to GDP (excluding official reserve assets). Since the Global Financial Crisis, CEE countries have experienced an increasing reliance on net equity liabilities in their external financing—a trend consistent with developments observed in several other countries worldwide (Joyce, 2019). In 2010, the region—excluding the Czech Republic—relied predominantly on net debt instruments to obtain external financing. Between 2010 and 2023, the improvement in the net foreign liability position was largely driven by developments in debt instruments, with the average net external debt position of the region narrowing significantly from a markedly negative level of –56% of GDP to –27% of GDP. It is worth noting, that part of the debt financing came from foreign direct investors, which made it more solid, than financing from entities not linked by capital. The value of net debt financing from direct investors, relative to GDP, remained broadly stable across the region, with the exception of Bulgaria, where it declined significantly—by 22 percentage points—since 2010. As of the end of 2023, net debt owed to foreign direct investors accounted for approximately one-quarter of total net foreign debt in the Czech Republic and Romania, and around one-third in Poland. In contrast, Hungary was a net creditor in this category, which partially offset its net debt in other components of the international investment position. Net liabilities in equity instruments also declined over time, albeit at a slower pace. Consequently, by the end of 2023, net equity instruments constituted a more prominent component of net liabilities compared to net debt instruments in most CEE countries, with the exception of Romania, which continued to exhibit substantial net debt liabilities at the end of 2023.

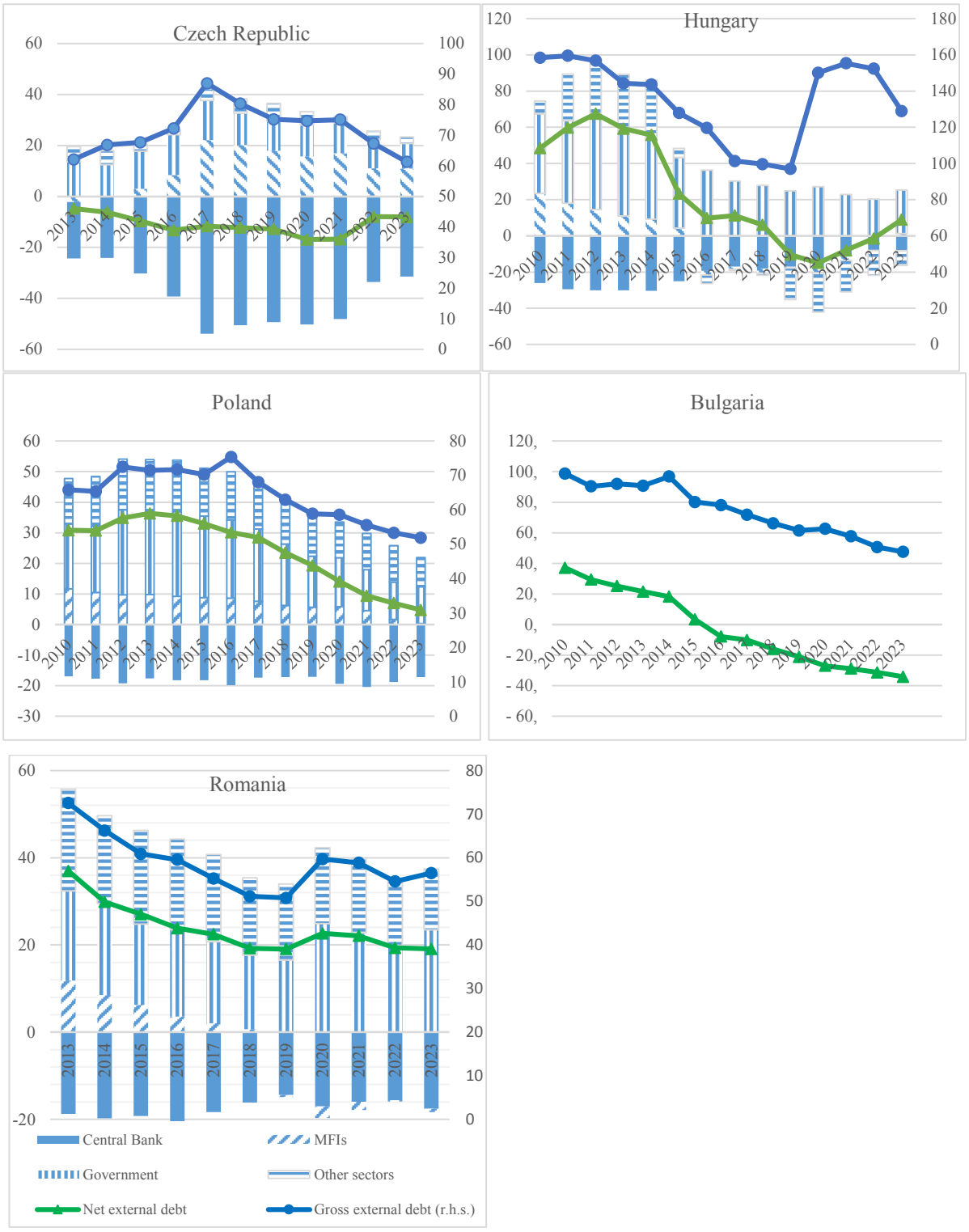
**Table 1.**

*Net international investment position by instrument of CEE countries (%GDP)*

| | Financial instruments | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bulgaria | Net equity instruments | -54 | -53 | -53 | -51 | -53 | -60 | -58 | -56 | -56 | -54 | -53 | -47 | -43 | -42 |
| | Net debt instruments (PI and OI) | -43 | -35 | -33 | -28 | -29 | -25 | -21 | -15 | -11 | -3 | -6 | -6 | -4 | -2 |
| | Net debt instruments (FDI) | -28 | -27 | -28 | -28 | -28 | -21 | -18 | -18 | -15 | -14 | -15 | -11 | -8 | -7 |
| Czech Republic | Net equity instruments | -48 | -44 | -49 | -46 | -45 | -46 | -44 | -43 | -41 | -39 | -41 | -40 | -36 | -30 |
| | Net debt instruments (PI and OI) | -12 | -11 | -11 | -14 | -13 | -18 | -22 | -41 | -35 | -33 | -29 | -31 | -24 | -20 |
| | Net debt instruments (FDI) | -5 | -5 | -6 | -4 | -6 | -3 | -5 | -5 | -6 | -6 | -6 | -5 | -6 | -5 |
| Hungary | Net equity instruments | -56 | -32 | -21 | -18 | -19 | -41 | -47 | -41 | -41 | -54 | -65 | -61 | -49 | -32 |
| | Net debt instruments (PI and OI) | -86 | -96 | -102 | -92 | -88 | -49 | -30 | -29 | -25 | -8 | -8 | -13 | -18 | -27 |
| | Net debt instruments (FDI) | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Poland | Net equity instruments | -34 | -27 | -33 | -34 | -33 | -27 | -30 | -35 | -32 | -33 | -32 | -34 | -30 | -33 |
| | Net debt instruments (PI and OI) | -42 | -42 | -46 | -45 | -44 | -42 | -44 | -38 | -33 | -30 | -27 | -24 | -20 | -18 |
| | Net debt instruments (FDI) | -7 | -8 | -9 | -10 | -10 | -10 | -10 | -10 | -9 | -8 | -8 | -8 | -8 | -7 |
| Romania | Net equity instruments | -28 | -27 | -29 | -29 | -30 | -30 | -30 | -29 | -28 | -27 | -28 | -27 | -25 | -24 |
| | Net debt instrument(PI and OI) | -51 | -51 | -49 | -45 | -38 | -35 | -31 | -28 | -23 | -22 | -27 | -26 | -25 | -27 |
| | Net debt instruments(FDI) | -11 | -11 | -12 | -14 | -12 | -12 | -13 | -12 | -11 | -12 | -12 | -12 | -11 | -10 |

Note. Financial instrument according to the broad groupings (equity and investment fund shares, debt instruments (PI – portfolio investment, OI – other investment), debt instruments (FDI – foreign direct investment). Official reserve assets are excluded.

Source: own study based on Eurostat data: https://ec.europa.eu/eurostat/databrowser/view/bop_iip6_q/.




Note. Sectoral breakdown of net external debt is not available for Bulgaria.

**Figure 2.** Gross external debt, net external debt by sector (as a percentage of GDP).

Source: own study based on Eurostat data: https://ec.europa.eu/eurostat/databrowser/view/bop_iip6_q/.

In the CEE countries, the net external debt-to-GDP (NED-to-GDP) ratio—including official reserve assets—remained significantly more favorable than the NIIP-to-GDP ratio and did not exceed the safety thresholds commonly referenced in the literature (Figure 2). This outcome can be attributed to the substantial share of net equity investments in the NIIP, as well as

significant holdings of foreign debt assets, primarily in the form of official reserve assets managed by central banks—the principal agents of outward investment in the region (Śliwiński, 2022). Notably, the Czech Republic recorded a negative NED-to-GDP ratio throughout the period, indicating that its residents were in a net creditor position vis-à-vis the rest of the world. Similarly, Bulgaria has maintained a net creditor status since 2016, and Hungary also held this position between 2019 and 2022 (Figure 2). In Romania, the COVID-19 pandemic led to a temporary increase in net external debt, although this was reversed by the end of 2023. In subsequent years, a deterioration in net creditor position in both Hungary and the Czech Republic was observed. The remaining countries did not experience a significant rise in net external debt as a result of the pandemic. The latest available results from (Alert Mechanism Report, 2025) support these findings.

Figure 2 reveals composition of net external debt in relation to GDP by sector in CEE countries. Despite substantial decline of net debt liabilities since GFC, government accounted for the significant part of the net external stock imbalances in region (except Czech Republic). This reflects the fact that the sovereign's gross foreign assets tend to be negligible, while its debt is often held by foreign investors (Zorell, 2017). At the end of 2023 the government sector remained the biggest net borrower in Hungary (24% of GDP), Romania (23% of GDP) and Poland (12% of GDP)**.** However, in the case of Poland, the government sector's debt-to-GDP ratio only marginally surpassed that of other sectors. A sectoral breakdown further reveals that, during the COVID-19 pandemic, the share of net government debt in relation to GDP increased substantially in Romania and to a lesser extent in Hungary, as countries resorted to external borrowing to counteract the economic fallout and finance public health expenditures. By the end of 2023, government net debt to GDP ratio in Hungary returned to pre-pandemic levels, but remained at higher level in Romania. The net foreign debt in relation to GDP of the other sectors category has also declined since the GFC. In Hungary, the net debt position of other sectors shifted into positive territory, while in the Czech Republic it became nearly balanced. In contrast, Poland and Romania continued to register sizeable negative net external debt positions in this category, which constitute a significant share of their overall net foreign liabilities. During the period under analysis, CEE countries also experienced a deleveraging of the monetary financial institutions (MFI) sector. By the end of 2023, banks in Hungary, Poland, and Romania held relatively small net debt positions, whereas the Czech Republic remained an outlier with a more pronounced position. It is important to note, however, that the net positions of the MFI sector often obscure substantially larger gross positions (Zorell, 2017). Central banks across the region maintained positive net debt positions, primarily due to their holdings of official reserve assets. Elevated levels of foreign exchange reserves serve as a mitigating factor against external vulnerabilities.

Although net debt position are currently more balanced in the region, gross external debt in relation to GDP still remain a source of external high at the end of 2023 in the region. Csonto, Chen (2024) also pointed to this risk to external sustainability of CEE countries. All countries

except Bulgaria, had debt ratios above 50% of GDP (Alert Mechanism Report, 2025). The most indebted economy in relation to GDP was Hungary, where the ratio surged during pandemic crisis from an already high level of 97% in 2019 to 157% in 2020 and is currently estimated at about 130%. These levels are generally associated with an increased vulnerability to external crises. However, a significant portion of this debt is owed to foreign direct investors, which partially mitigates associated risks.

More in-depth analysis of external balance also require determining the maturity structure of external debt. Eurostat data offer a maturity breakdown only for portfolio and other investment external debt (excluding FDI). Liabilities with maturities of less than 1 year constituted a smaller part of total liabilities in all countries except Czech Republic at the end of 2023 (Table 2). The largest part of gross external "portfolio debt" in the region was of a longer-term nature, with an original maturity of more than one year. The maturity structure of external debt in the "other investment" category was also dominated by long-term liabilities across the region (except the Czech Republic), but the margin by which long-term debt exceeded short-term debt was narrower. The government sector exhibited a favorable maturity profile in all countries, contributing to the mitigation of external sustainability risks. By contrast, the monetary financial institutions (MFI) sector in the Czech Republic held a relatively high share of short-term external debt, indicating a less favorable maturity composition. The government sector is the primary contributor to net external debt in the form of foreign portfolio and other investment liabilities.

**Table 1.**
*External debt in relation to GDP (excluding FDI) at the end of 2023 of CEE countries (%GDP)*

| | % of GDP | | By financial instrument | | | | By sector | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | | Portfolio debt | | Other investment | | MFIs | | General Government | | Other sectors | |
| Country | Long term | Short term | Long term | Short term | Long term | Short term | Long term | Short term | Long term | Short term | Long term | Short term |
| Bulgaria | 23 | 8 | 9 | 0 | 14 | 8 | 3 | 4 | 12 | 0 | 9 | 3 |
| Czech Republic | 21 | 23 | 14 | 1 | 7 | 22 | 5 | 15 | 10 | 0 | 5 | 6 |
| Hungary | 48 | 14 | 24 | 4 | 24 | 11 | 10 | 3 | 26 | 1 | 9 | 6 |
| Poland | 25 | 6 | 14 | 0 | 11 | 6 | 5 | 2 | 15 | 0 | 5 | 3 |
| Romania | 25 | 4 | 15 | 0 | 10 | 4 | 1 | 1 | 19 | 0 | 4 | 3 |

Source: own study based on Eurostat data: https://ec.europa.eu/eurostat/databrowser/view/bop_iip6_q/.

## 5. Conclusions

In summary, the analysis of external stock imbalances in the CEE countries suggests that, since the end of the Global Financial Crisis, external stock imbalances in Central and Eastern European countries have declined toward safer levels. By the end of 2023, these economies

exhibited diminished external sustainability risks due to reduced net foreign liabilities to GDP, an increased role of equity financing in net liabilities and the favorable maturity structure of debt instruments. Although the outbreak of the COVID-19 pandemic temporarily increased net and gross external debt ratios relative to GDP in parts of the region, a trajectory of gradual improvement has since resumed. Nonetheless, the high level of gross external indebtedness—particularly in Hungary and Romania—continues to present a source of vulnerability and limits resilience to adverse external shocks.

Based on the findings of this analysis, several policy recommendations can be proposed to strengthen the external sustainability of CEE countries and reduce persistent vulnerabilities, particularly in Hungary and Romania. To reduce high levels of gross external debt, it is essential that CEE countries maintain sustained current account surpluses. The region should continue the shift toward equity-based external financing, as this can enhance resilience by reducing exposure to debt-related risks. Strengthening domestic capital markets and fostering transparent corporate governance frameworks can help attract long-term equity investment. To mitigate vulnerabilities associated with elevated gross external debt, targeted debt management strategies should be adopted. These include lengthening the maturity profile of external obligations, reducing reliance on short-term borrowing, and enhancing debt transparency.

An important direction for further research is to determine the currency composition of foreign assets and liabilities and to examine its' impact on the external vulnerabilities of CEE countries. Since these countries maintain their own national currencies and are not part of the euro area, fluctuations in exchange rates can cause substantial changes in the valuation of external assets and liabilities. These valuation effects can distort the measurement of net and gross positions over time, making it difficult to distinguish between genuine improvements or deteriorations in external sustainability and those driven by currency movements. As a result, comparing IIP metrics across countries without accounting for exchange rate effects may lead to misleading conclusions regarding relative external vulnerabilities and risk exposure.

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# THE ROLE OF SOCIAL PROJECTS IN SHAPING A UNIVERSITY'S IMAGE – A CASE STUDY OF "BEE IN THE CITY"

Katarzyna BRENDZEL

Czestochowa University of Technology; katarzyna.brendzel@pcz.pl, ORCID: 0000-0003-1654-7046

**Purpose:** With the development of the market economy, the situation in the domestic market for educational services provided by universities has changed. Currently, it is characterized by increasing difficulties in attracting service recipients. Due to the demographic decline, the number of potential candidates for studies is decreasing, and some of them choose to study abroad. On the other hand, there is a large number of educational offerings, but their evaluation and selection are hindered by the intangible and specific nature of the service. In this situation, universities' image-building activities become a natural instrument for competing in the market. The essence of these activities is systematic communication with both the internal and external environment of the university to gain its approval (meet or exceed its expectations) and thus achieve a favorable market position. This raises the question: Do social projects implemented by universities contribute to building their positive image?
**Design/methodology/approach**: The aim of the presented study was to verify the claim that the implementation of social projects is an effective tool for building a positive image of Czestochowa University of Technology, using the example of the project "Been in the City". The study was conducted using a questionnaire survey. The research group consisted of high school students and teachers cooperating with the University, as well as university students and academic staff.
**Findings:** The study found that through social projects, the University fulfills its educational mission and engages internal stakeholders in solving local community problems. Social projects are an effective tool for building positive relationships with the environment, which is a crucial element of image building. Such initiatives must not be isolated or incidental, as inconsistent efforts may, over time, erode the University's credibility and have a detrimental impact on its institutional reputation and public perception.
**Originality/value:** The article outlines the principles of effectively utilizing a university's social engagement to shape its image. It emphasizes the importance of identifying stakeholders' needs and communicating valuable content. The study recommends implementing the concept of social engagement within the Czestochowa University of Technology.
**Keywords:** university, university image, social engagement, green university.
**Category of the paper:** research paper.

## 1. Introduction

The Higher Education Act, implemented in the 2019/2020 academic year, explicitly highlighted the need for a new perspective on the role and position of scientific and research institutions in the educational and research market. Consequently, this also raised the issue of building the image and reputation of these institutions. The new legal conditions governing their operations, combined with evolving socio-economic factors (broadly understood) and the necessity of internationalizing education and scientific research, have led to the need for re-evaluating many existing activities and tools used to shape the image and reputation of institutions in this sector (Gołata, Sojkin, 2020). This is particularly important in terms of their competitiveness—not only at the regional or national level but also in the international dimension—as well as in building relationships with the environment, including cooperation with internal and external stakeholders.

The university's environment consists of highly diverse and evolving groups of stakeholders (both internal and external), each with distinct expectations towards the institution (Piotrowska-Piątek, 2016). In this context, the assessment of the university's image and reputation will be a derivative of fulfilling these expectations, as well as addressing and creating new, innovative proposals. According to the author, a university should build a coherent image that is communicated in various ways through diverse communication channels. Different aspects come into focus when the university seeks to attract prospective students by shaping its image among high school students and their parents—highlighting its academic and teaching potential as well as the career prospects of its graduates (Uroda, 2014). On the other hand, when the university aims to establish partnerships with businesses that provide financial and substantive support, it primarily emphasizes its research and scientific potential, offering potential fields of collaboration with industry and the mutual benefits that arise from such cooperation.

Social projects appear to be an effective tool for building a university's image among various stakeholder groups (Gołata, Sojkin, 2020). The article presents the assumptions of the "Bee in the City" project, which has been implemented by the Czestochowa University of Technology in cooperation with partners since 2022. This example demonstrates that a university's social engagement is positively perceived by a wide range of stakeholders. This suggests that social projects are an effective and universal tool for shaping a university's image. The growing engagement in such initiatives is supported by the evolving awareness of local communities. This dynamic requires universities to observe their environment, respond to changes, and leverage current trends.

## 2. Stakeholder relations in shaping a university's image

In the subject literature, the distinction between image and reputation is primarily based on the time perspective of both concepts and the actions undertaken to communicate with stakeholders (Balmer, Gray, 2000; van Riel, Balmer, 1997; Vogler, Post, 2019). Reputation reflects long-term interactions (relationships) and the experiences that arise from them, forming a historical record of experiences. In contrast, image refers to the current, immediate, and most recent experience—an assessment of the institution's present external perception (Skowronek, 2012). Reputation is the result of images created based on behaviors, noticeable and recorded effects stemming from actions in the communication process, as well as the symbolism of a higher education institution. In the case of image and reputation, much has been written on the subject, particularly in the field of marketing, and mainly from the perspective of public relations, which aligns more closely with the concept of reputation as a reflection of an institution's image and position within its environment. In contrast, image is associated with the value of the relationship–opinion–evaluation as perceived by clients (Gołata, Sojkin, 2020). The author uses these terms interchangeably, as they focus on the same factors and generally serve almost identical purposes — namely, creating a desired image of the institution, as perceived by its management and stakeholders. This image is significant in the context of trust and the evaluation of the institution within a multidimensional market space, considered over both short- and long-term perspectives. For this reason, the author also introduces the term *visual identity* in the study to emphasize the importance of the institution's image in its environment.

The approach to interpreting these concepts and defining their scope is particularly important in the context of actions aimed at achieving a designated market position. This is especially relevant when considering these terms from the perspective of stakeholders. The development of relationships within a higher education institution should be understood as various forms of engagement in cooperation with internal and external stakeholders. The goal is to fulfill the tasks outlined in the institution's statute and strategy while securing the desired market position. Collaboration can take multiple forms, including education, communication, consultations, dialogue, coordination, partnership, research, commercialization, control, auditing, and the implementation of experiences and achievements (Grucz, 2012). A crucial aspect of shaping relationships is ensuring openness to changes occurring in the external environment and addressing emerging future challenges. These challenges are not limited to economic or political spheres but also include social, technological, and environmental aspects (Cymanow-Sosin, 2017). In the market environment, each of these collaborative approaches can take different forms depending on the objectives, the expected scope of cooperation, and the established operational principles. Additionally, the nature of these relationships is influenced by their stage—whether at the beginning,

development, maturity, or conclusion. The literature emphasizes that the implementation phase, relationship structure, and form of cooperation determine the value of these relationships (Storbacka, Lehtinen, 2001). Furthermore, it is important to highlight that both image and reputation represent a collective assessment of an institution's attractiveness to a specific group of stakeholders, particularly in comparison to other institutions competing for available resources. Therefore, relationship-building efforts should be individualized, considering the comparative and competitive nature of a university's image and reputation. Table 1 presents the groups of university stakeholders, categorized into internal and external stakeholders.

**Table 1.**
*Internal and external stakeholders of the university*

| Internal stakeholders | External stakeholders |
|---|---|
| **Rector** | **Public administration:** |
| **Senate, University Council** | Local government |
| **Employees:** | Political parties and politicians |
| Executive Authorities | Government authorities |
| Academic and Teaching Staff, | Local community |
| Research Staff, Technical Staff | **Economy:** |
| Administrative Staff | Enterprises and institutions |
| University Students and Prospective Students | Business people |
| **Internal Organizations:** | Labor market institutions |
| Student Government | *Companies supporting the university* |
| Student Organizations | **Environment:** |
| Trade Unions | Domestic higher education institutions |
| Retirees and Pensioners | Foreign higher education institutions |
| **Others:** | Scientific and research institutions |
| Alumni | Science funding institutions |
| Partners | Scientific community |
| Special Purpose Entities | Scientific and research organizations |
| | **Secondary schools:** |
| | Local |
| | Regional |
| | Traditional media (national and regional) and social media |
| | Social organizations |
| | Non-governmental organizations (NGOs) |

Source: Gołata, Sojkin, 2020, p. 34.

The group of internal stakeholders includes the university's rector, the senate, and university councils. This classification directly results from the provisions of the new Higher Education and Science Act, which grants these bodies new and significant competencies in university governance (Gołata, Sojkin, 2020). The rector holds a particularly important position as the creator of the university's structure and vision for its future development. The rector's leadership and personality can be a key factor in shaping the university's image and reputation in the evolving landscape of higher education in Poland. The rector is responsible for conducting scientific research, providing research services, and transferring knowledge and technology to the economy. Among other stakeholders, the most influential group consists of academic and research staff, who play a crucial role in shaping the market value of the university's re and reputation, both in daily operations and over the long term. Additionally, students and their families, as well as internal organizations, form two other vital groups that

contribute to building the university's image and, consequently, establishing a strong reputation. The remaining stakeholder groups serve to complement both the image and reputation of the university. As previously mentioned, the ways in which these relationships are realized change over time, and it is difficult to define a single, unified image. Instead, multiple images are formed by different groups, each contributing to the development of a cohesive, distinctive, and well-defined university reputation.

In the case of external stakeholders, the number of groups is significantly larger than that of internal stakeholders. Consequently, the forms of relationships and ways of establishing them are much more diverse. This is influenced by factors such as the educational offer, ownership structure, the number of external funding sources (projects, programs, grants), the intensity of interactions with the business environment, and the extent of collaboration with competitors. Thus, the cooperation between a university and its external stakeholders takes on highly varied forms. Additionally, the direction and strength of relationships between these stakeholders differ significantly (Piotrowska-Piątek, 2016).

A university thus has a substantial and diverse group of stakeholders, with whom building and maintaining relationships is a necessity in today's education market. Image is becoming an increasingly important attribute for any organization, particularly for higher education institutions. Effective communication with the external environment and relationship-building have become essential attributes of institutions that must respond to the challenges of the so-called new economy (Waszkiewicz, 2011). It is difficult to disagree with the perspective expressed by P. Morschheuser and J. Redler, who state that reputation, as an organizational characteristic, "is perceived as the key to competition in the market" and is "a crucial factor for future success" (Morschheuser, Redler, 2015).

The literature on the subject includes several studies on the image and reputation of Polish higher education institutions. For example, A. Waszkiewicz conducted research on several Polish universities, including Adam Mickiewicz University in Poznań, Jagiellonian University, Kazimierz Wielki University in Bydgoszcz, as well as the universities of Opole, Rzeszów, and Warsaw. The study focused on faculties of humanities and mathematics (Waszkiewicz, 2011). The research involved a population of over 700 respondents, and the author analyzed the university image through seven dimensions: moral authority, educator, creator of science and culture, employer, investor, financially supported entity, and knowledge transmitter. Meanwhile, the previously mentioned A. Piotrowska-Piątek focused her research on the stakeholders of Polish higher education institutions, including both public academic universities (as well as state vocational universities) and non-public institutions (Piotrowska-Piątek, 2016). These studies covered entities operating under the supervision of the Ministry of Science and Higher Education. The core research was preceded by a pilot study conducted in four universities in the Świętokrzyskie Voivodeship—one public and three non-public institutions.

These studies confirm that an institution's image results from interactions, perceptions, and acquired knowledge. Image is often shaped by opinions and the emotional attitudes of its audience (Ryłko-Kurpiewska, Łosiewicz, 2019). The perception of an organization is subjective and formed through the process of observation. Therefore, the image of a higher education institution is the sum of all impressions about that institution. This image is constructed based on the university's identity—its unique set of characteristics, norms, and values that distinguish it from its surroundings and make it easily recognizable. A university's identity is shaped by academic staff, administrative employees, and the student community. It is developed through clearly defined objectives and the institution's flagship strengths, which are emphasized in its communication with stakeholders (Wrzochul-Stawinoga, 2015).

## 3. Social engagement in university image building

Universities are increasingly leveraging social engagement as a key element in shaping their image. This applies both to preparing graduates for roles as knowledge workers in the evolving knowledge-based economy and to establishing strong ties with the business community and local government. According to K. Leja, a university fulfills its social responsibility only if it evolves into an organization that serves its environment (Leja, 2008). University social responsibility (USR) is, in fact, the equivalent of corporate social responsibility (CSR), as described by H. Ansoff, who referred to such organizations as "environment-serving organizations" (Ansoff, 1985). B. Wawrzyniak emphasizes that "a traditionally understood public institution must primarily meet the expectations of a diverse group of stakeholders" (Wawrzyniak, 2004), which constitutes the essence of its social responsibility. J. Sutz identifies a transformation in universities, which, in addition to their two traditional roles—educating students and conducting scientific research—are now undertaking a third, increasingly significant role: fostering mutual relationships with their environment (Sutz, 1997). This third mission is becoming a crucial factor in shaping a university's image. The "green university" concept plays a vital role in developing these relationships (Malinowska et al., 2023). Universities are implementing initiatives aimed at minimizing their negative environmental impact and promoting sustainable practices in education, research, and infrastructure (Geng et al., 2013). These actions align with the principles of the green university model and contribute to the positive image of institutions that proactively respond to contemporary challenges (Finlay et al., 2012).

In Poland, a Working Group on University Social Responsibility was established within the Team for Sustainable Development and Corporate Social Responsibility at the Ministry of Funds and Regional Policy. The group's objective is to promote the principles of university

social responsibility, as defined by the academic community in the Declaration of University Social Responsibility. This declaration represents the voluntary commitment of higher education institutions to integrating sustainable development and social responsibility principles into educational programs, as well as in university governance and organizational solutions. According to information published by the Ministry of Science and Higher Education (2024), 65 higher education institutions were signatories of the Declaration in 2017, increasing to 83 in 2019 and further expanding to 160 universities by 2022. In 2019, the first Catalogue of Good Practices in University Social Responsibility was published, showcasing initiatives from 40 Polish universities. By the 2022 edition, 53 universities contributed to the catalog.

According to the author, one of the key actions universities should undertake in this area is the implementation of initiatives that are significant for local communities—namely, the realization of social projects. On the one hand, universities fulfill their educational mission, while on the other, they engage internal stakeholders in addressing community issues, thereby fostering relationships with their environment. The author argues that certain conditions must be met for social initiatives to be effectively utilized in university image-building: the university must respond positively—but not uncritically—to stakeholder expectations; the degree to which stakeholder expectations are met is crucial in shaping the university's image; the selection of appropriate communication tools to promote social initiatives is essential.

## 4. Methodology of own research

A literature review indicated that the topic of building and managing a university's image through social engagement is rarely addressed. A search of databases (including Scopus, Web of Science, and Elsevier) yielded over 2000 publications on university image-building. An analysis of these publications in terms of research focus and data relevance showed that only 12 addressed the use of social projects in shaping a university's image. Most publications presented best practices in this area.

The aim of the study presented in this article is to verify the view that implementing social projects by a university is an effective tool for building a positive image. On one hand, the university fulfills its educational mission, while on the other, it engages internal stakeholders in addressing community issues, thereby fostering relationships with its environment. The study focuses on the project "Bees in the City," implemented by the Czestochowa University of Technology in collaboration with partners. This project was selected due to its broad range of stakeholders, including both internal (faculty, students) and external (elementary and secondary school students, parents, and the local community), as well as the diversity of activities undertaken within its framework.

"Bees in the City" is a partnership project that has been implemented since 2022, involving the Czestochowa University of Technology, the W. Reymont School of Fashion and Advertising Industry in Czestochowa, the Investor Service Center of the City of Czestochowa, the M. Skłodowska-Curie School of Gastronomy, and the Czestochowa branch of the League for Nature Protection. "Bees in the City" is an educational project aimed at children, school youth, university students, and the entire local community. It promotes knowledge about the role of bees in the natural environment and highlights the necessity of greening urban areas. Each edition of the project involves several kindergartens and primary schools from Czestochowa and the surrounding region. Educational institutions host thematic lessons and meetings with beekeepers. In previous editions:

- Video materials were developed on the life of bees, their importance in nature, and the properties of honey.
- Under the guidance of teachers and high school students from the M. Skłodowska-Curie School of Gastronomy, holiday pastries were made using honey.
- Dozens of flower beds and lawns located near educational institutions and within the Czestochowa University of Technology campus were sown with nectar-rich plants.
- An art competition titled "The Bee—A Friend of Humans" was organized.
- Bee hotels for mason bees and other pollinators were installed on the university campus. Initially, there were plans to establish an apiary on campus, but a regulation by the Czestochowa City Council excludes this area from livestock farming.
- Green space development on the university campus began, with landscaping efforts initiated by Landscape Architecture university students in 2024.
- High school students from the W. Reymont School of Fashion and Advertising Industry, along with Wioletta Podsiadlik, designed a bee-inspired clothing collection and organized a fashion show. The collection was made from eco-friendly and certified fabrics.

The study was conducted among high school students and teachers from 16 partner schools of the Czestochowa University of Technology, as well as the university’s students and staff. The analysis focused on the following areas: the university's visual identity, reputation, project implementation quality, marketing communication, social engagement, and loyalty. To achieve the study’s objective, the following questions were formulated:

P1: What conditions must be met for a university’s social engagement to be an effective tool for building its positive image?

P2: Do university social projects contribute to building long-lasting and loyal relationships with stakeholders?

The presented empirical research was conducted using a quantitative method between October and December 2024 through an online survey questionnaire. The survey was carried out via the interankiety.pl platform. The questionnaire consisted of closed-ended questions with

a five-point Likert scale to assess specific phenomena, as well as explanations of key concepts and a demographic section. The study was of a pilot nature. It aimed to determine whether modifications to the online survey questionnaire were necessary in terms of clarity and comprehensibility. This will enable further research on building a university's positive image.

## 5. Presentation of research results

A total of 408 individuals participated in the study, including 180 high school students and 32 teachers, as well as 140 university students and 56 academic staff members (Figure 1).

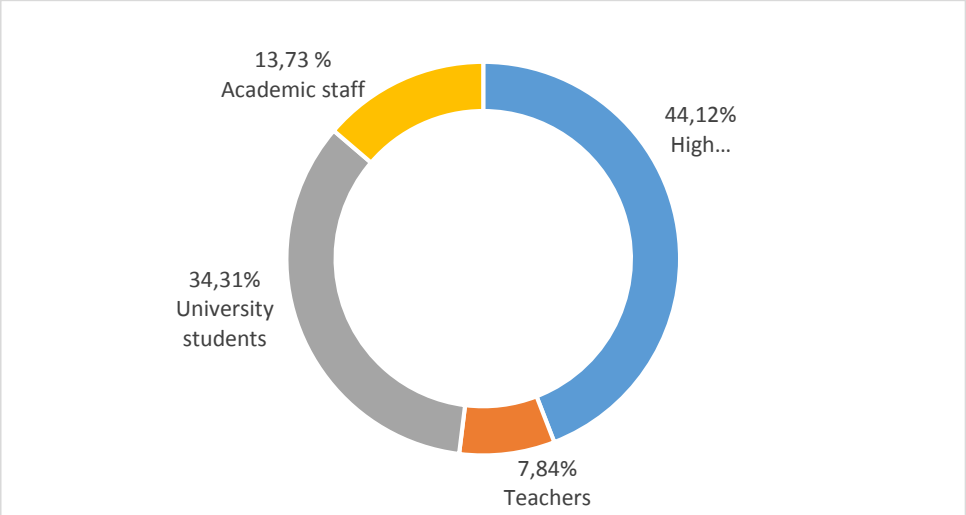



**Figure 1.** Characteristics of respondents.

Source: own research.

Table 2 present a detailed characterization of the research group. The vast majority of respondents participated in activities offered by the Czestochowa University of Technology, primarily workshops and educational projects. 65% of the respondents took part in the "Bee in the City" project.

**Table 2.**
*Characteristics of the study group*

| **Respondents** | **Yes** | **No** |
|---|---|---|
| Participation in the "Bee in the City" project | 65% | 35% |
| Participation in educational projects of Czestochowa University of Technology | 83% | 17% |
| Attendance at workshops/lectures * | 94% | 6% |

* applies to high school students and teachers.

Source: own research.

The study results confirmed that the implementation of social projects by the university is an effective tool for building a positive image. Through the "Bee in the City" project, Czestochowa University of Technology fulfills its educational mission. The research showed

that nearly 80% of surveyed academic staff learned about the existence of mason bees and their significant environmental role, despite the fact that they do not produce honey. Both students and university staff participated in the transformation of green areas within the academic campus. Notably, university students from Landscape Architecture and Design and Project Management programs played a key role in this process. In this way, internal stakeholders actively contribute to addressing a major community issue—urban concretization.

The study results indicate that social projects are an effective tool for building strong and lasting relationships between the university and its external stakeholders (Fig. 2). In particular, high school students and university students rate the activities of Czestochowa University of Technology in this area very positively. The university's social engagement is also rated highly, although respondents note that this involvement often consists of individual initiatives rather than a comprehensive strategy. As shown in the figure below, all key areas essential for shaping the institution's image received high ratings from all respondent groups.

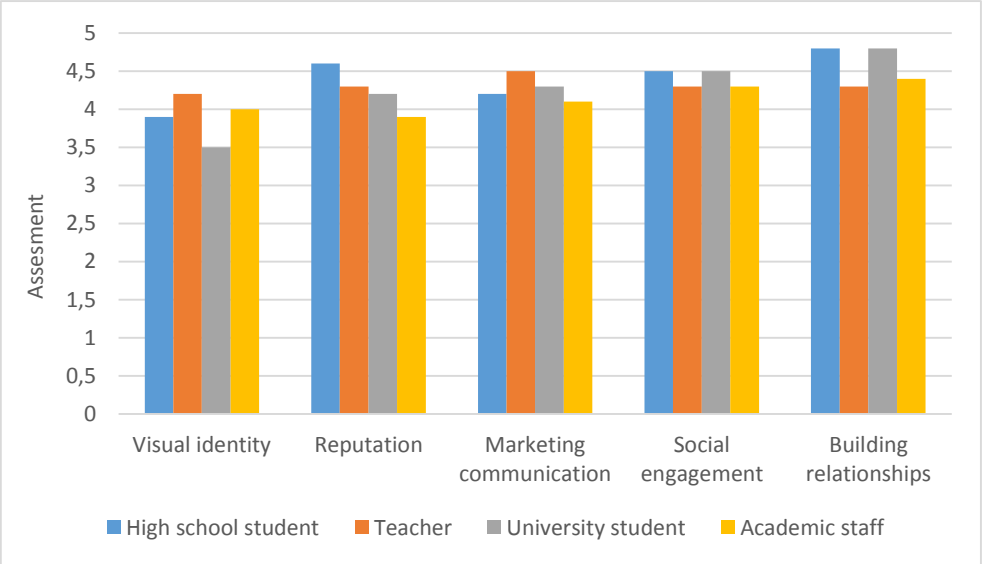



**Figure 2.** Evaluation of Key Areas for Building a Positive University Image: The Case of "Bee in the City".

Source: own research.

In the case of the study on "visual identity" and "reputation," the evaluation of these areas was compared between participants and non-participants of the "Bee in the City" project. In both cases, these areas received high ratings. It is not surprising that the ratings were higher among project participants by 0.5 and 0.3 points, respectively (Fig. 3).

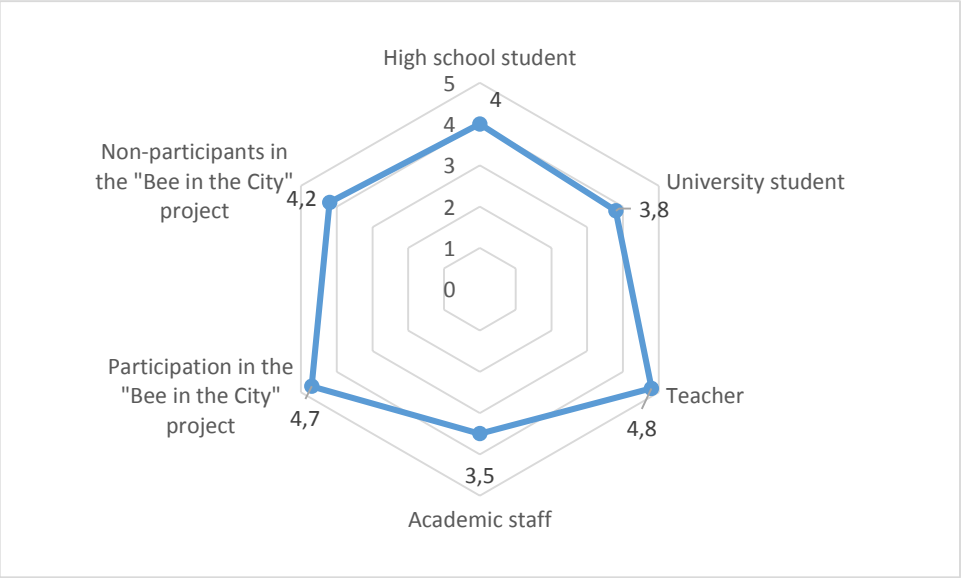



**Figure 3.** Visual Identity of the University in the Opinion of Respondents.

Source: own research.

The research results indicated the positive aspects of implementing social projects in building the positive image of Czestochowa University of Technology. Engagement in the "Bee in the City" project, especially its continuation and expansion with new activities, was recognized as a unique value characterizing the University.

The study confirmed that implementing social projects is an effective tool for building a university's positive image. The "Bee in the City" project allowed Czestochowa University of Technology to fulfill its educational mission while actively engaging internal and external stakeholders in addressing social and environmental issues. The results showed that participation in the project positively influenced perceptions of the university's visual identity and reputation, with higher ratings among those directly involved. Moreover, while the university's social engagement was highly rated, some respondents, particularly academic staff and students, noted that these efforts often take the form of isolated initiatives rather than a broader strategy. Overall, the findings highlight the importance of long-term commitment to social projects in strengthening stakeholder relationships and reinforcing the university's distinctive identity. The continuation and expansion of "Bee in the City" were recognized as key factors in shaping a sustainable and community-oriented institutional image.

## 6. Conclusion

The study highlighted a crucial aspect of leveraging university social engagement in building its public image. To ensure that social projects effectively contribute to a university's positive reputation, the following conditions must be met:

- Consistent communication of project activities – all marketing and communication efforts must align with the university's core values.
- Identification and fulfillment of stakeholder needs – during the implementation of the Bee in the City project, stakeholder needs assessments led to the expansion of activities. Respondents recognized this as a unique value. The internal stakeholder relationship, particularly with university students and faculty, sparked the idea of creating a green relaxation zone on campus.
- Creating valuable and inspiring content for the local community – the fashion collection created within the project raised awareness about the environmental impact of textile production and its influence on quality of life.
- Using diverse communication channels tailored to the audience – project-related content is shared through partner websites, social media accounts, YouTube channels, as well as local TV and press publications.
- Consistency and credibility in action – respondents emphasized the importance of the project team's dedication to building strong relationships with stakeholders.

By adhering to these principles, universities can effectively integrate social engagement into their brand identity, strengthening their relationships with both internal and external stakeholders.

The study suggests that the Bee in the City project could serve as a catalyst for implementing the Green University concept at Czestochowa University of Technology. Respondents, particularly university students and academic staff, highlighted key aspects related to enhancing the university's public image:

- Institutionalizing social engagement – instead of limiting efforts to isolated social projects, a structured approach to long-term social engagement is needed. Apart from Bee in the City, respondents mentioned only blood donation campaigns and animal shelter fundraisers as existing social initiatives.
- Involving the academic community in environmental actions – encouraging sustainable behaviors such as cycling, reducing paper consumption, conserving water, electricity, and heating energy, and improving waste segregation practices.
- Collaborating with external stakeholders on environmental initiatives – undertaking joint efforts with the local community to protect and improve the local environment.
- Promoting volunteerism within the academic environment – strengthening and encouraging student and faculty involvement in volunteer programs.
- Integrating social responsibility into the curriculum – university students pointed out a lack of content related to corporate social responsibility (CSR) in academic courses.

Further research is needed on the aspect of potential risks, such as the threat of greenwashing or stakeholder fatigue. Excessive exposure to such initiatives without real impact may weaken stakeholder trust and negatively affect the university's image. This strengthens the

argument for the necessity of institutionalizing social engagement. The long-term effectiveness of social projects depends on their integration into the strategic framework of the university. These insights underline the need for a comprehensive sustainability strategy at the university, ensuring that social and environmental engagement becomes an integral part of its identity rather than a series of isolated efforts.

Adhering to these conditions ensures the development of a positive image for Czestochowa University of Technology while preventing social projects from being perceived merely as branding efforts. This justifies the continuation of research within the university's academic environment, focusing on the implementation of the concept of social responsibility within the institution.

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# SOCIAL INNOVATIONS IN FAMILY BUSINESSES: FOUNDER-LED VS. NEXT-GENERATION LEADERSHIP

Agnieszka DOMAŃSKA-SIENKIEWICZ[1*], Beata ŻUKOWSKA[2]

[1] Uniwersytet Marii Curie-Skłodowskiej w Lublinie; agnieszka.domanska-sienkiewicz@mail.umcs.pl, ORCID: 0009-0006-3164-6201
[2] Uniwersytet Marii Curie-Skłodowskiej w Lublinie; beata.zukowska@umcs.pl, ORCID: 0000-0002-5644-6963
* Correspondence author

**Purpose:** Social innovations are important tools for alleviating social problems and fostering societal development. Their presence in the business sector is highly desirable, making it crucial to identify potential factors that support their creation. We find that family businesses can provide a favorable environment for social innovations. The purpose of this article is to present the importance and role of first-generation family business founders with management functions in the creation and implementation of social innovation.
**Design/methodology/approach**: In order to determine who contributes more to social innovations in family businesses—founders or successors—we conducted a survey on a sample of 485 family businesses. We utilized the Mann-Whitney U test to identify any significant differences in the implementation of social innovations between firms managed solely by founders and those led by successors. We utilized a validated scale to assess engagement in social innovations.
**Findings:** Our analysis demonstrates that the presence of the founder on the management board is a significant factor differentiating both the perceived importance and practical implementation of social innovations in family businesses.
**Research limitations/implications**: It should be underscored that we did not examine the dynamics within the management board (such as potential conflicts, succession plans, gender structure, and so on). Taking into consideration these potential factors might shed additional light on the barriers to implementing social innovations in family businesses.
**Practical/social implications:** In our research, we present various forms of social innovation implementation. Practitioners can find potential examples of simple solutions to make their businesses more socially oriented and enhance their reputation, which is particularly important for family businesses.
**Originality/value:** This study contributes to the understanding of social innovation in family businesses by exploring the role of founders and successors in driving socially oriented initiatives. Its value lies in providing empirical evidence on the differences in social innovation engagement between generations, offering practical insights for family business practitioners and policymakers.
**Keywords:** family businesses, social innovations, succession, founder-led businesses.
**Category of the paper:** Research paper.

## Introduction

The importance of family businesses in the development of social innovation can be considered at many levels through: 1) the conditions affecting the conduct of innovative activities, 2) the process of creating and implementing social innovation, 3) studying the effects of innovation, 4) identifying the factors determining the development of social innovation. In the business sector, social innovation includes: the creation of new products, services and processes that should respond to social, economic and environmental challenges and needs, as well as generate revenues. At the same time, social innovation should create new business values, which should not only be equated with revenue growth, but also with positive social change. Such an approach requires the creation of business models that are dedicated to social expectations and challenges, respond to the socio-economic problems of the modern world. Factors influencing the innovative nature of family firms are their social capital relating to the firm and the family, a source of competitive advantage (Herrero, Hughes, 2019; Arregle et al., 2007). It is shaped by a specific ownership structure, with family members' involvement in management functions, a corporate governance structure, a family-based organisational culture, as well as built-up multi-generational internal relationships and links between family members, a shared vision and goals, norms and responsibilities, and a sense of identity (Pearson et al., 2008; Hoffman et al., 2006).

A special role in a family business is played by the founders/persons (first generation). Their activity in the management structure has a significant impact on the way the family business is managed and the strategic and operational decisions taken (Lussier, Sonfield, 2009). Research indicates, among other things, that companies controlled by their founders, have a lower level of engagement in CSR activities (Dick et al., 2021). Furthermore, it is indicated that it is the next generation that is more willing to take riskier decisions and implement innovations (Zahra, 2005).

The purpose of this article is to present the importance and role of first-generation family business founders with management functions in the creation and implementation of social innovation. A key research aspect is to determine whether the founder of a family business with managerial functions is a motivator or demotivator for innovative change and to what extent this is a limiting factor for the company's ability to implement social innovation. The analysis of family firms points to their specific and unique characteristics, which are drivers of innovation, but at the same time draws attention to the presence of factors that perform limiting functions (Sopińska, Dziurski, 2023). In order to achieve the stated objective, quantitative research was carried out on a sample of 485 family firms. Tests of differences were used to assess whether family firms under the management control of the founders differ from family firms in which management functions are performed exclusively by representatives of successive generations.

The article is structured as follows: first, a literature review is presented on the nature of social innovation, innovation in family firms and the role of the founder in the family business. Based on the literature, the research hypotheses are formulated. Then the method of data collection, sample structure and research methods were discussed. Finally, the results are presented and conclusions are formulated.

## Theorethical background

### Social innovation

To analyzing the context of social innovation in relation to the business sector, it should be noted that they focus on selected criteria, variables and different conceptual approaches. Some of the definitions of social innovation refer to the classical view of innovation presented in the Oslo Manual, whose latest update (2018) also includes a reference to social innovation in terms of objectives related to improving the well-being of individuals or communities. "Social innovation are defined as new products, activities and services that are created to meet social needs and achieve social goals. Social innovation refers to new ideas that work in meeting social goals" (Mulgan et. al., 2007, p. 8). According to the European Commission's definition, social innovation can be defined as "the development and implementation of new ideas (products, services and models) to meet social needs and create new social relationships or collaborations. It represents new responses to pressing social demands, which affect the process of social interactions. It is aimed at improving human well-being. Social innovations are innovations that are social in both their ends and their means. They are innovations that are not only good for society but also enhance individuals' capacity to act" (European Commission, 2013, p. 6). According to the definition of the National Centre for Research and Development, social innovations are "solutions that both respond to a social need and bring about a lasting change in the social groups concerned. These solutions may involve innovative products, services or processes that enable typical social problems to be solved differently" (NCBiR, 2012).

Definitions of social innovation indicate that it can be characterised on the basis of criteria such as: the innovation must be new to users, the process or outcome of the innovation must be effective and more efficient than previous solutions, and the innovation should be useful over a longer period of time and its effectiveness is defined as its ability to meet social needs (Jędrych, 2016). A rich overview of the definitions of social innovation is provided in the reports of the EU 7th Framework Programme funding research project "The Theoretical, Empirical and Policy Foundations for Building Social Innovation in Europe (TEPSIE)", which developed methods to assess the effectiveness of innovation and policies and programmes to support social innovation.

Social innovation is identified in relation to its different areas of occurrence (Wronka-Pośpiech 2015): 1) social transformation encompassing the development of civil society and social entrepreneurship taking into account processes of social inclusion, economic growth, the role of business in social change and the importance of businesses in "social" fields such as education, healthcare, etc., 2) transformation of strategies and business models including social potential, human and institutional capital, generation of value for the general stakeholders, employees and society, improvement of the management process, improvement of – organisation efficiency and increase of competitiveness, non-profit management, 3) support and development of entrepreneurship oriented in its activity to search for innovative ways of solving important social problems, pursuing social objectives, 4) development of new products, services and programmes for implementation of innovations in the public sector, involvement of social enterprises and civil society organisations in meeting social needs, 5) development and implementation of good practice principles in private and public sector organisations within the framework of a new model of governance, increasing the role and competence of social institutions, their involvement in the preparation of strategies and implementation of socio-economic programmes.

In social innovation models, the business sector has a very important role to play in initiating the creation of social innovation by creating a platform for cooperation with other sectors. Business social innovation is also seen in the context of corporate social responsibility. By creating social innovations, family businesses can respond to social needs and improve the quality of life of specific social groups. Oriented towards social goals and values, integrating the principles of corporate social responsibility in business strategies, create a positive social impact. By creating social innovations, they become socially responsible companies. The business sector also has non-financial resources that are important in developing new solutions (Szul, 2017). Within the analysis of definitional approaches, the literature distinguishes business social innovation (*Corporate Social Innovation*), which gives companies the opportunity to create new products, services, business models to meet the needs of their customers, including those not previously considered in business strategies. Bisgaard T. defined business social innovation as a new products, services, business models, processes, distribution channels, etc. that respond to global challenges while addressing environmental and social issues. Social innovation can refer to managing complex relationships with multiple stakeholder groups, using technology to reach target groups that have been marginalised, co-creating a product or service in collaboration with different stakeholder groups, inducing social behaviour change through education and addressing audience needs or the need to engage unused resources and minimising resource consumption (Majchrzak, 2018).

According to the adopted model of social innovations from Sanzo-Pérez et al. (2024), there are: 1) social goal-oriented innovations, 2) social process-oriented innovations, 3) innovations included in the dimension of sustainable development. The first level of social innovation refers to social goal-oriented innovation (SGOAL), which means that the basic

element of its implementation is to satisfy social needs and expectations. The research area is concerned with social, economic and environmental aspects in relation to the internal environment of the family business and its customers. As examples of such innovations, we can include the implementation of health security programs for employees, the reduction of air pollution through the use of ecological heating systems, the introduction of waste sorting policy and others. The second level concerns social process-oriented innovation. This framing refers to the building of relationships with stakeholders at the stage of their creation, as well as the nature of social innovation based on cooperation and networking. The social process-oriented social innovation (SPROC) includes aspects related to, among other things: relationship building, collaboration with stakeholders, the process of creating products and services, modes of governance, the use of new technologies. Examples of such innovations include employee volunteering initiatives engaged in local community issues, involving customers in the product development process, and sharing knowledge about social innovations with clients, partners, and other stakeholders. The third level includes research on the dimension of sustainability (SUSTAIN) relating to the definition of social innovation as the application of practical, sustainable and practical approaches that benefit society as a whole, incorporating social goals, taking into account social, economic, environmental criteria (Sanzo-Pérez et al., 2024). Among such innovations, we can indicate, for example, the creation of trends that positively impact society—such as encouraging customers to be more physically active, eat healthier or pay attention to their mental well-being. As benefits of the implementation of social innovation by enterprises, it is pointed out that they increase their competitiveness, gain greater trust among its stakeholders, increase employee satisfaction and commitment, increase customer loyalty, create products and services that meet social and environmental expectations, increase sales, build a network of relationships with suppliers and business partners, strengthen the brand.

**Innovation in family firms**

Regardless of the adopted definition of a family business, more and more space in the research and scientific literature is devoted to the issue of their innovativeness and the factors that influence the development of family businesses. The analysis of the innovativeness of family businesses indicates their specific features, which are factors favourable to the implementation of innovations, but also the occurrence of features that perform a limiting or inhibiting function on their formation and implementation. On the one hand, conditions resulting from the family nature of these enterprises and attachment to tradition may reduce the propensity to implement innovative undertakings, but on the other hand, the long horizon of functioning of this type of entities on the market predisposes them to create and implement innovations (Sopińska, Dziurski, 2023).

In the literature, opinions on the innovativeness of family firms are divided. One points to the so-called ‘paradox of ability and willingness’ (De Massis et al., 2014; Dieleman, 2019), which refers to the lower propensity of family firms to engage in innovation activities compared

to non-family firms, despite a significantly higher capacity to innovate. This is due to the ability of family firms to identify opportunities and accumulate knowledge beyond their boundaries, driven by their non-economic goals (Zapata-Cantu et al., 2023). The reduced willingness to innovate, on the other hand, is due, among other things, to an above-average attachment to tradition and an increased concern for the reputation of the business and the corporate family (Hauck, Prügl, 2015). In contrast to non-family firms, which base their decisions mainly on economic considerations, family firms tend to prioritise a behavioural approach to decision-making, in which non-monetary goals are more important than purely financial goals (Chrisman et al., 2015). The concept of the socio-emotional wealth (SEW) model, highlights the influence of socio-emotional factors on strategic and financial decisions in family firms (Arzubiaga et al., 2021). Some studies show that family firms are more innovative than non-family firms (Muñoz-Bullón, Sanchez-Bueno, 2011) and place a high value on innovation (Craig, Moores, 2005). A review of the literature also indicates that characteristics that support the social innovativeness of family firms are: the ability to respond quickly to change (Pounder, 2015), social-emotional richness (Hauk et al., 2016; Arzubiaga et al., 2021), sensitivity to sustainability goals (Campopiano, de Massis, 2015).

According to the researchers, factors influencing the innovative character of family businesses are their social capital based on family relationships, jointly held moral norms or patterns of behaviour that are passed on to the next generation (Arregle et al., 2007). A strong customer orientation and focus on high quality of products/services offered, internal relations and connection between family members based on trust, solidarity and a sense of pursuit of a set goal, as well as strong commitment to the company, mutual altruism and care for future generations are mentioned as factors supporting the development of family business innovation. It is also indicated that when control of the family business is threatened, the family is willing to pursue riskier and more innovative ventures. The factors that can negatively influence the development of innovation in family firms are mainly the combination of business and family interest, lower risk propensity, conservative approach to change, reacting to changes in response to competitors' behaviour. The natural inclination of family entities to implement innovation processes due to their long-term perspective of operation is indicated. Moreover, factors such as family ownership and corporate governance structure, the family nature of the organisational culture and the ability to manage the family value of reconciling business interests with family benefits are conducive to the innovative activity of family entities (Sopińska, Dziurski, 2023).

The literature indicates that innovation attitudes are passed on to the next generation through succession and that innovation itself is generated by the family (Winnicka-Popczyk, 2015). But at the same time, it is pointed out that family businesses are nevertheless more likely to stick to tried-and-tested patterns of operation. The basic determinants of the innovative activity of family businesses include strong leadership (entrepreneurial orientation, global thinking, education and age of the leader), prior succession planning (presence of a strong, decisive

successor), an open ownership structure (as a leaven for innovation), and only then the size of the business or the sector in which it operates (Winnicka-Popczyk, 2016).

Sopińska A. and Dziurski P. (2023) identifies four model family attitudes in relation to the innovative activities of family businesses. These are : 1) the attitude of an active initiator - the family limits itself only to initiating innovative activities but does not get involved in their implementation, 2) the attitude of an active doer - the family does not initiate innovative activities but gets involved in their implementation, 3) the attitude of an active initiator and doer - the family is both an initiator of innovative activities and gets involved in carrying out innovative activities, 4) the passive (passive) attitude - the family shows no interest in innovative activities. As a result of the literature review and research conducted among family businesses in Poland, it was indicated, among others, that (Sopińska, Dziurski, 2023):

1. The innovative activity of family businesses is determined by a number of factors, of which familiness is of primary importance.
2. The combination of the positive aspects of familiness and openness towards innovation processes will foster innovation and, consequently, the success of family businesses.
3. Development and achievement of a higher level of innovativeness is fostered by a long-term perspective of operation of family entities and broadly understood family know-how, while it is lowered by limiting the realisation of management and decision-making functions only to family members.

Based on the above literature review, the following characteristics of family businesses were identified as potentially influencing the level of social innovation: long-term development goals, organisational flexibility, adaptability to change, less formalised organisational structure and management, social capital creating conditions for knowledge sharing among family members and company employees, customer orientation and quality orientation, fostering lasting relationships with stakeholders, links between family members based on trust and a sense of purpose, family members' commitment to the company and care for future generations (Sopińska, Dziurski, 2023). The attitude of family business owners and the business management model adopted, are crucial to how the characteristics of family businesses will enhance their innovation.

**The role of the founder in family business**

As one of the important aspects influencing the development of a family business is the attitude and role played by its founder representing the first generation exercising management functions.

The founder has a key function in shaping the strategic foundations of the organisation, including its mission, vision and long-term development goals. The founder's goal is to find a successor who will identify with the company's heritage and culture and develop it for the future (Marjański, 2012). The main tasks of the founder of a family business include "ensuring the operation of the enterprise, guaranteeing its survival, developing appropriate management

mechanisms, managing conflicts, creating various values and the basic activity of preparing and carrying out succession" (Zajkowski, 2018, p. 69).

Referring to the life cycle of a family business, it is possible to identify differences in the level of tasks and functions performed by the founder of a family business, which evolve with the growth of the business and its level of maturity. Winnicka-Popczyk A. and Popczyk W. (2004) distinguished three characteristic phases of the life cycle of a family business: 1) the creation stage, in which the company starts up, engages primarily its own capital, and bases the company's development activities on the work of committed family members focused on success, most decisions are made by one person; 2) the mature stage of the family business, in which the company increases the scale of its operations, undertakes competitive activities in the market and requires the involvement of professionals (primarily in managerial positions) who, with their experience, strengthen the development of the company. At this stage, successive generations appear in the company, not always as committed as the founders; 3) decline of the family business - the stage when the family ceases to have a dominant influence on the company. Depending on the development phase of the family business, the founder's importance changes from being the main initiator, leader and creator of the company's success, where the founder's role is leading, decisive and oriented towards ensuring the sustainability of the business, to performing management and decision-making functions at the strategic level within the developed organisational structure, up to the succession stage and taking over the role of the predecessor of the family business. At the stage of the company's development and expansion of its human, organisational or financial resources, the founder, in his/her function as leader and manager, is faced with the necessity of delegating tasks and making decisions leading to the professionalisation of the company. Including the involvement of external managers in the company's development strategy may in practice mean a clash with the vision of company development outlined by the founder as dominant. Family businesses are more likely to rely on alternatives based on family-accepted value systems, internal traditions, accepted norms and rules of conduct when it comes to management methods and development strategies (Jeżak et al., 2019). The transfer between owners and successors should not only be geared towards the transfer of management and ownership to the successor, but should also involve the 'know how' of running the business in question. This includes experience, management mechanisms as well as socio-emotional values that can be transferred between generations (Zajkowski, 2018).

The analysis of the peculiarities of family businesses points to attitudes, behaviours or styles of leadership of the family form by its founder that can significantly limit its innovation. A paternalistic style of leadership, which is conditioned by the leader's expectations related to the belief that he or she will perform his or her functions indefinitely and that the other employees are obliged to remain loyal (Winnicka-Popczyk, Popczyk, 2004). In addition, the phenomenon of centralisation of decision-making in family businesses may have a limiting effect on pro-innovative attitudes and the introduction of change at different stages of its

development, and may also have a limiting effect on its level of professionalisation. A factor hindering the development of the organisation is the inability to share power in the company with other employees (both family and non-family) (Whisler, 1988). Moreover, the level of decentralised decision-making in family firms may also be determined by the level of family relationships, including above all the existence or absence of intergenerational dialogue. If the company founder is reluctant to share power with the younger generation, there is resistance to handing over the running of the company to a successor. This means that he or she wants to influence the company's decision-making processes for as long as possible and thus may limit the company's flexibility to change, including inhibiting an open approach to innovation and reduce the chances of successors developing the company (*generational shadow phenomenon)* (Domańska et al., 2019). Another challenge in the context of the future development of a family business is succession understood as a long-term transfer process referring to the 3W model - ownership, power, knowledge (Safin et al., 2014). At this stage, owners as well as successors have to fulfil specific tasks and roles arising from the succession process itself and create interactions between themselves at different managerial and operational levels. The founder often faces difficulties in handing over control of strategic decisions, fearing the loss of influence over the direction of the company and the possible consequences resulting from the changes made. Building the right relationship in a family business between founder and successor increases the level of trust, intergenerational dialogue, openness and consequently allows for effective generational change (Zajkowski, 2018).

Factors affecting the course of succession that characterise the predecessor in a family business are: the degree of trust in the younger generation taking over the business, the need/necessity to step away from the role of often sole owner and manager of the family business, the fear of losing control of the family business, the belief in one's own infallibility in making key decisions, the potential for compromise between the predecessor and successor generations in matters concerning the family business, as well as the exhaustion of creativity and lack of involvement in the affairs of the business (Perz, Kaszuba-Perz, 2016). The innovation of family businesses may be limited by the seniors who want to maintain their position in the company and are less inclined to create and implement innovations (Steinerowska-Streb, 2016). On the other hand, a greater willingness to take risks, modern management styles and innovative approaches are more characteristic of the future successors of a family business. Therefore, innovation, sustainability or corporate social responsibility initiatives linked to the goals and values of the family are inscribed in the second and succeeding generations. With the succession process and the gradual transfer of power to the younger generation, management priorities and approaches to modern technologies and business models change. Successors are more likely to be more open to organisational transformation and the implementation of innovation strategies.

Shaping the organisational culture of family businesses based on family values and succession is a complex task, as it “requires a change of mindset, some concessions, investment in modernity and innovation and shedding some outdated norms and rules" (Łukasik, 2013, p. 41). Therefore, the sceptical attitude of the founder towards innovative solutions and change can limit and block the developmental attitudes of the younger generation and cause family conflicts (Kempa, 2016) The causes of intergenerational conflict are multidimensional and may arise from, among other things, interrelationships, inappropriate delegation of authority and responsibility, management methods, interpersonal problems, dilemmas within individual family members. The development of family businesses requires balance in all areas, including intergenerational cooperation (Zajkowski, 2018). The attitude of family business owners and the business management model adopted, as well as its level of professionalisation, are crucial to the development of social innovation. The greater innovative capacity of family firms tends to become apparent when members of the younger generation join the firm. Family businesses innovations can become an action strategy for future family business owners (Rondi et al., 2019).

The presented considerations regarding the innovativeness of family businesses and the importance of family business founders representing the first generation exercising management functions in the creation and implementation of innovations are reflected in the following hypotheses:

H1: In family firms managed by the founder, the social innovations are less important than in family firms led by the next generations.

H2: In family firms managed by the founder, the level of social goal-oriented innovation (SGO) is lower than in family firms led by the next generations.

H3: In family firms managed by the founder, the level of social process-oriented innovation (SPO) is lower than in family firms led by the next generations.

H4: In family firms managed by the founder, the level of the Sustainable Improvement Dimension (SID) is lower than in family firms led by the next generations.

In the following chapters, we verified the stated hypotheses using primary data collected from Polish family businesses. In Poland, due to its historical background, many family businesses are still managed or co-managed by their founders. This allowed us to examine the potential impact they have on social innovations within their businesses.

## Methods

### Sample

The data was obtained through a Computer-Assisted Web Interview (CAWI) survey conducted by an external research company between July and September 2024. Contact details for the firms identified as family businesses were provided by the co-author of the study. The sampling method was purposive (judgment sampling), employing a non-probability technique to ensure relevance to the research objectives. The study focuses on Polish family businesses that self-identify as family-owned, employ at least one person (to exclude sole proprietors), and have at least one family member actively involved in the management board. The final sample consists of 485 firms. Of these, 59% are still managed by their founder, who remains active in the management board, while 41% are managed exclusively by second or later-generation family members. The average number of employees in the surveyed businesses is 27.77. These characteristics are similar to those obtained in similar research among family businesses in Poland (Pernsteiner, Węcławski, 2016; Żukowska et al., 2021).

### Variables

We utilized items representing the dimensions or facets underlying the concept of social innovations, with a specific focus on goals (SGO), processes (SPO), and sustainable improvements (SID), as adapted from Sanzo-Pérez et al. (2024). This concept includes research questions and formative subscales for social innovations oriented towards social goals and social innovations oriented towards social processes, as well as reflective subscales for evaluating the impact of social innovation on sustainable development. The survey questions for family businesses were developed in three levels according to the adopted research model, which was designed and implemented in practice with reference to the non-profit sector, but its universal and multidimensional nature is also applicable to the entrepreneurship sector and the shaping of public policies related to social innovation.

Each dimension was examined in greater detail, considering various types of social goals and collaborative processes. All items are listed in the table below (table 1). Respondents were asked to indicate their level of agreement with each statement on a 1-5 Likert scale, where 1 represents "definitely disagree" and 5 represents "fully agree". Then, we calculated mean values for three analysed concepts: SGO, SPO and SID. We also introduced one general question (G1) in order to examined the significance of social innovations for family businesses.

**Table 1.**
*Items used in the study*

| Var | Statements |
|---|---|
| G1 | Social innovation - that is, the activity of providing new products and services to solve social problems, meet social needs and create social relationships - is relevant to your business. |
| **Social goal-oriented innovation (SGOAL)** | |
| SGO1 | Your company's activities contribute to the availability of training/education/competency enhancement for employees, clients, other audiences with whom you work. |
| SGO2 | Your company's activities contribute to increasing access to health services and preventive health care for employees, customers, other recipients with whom you work |
| SGO3 | Your company's activities contribute to increasing the availability of employees, customers and other recipients to basic products/services that affect the quality of their everyday life, e.g. food products, cleaning products, housing, means of transport, etc. |
| SGO4 | Your company's activities contribute to reducing environmental pollution. |
| SGO5 | Your company's activities contribute to the creation of new jobs. |
| SGO6 | Your company works to raise others' awareness of social issues. |
| SGO7 | Your company works to reduce social problems. |
| **Social process-oriented innovation (SPROC)** | |
| SPO1 | Your company implements new ways of building relationships with its business partners, customers, employees (social media, website, blog, networking, purchasing platform, etc.) |
| SPO2 | Your company is willing to include managers not previously associated with it in the management team |
| SPO3 | Your company is willing to develop and implement a collaborative governance model with external stakeholders. |
| SPO4 | Your company involves recipients/customers/partners in the design of its products/services. |
| SPO5 | Your company collaborates with non-governmental organizations, local authorities, and the local community. |
| SPO6 | Your company promotes social initiatives and participates in their implementation. |
| SPO7 | Your company takes part in building a community in its industry by exchanging experiences, participating in cooperation networks and industry events. |
| SPO8 | Your company uses modern technology to create new solutions. |
| **Sustainable improvement dimension (SUSTAIN)** | |
| SID1 | Your company contributes to solving social problems |
| SID2 | Your company's product or service solves the problems of a specific social group(s). |
| SID3 | Your company's activities influence the achievement of social change among its customers, employees or other audiences (e.g. in the way they behave, their lifestyle, the way they spend their time, the use of products/services, the use of new technologies). |

Source: Sanzo-Pérez et al. (2024).

The independent variable used in the research is the founder's status in management. We employed a binary variable that divides the sample into two groups. The first group consists of businesses where the founder is still active on the management board, while the second group includes firms managed exclusively by subsequent generations. Cases where no family member was active in management were excluded from the sample.

## Results

The surveyed family businesses generally exhibit a strong commitment to social innovation (table 2), particularly in areas such as reducing environmental pollution (SGO4, mean = 3.69) and utilizing modern technologies for creating new solutions (SPO8, mean = 3.67). Actions

aimed at increasing access to education, health services, and basic products are also emphasized, though with slightly lower mean scores (3.40-3.25), indicating a somewhat moderate level of activity in these areas. The data reveals that family businesses actively engage in building relationships with stakeholders (SPO1, mean = 3.57) and promoting social initiatives, such as participation in community-building within their industries (SPO7, mean = 3.55). It is visible that social process orientation is stronger that social goals orientation or sustainable improvement dimension. The social process oriented innovation are somehow natural for any business which is interested in escalating their businesses and those who care about their reputation. In the case of family businesses, their commitment to local communities has been extensively explored in the literature (Campopiano et al., 2014; Riviezzo et al., 2015). Studies consistently indicate that family-owned enterprises tend to engage more actively in positive social initiatives compared to their non-family counterparts (Bingham et al., 2011). This heightened involvement often stems from their long-term orientation, strong identification with local communities, and emphasis on preserving family reputation and legacy (Berrone et al., 2012; Cennamo et al., 2012).

**Table 2.**
*Descriptive statistics for specific items*

| Item | mean | sd | median | min | max | Skew | kurtosis |
|---|---|---|---|---|---|---|---|
| G1 | 3.414 | 1.175 | 3 | 1 | 5 | -0.341 | -0.672 |
| SGO1 | 3.402 | 1.140 | 3 | 1 | 5 | -0.310 | -0.698 |
| SGO2 | 3.175 | 1.268 | 3 | 1 | 5 | -0.161 | -1.015 |
| SGO3 | 3.245 | 1.157 | 3 | 1 | 5 | -0.286 | -0.633 |
| SGO4 | 3.687 | 1.076 | 4 | 1 | 5 | -0.626 | -0.098 |
| SGO5 | 3.586 | 1.128 | 4 | 1 | 5 | -0.519 | -0.396 |
| SGO6 | 3.408 | 1.207 | 3 | 1 | 5 | -0.292 | -0.827 |
| SGO7 | 3.404 | 1.210 | 3 | 1 | 5 | -0.278 | -0.866 |
| SPO1 | 3.571 | 1.138 | 4 | 1 | 5 | -0.519 | -0.498 |
| SPO2 | 3.348 | 1.168 | 3 | 1 | 5 | -0.204 | -0.878 |
| SPO3 | 3.528 | 1.099 | 4 | 1 | 5 | -0.462 | -0.395 |
| SPO4 | 3.544 | 1.168 | 4 | 1 | 5 | -0.510 | -0.604 |
| SPO5 | 3.404 | 1.225 | 3 | 1 | 5 | -0.313 | -0.791 |
| SPO6 | 3.443 | 1.167 | 4 | 1 | 5 | -0.338 | -0.722 |
| SPO7 | 3.553 | 1.137 | 4 | 1 | 5 | -0.453 | -0.592 |
| SPO8 | 3.668 | 1.094 | 4 | 1 | 5 | -0.620 | -0.261 |
| SID1 | 3.353 | 1.181 | 3 | 1 | 5 | -0.240 | -0.743 |
| SID2 | 3.499 | 1.162 | 4 | 1 | 5 | -0.439 | -0.565 |
| SID3 | 3.392 | 1.142 | 3 | 1 | 5 | -0.348 | -0.628 |
| SGO_total | 3.415 | 0.882 | 3.429 | 1 | 5 | -0.340 | -0.233 |
| SPO_total | 3.507 | 0.869 | 3.625 | 1 | 5 | -0.526 | 0.103 |
| SID_total | 3.414 | 0.966 | 3.333 | 1 | 5 | -0.336 | -0.292 |

As the variables were not normally distributed (Shapiro-Wilk tests confirm that), the assumptions for using parametric tests were violated. Therefore, we decided to conduct the Wilcoxon-Mann-Whitney U test to examine significant differences between the groups. The results are presented in the table 3.

**Table 3.**
*Differences between examined groups and their significance*

| Construct | W_statistic | p_value | Group 1 – Inactive founder | Group 2 – Active founder | Hypothesis | Decision |
|---|---|---|---|---|---|---|
| G1 | 31700 | 0.023 | 3.569 | 3.309 | H1 | Confirmed |
| SGO_total | 34866 | 0.000 | 3.613 | 3.280 | H2 | Confirmed |
| SPO_total | 33838.5 | 0.000 | 3.679 | 3.390 | H3 | Confirmed |
| SID_total | 32752.5 | 0.004 | 3.567 | 3.310 | H4 | Confirmed |

Conducted tests have confirmed all stated hypotheses. Our analysis demonstrates that the presence of the founder on the management board is a significant factor differentiating both the perceived importance and practical implementation of social innovations in family businesses ($p < 0.01$). This finding contributes to the growing body of literature on generational effects in family firm management and innovation practices.

## Discussion

We positively verify that in family firms managed by the founder, the social innovations are significantly less important than in family firms led by the next generations (H1). This results resonate with previous studies that have characterized founders as less socially oriented than their successors (Dick et al., 2021). The observed pattern can be explained through the lens of Gersick et al. (1997) framework, which posits that the primary objective of a founder-led family firm is to secure sufficient resources for its development. In the early stages of a family business, the focus on economic stability may leave limited capacity for pursuing innovative challenges or initiatives.

In addition to examining the perceived significance of social innovations, our study explored and compared the level of implemented social innovations across family companies (H2, H3, H4). Our findings reveal that family businesses managed by founders exhibit significantly lower levels of all types of social innovations compared to firms where the family founder is no longer present on the management board ($p < 0.05$). Interestingly, extant literature provides evidence of a contrasting phenomenon for family businesses' corporate social responsibility (CSR). According to Park (2024) in founder-led businesses, the gap between the intention behind social initiatives and their actual implementation is smaller than in firms led by successors. However, a study by Bingham et al. (2011) did not support the hypothesis that greater founder involvement in a family business leads to a higher number of community, employee, and consumer-focused social initiatives. Given that social innovations are often connected with environmental initiatives, it is also important to note that the existing literature suggests a lower green orientation in founder-driven family businesses compared to next-

generation companies (Fernández-Méndez, Arrondo-García, 2021). This disparity is especially evident in the scale of investments into green technologies, which tends to be higher in next-generation family businesses (Mullens, 2018). According to the subject literature, while founders demonstrate superior capability in creation and leveraging existing innovations (Kellermanns et al., 2012) successor generations drive more dynamic innovation cultures (Zahra, 2005), particularly as founders shift focus toward stability and wealth preservation (Lorenzo, Núñez-Cacho, 2015). Social innovations, being rather recent phenomenon, may be perceived by founders as too abstract or insufficiently business-oriented. It should be the role of the next generation to raise awareness about the importance of such initiatives and to demonstrate their long-term benefits to the founding generation. Next-generation representatives are particularly best suited for this task, as they tend to be more familiar with new technologies (Lannon et al., 2024) that support social initiatives, more aware of social and environmental risks, and more eager to implement their own ideas into the business (Domańska et al., 2024). It is also important to emphasize that the implementation of social innovations requires specific resources. Although these innovations may not demand substantial financial investment, the time and effort needed to organize them can be significant. In the early stages of a family business—when the enterprise is just starting out—it typically relies on its own capital and the commitment of family members (Winnicka-Popczyk, Popczyk, 2004). These resources are often limited and primarily directed toward establishing the core foundations of the business. Nevertheless, this should be viewed as a strategic challenge: to integrate social innovations into the business model from the outset. The benefits they offer—such as strengthening stakeholder relationships, enhancing brand recognition, and increasing employee engagement—are precisely the outcomes sought by emerging enterprises.

## Conclusions

Thanks to their unique characteristics rooted in socio-emotional wealth, family businesses can be seen as a suitable environment for fostering social innovations. The benefits of engaging in social change can be both intangible—such as enhancing reputation and fostering a sense of being a social game-changer—and tangible, as simple social innovations that support employees in achieving work-life balance or developing their talents can help attract and retain top talent, ultimately leading to measurable financial gains.

Our results suggest that the involvement of the founder in family business management can serve as a barrier to social innovation creation. This can be explained by literature suggesting that founders may become more conservative when it comes to less familiar, riskier initiatives. On the other hand, these individuals established the businesses, demonstrating the entrepreneurial characteristics needed, including risk-taking. Probably, in the case of social

initiatives, the older generation does not see their business potential. We conclude that it is the role of subsequent generations to implement these practices within the business. They are particularly well-suited to do so, as they are more oriented toward sustainability issues, including social and environmental concerns. As a managerial implication, it can be suggested that family business leaders should listen to next-generation representatives and allow them to present their ideas, which can be refreshing for the business and not only socially beneficial but also advantageous for the company's sustainable development. Caring about employees, customers, the local community, and society in general can be rewarded in the long term with a positive reputation and legacy, factors crucial for securing the long-term survival of family businesses. As practical guidance for policymakers and educators, we recommend that programs aimed at supporting social innovations among entrepreneurs should also be promoted as suitable for businesses in their early stages of development. This would encourage entrepreneurs to incorporate such innovations into the core assumptions of their business models from the outset. It is also advisable that organizations cooperating with family businesses—such as associations and research institutes—actively disseminate knowledge about social innovations. They should aim to convince both senior and next-generation family business leaders that these solutions often do not require significant financial resources, but rather simple organizational adjustments.

The paper has its limitations. It should be underscored that we did not examine the dynamics within the management board (such as potential conflicts, succession plans, gender structure, and so on). Taking into consideration these potential factors might shed additional light on the barriers to implementing social innovations in family businesses. The phenomenon of social innovation itself is a challenging issue for researchers with regard to the increasing dynamics of socio-economic change, as well as changes associated with the development of information, knowledge-based societies.

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# SHAPING THE QUALITY OF A MANUFACTURING ORGANISATION IN THE CONTEXT OF SELECTED ASPECTS OF STRATEGIC MANAGEMENT

Marta DUDEK-BURLIKOWSKA

Silesian University of Technology, Faculty of Mechanical Engineering, Department of Mechanical Engineering; Marta.Dudek-Burlikowska@polsl.pl, ORCID: 0000-0003-2056-7250

**Purpose:** Presenting an original methodology for assessing opportunities and threats to a manufacturing organisation, which uses proprietary scenario sheets of possible events to gather information for formulating the organisation's strategy. With the input assumption that the organisation wants to increase its participation in global markets and thus achieve success.
**Design/methodology/approach**: A mature organisation that is quality-focused is aware of the need for strategic thinking in each of its fields of operation and in each of its processes, with a constant assessment of the opportunities and threats resulting from the relations between the production enterprise and its environment. The proposed methodology provides an opportunity to obtain information, translate it into a formulated strategy and thus into effective actions. Thanks to the attributes included in the developed scenarios, the organisation has the opportunity to verify its attitude to the implementation of the indicated activities, namely: concerning the development through the indicated opportunities; as well as the probability of the occurrence of threats in relation to the indicated activity. The graphical form of the power diagram template for groups of criteria such as Customer Orientation, Organisational Improvement, Strategy and Organisational Culture, Production Process and Technology Management, Intellectual Capital Management, Quality Management, Occupational Safety and Environmental Protection, will allow the organisation to react and adapt to change more quickly in today's dynamic markets.
**Findings:** The most important findings relate to obtaining the information needed to formulate both the organisation's strategy and to estimate the potential level of management risk. In addition, the scenarios built and their analysis will allow the corporate entity to be able to react more quickly to external and internal stimuli and will influence the reduction of time when making decisions related to the functioning of its own entity.
**Research limitations/implications**: The formulated worksheets of scenarios are a proposal for an organisation that is quality-oriented, is a learning organisation, and thus consciously transforming itself towards complex, holistic strategic concepts that influence market positioning and success. At the same time, it should be remembered that the organisation's ability and level of use of the empirical knowledge gained will depend on an objective estimation of the quantities according to the adopted scale. In conclusion, a lack of objectivity will consequently work to the disadvantage of the organisation.

**Practical implications:** The proposed scenario sheets will allow for the evaluation of the negative and positive strength of the attributes' influence in scores and significance, as well as further trend analysis and the formulation of a pessimistic, optimistic and most likely scenario. They will thus provide an input for defining the company's strategic objectives.
**Social implications:** Continuous development of the organisation, understanding of its opportunities and threats will improve the work experience as well as create a company culture.
**Originality/value:** The publication contains the author's development of worksheets of possible events, including a form for the most positive scenario, the most negative scenario and the most likely scenario in the assessment of the organisation, as well as a template for a strength of influence chart for a group of attributes and their factors. The defined attributes and factors were formulated in accordance with the adopted methodology for building the MSOP self-assessment model using the Quantitative Priority Grading methodology, of importance approach, the AHP method and expert interviews.
**Keywords:** organisation, strategy, quality, environment, scenario methods, trend analysis.
**Article category:** Scientific article.

## 1. Introduction

The modern production organisation, operating in the current market, regardless of its size and type of production, is focused on achieving success. Thus, the organisation is aware of being subjected to a number of endless transformations, the main aim of which is to constantly adapt to changing dynamically growing market requirements and, at the same time, to meet the expectations and needs of both regular and potential customers. Consequently, it is important to be proactive, to recognise the need for change and to intensify internal development-oriented activities. In particular, this concerns the creation of an appropriate corporate strategy in the context of its development and the shaping of quality in all areas of its activities. At the same time, the unit is aware that the strategy it develops should be integrated with the vision, mission and quality policy, with implemented goals ranging from strategic to tactical to operational. It should also include an appropriate and factual distribution of responsibilities according to the competences of the employees, with a map of the organisation's processes and a clear structure adopted.

Thus, different aspects of the competitiveness of the organisation and thus the conditions for the formation of the strategy of the production organisation turn out to be: information, quality, knowledge intellectual capital organisational culture technology openness to effective ways of working. By developing an appropriate strategy in a quality-oriented organisation linked to a process- and employee-oriented improvement methodology, it is possible to transform its weaknesses into strengths and thus reduce threats and increase opportunities in a dynamic environment. The validity of such an outlook is reflected in the opinion of E. Skrzypek, S. Tkaczyk, who believe that looking at quality in an enterprise today is undoubtedly becoming the most important management mechanism and strategy element leading to a modern form of industrialisation (Skrzypek, 2000; Tkaczyk, 2010).

Viewing the management of a quality-oriented production enterprise in this way correlates with the need for a proper analysis of defining opportunities and threats to the organisation, as well as the formulation of scenarios of possible events, ranging from the pessimistic, through the most likely, to the optimistic. At the same time, with the above in mind, in each of these ways of analysing the organisation's activities affecting the construction of the strategy and, consequently, the perception of its success; uncertainty also manifests itself. E. Fermi rightly observed that (...) supposedly unquantifiable issues in business reveal secrets through the simple method of observation, once the illusory veil of unquantifiability is lifted (...)'. D. Hubbard defined measurement as the result of insights that quantitatively reduce uncertainty (Hubbard, 2013).

An organisation should therefore be aware of possible risks, uncertainties and hazards. According to PN-ISO 31000:2012, the impact of uncertainty on objectives is risk. It causes a deviation from expectations - either positive or negative. It seems right, therefore, to perceive the actions aimed at eliminating risk contained in the ISO 9001:2015 standard, according to which the organisation should plan actions aimed at eliminating aspects of risk and exploiting opportunities that have been defined, identified. The actions taken are to correlate proportionally with the potential consequences of the unworthiness of products, services and customer satisfaction.

In this context, the article presents the author's scenarios of possible events developed on the basis of the Model of Self-Assessment of a Quality-Oriented Production Organisation (MSOP) (Dudek-Burlikowska, 2023) and the adopted scale of assessment of potential negative and positive impact strength in the point and meaning system. The proposed solution adds value in the context of collecting information for the formulation of the enterprise's strategy, as well as providing an opportunity to assess opportunities and threats within the organisation and indicating the need to translate them into relations with the closer and further environment.

## 2. Quality oriented production organization and its environment – theoretical aspects

### 2.1. Organization management and its environment

Organisational governance is a very complex structure, many times difficult to define clearly. It is therefore worth taking a look at selected solutions, concerning management and thus the organisation management K. Perechuda defined management as an activity aimed at solving emerging problems in the course of achieving goals, and that is: pursuing goals consciously and non-randomly, implementing knowledge and skills to solve problems and making the "right" choices (Morawski et al., 2010). According to W. Griffin, management is a continuous process of creating rules, norms, forms and descriptions that bring organisations

closer to achieving intended goals based on a formulated strategy. It is a set of organising, controlling and planning functions that are structured and performed by the actions of managers (Griffin, 2001). R. Pascale and A.G. Athos, on the other hand, have formulated a set of "seven S" that act as determinants of effective organization management and have a clear impact on a company's ability to succeed (Fig. 1) - one of which is strategy (Zbiegień-Maciąg, Długosz-Truszkowska, 1995; Rasiegel, Friga, 2004).

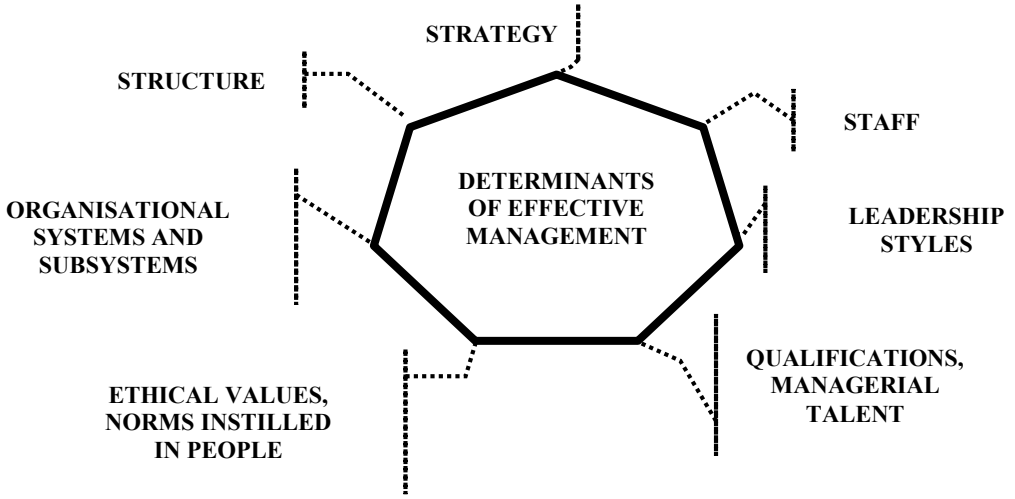



**Figure 1.** A set of "seven S" acting as determinants of effective management.
Source: own work on the basis of Zbiegień-Maciąg, Długosz- Truszkowska, 1995.

J. Penc uses the following formulation: (...) Management is a type of management in which the title to exert influence on the hierarchy and systems of values, interests and aspirations, as well as attitudes and organisational behaviour of those managed results mainly, although not exclusively, from the manager's command over, or the fact that the manager has at his disposal, material and energy or nominal and informational resources of particular importance for the functioning and development of the organisation, or from the very conviction of those managed that the manager has the possibility of obtaining these resources. (...) Management is a kind of 'wandering through chaos', the construction of reality from the elements available to the manager: ideas, people and relations between them, formal and legal institutions, material resources (machinery, equipment, buildings, materials, finished goods, etc.) and money, as well as the rights to dispose of them (...) (Penc,1997, 2007).

Bearing in mind the evolution of the approach to management, starting with the classical approach, through behavioural, systemic, situational and ending with the approach creating management as a philosophy of creating added value for the organisation (resource-based), it is possible, according to the proposal of Ł. Sułkowski, we can distinguish three areas of defining management, namely (Morawski et al., 2005; Sułkowski, 2005): management interpreted as the implementation of tangible and intangible resources to achieve set objectives, management perceived as a decision-making process, management as a method of leadership, exercising power and formulating strategy.

The above considerations can only reinforce the validity in perceiving organisational management as a very complex and variously defined aspect that voluntarily combines the three proposed tracks of thinking in the category of efficient management of contemporary organisations (Sułkowski, 2005).

P. Drucker notes that the organisation management aimed at the achievement of defined goals is a complex system, which includes many factors, it is, in his opinion, "(...) the dominant institution in the world today, (...) reflecting the beliefs of modern Western society (...) the belief in the possibility of controlling the means of human existence through the systematic organisation of economic resources (...) (Drucker, 1994). The modern approach to organisational management, as proposed by P. Drucker, is presented in Fig. 2. The indicated features of management emphasise the importance of such elements as: forms of influence on human resources, ethics in business, behavioural norms, information flow in management, effectiveness in taking actions aiming at the implementation of the set goals, economy of production (Drucker, 1992; Dołhasz et al., 2009). And as a result, they have a huge impact on the formation of quality and the formulation of corporate strategy.

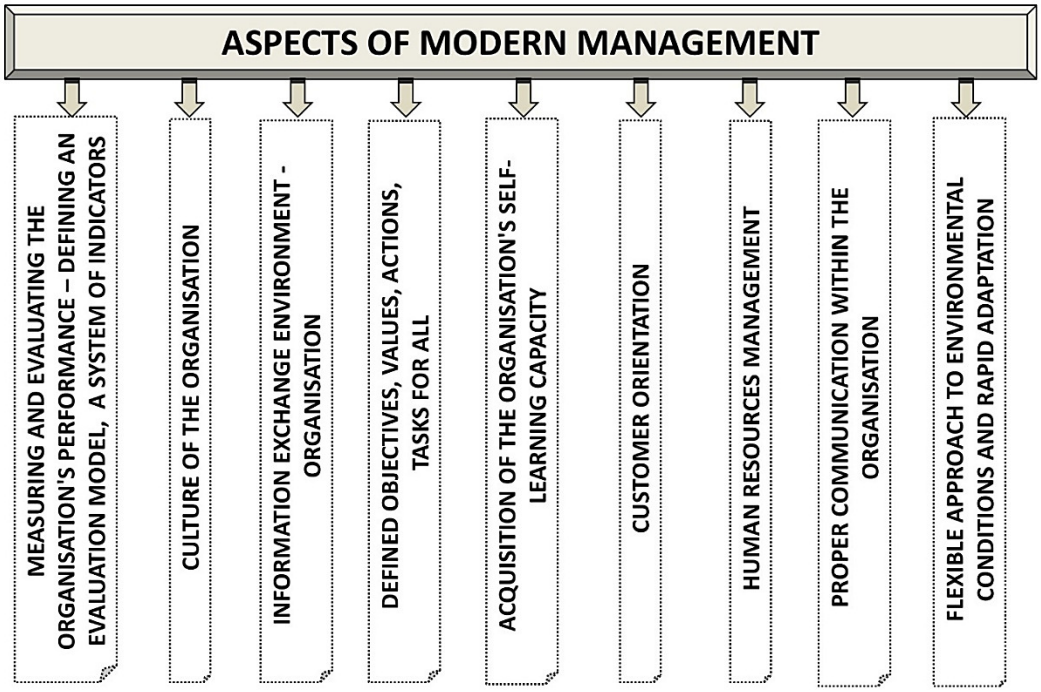



**Figure 2.** Interpretation of the modern approach to aspects of management according to P. Drucker.

The modern form of production management in organisation can therefore also be presented as a function translating are inputs into products dependent on the variables of traditional inputs which are labour power also fixed capital and working capital the potential of employees their human capital as the unique knowledge produced through innovation any other measurable determinant of productivity production (Dobrodziej, 2004).

It is important to emphasise the approach as to how the organisation's environment is perceived. Bearing in mind that all organisational management processes should directly or indirectly take into account the external conditions of the organisational unit, the management of the enterprise should not only define the environment, but it should also remember that all activities in this area should be continuous, as they have a direct impact on the quality of products and the adopted strategy of the organisation.

Therefore, the complexity of the organisation-environment relationship, as well as the diversity of external conditions, subject to many dynamic and turbulent changes, translates into a variety of definitions and classifications of the elements of the environment. Thus, one aspect remains constant, that there is a continuous interdependence between the organisation and the environment. In the literature on the subject, one can see a multidirectional multi-faceted interpretation of the factors comprising the organisation's environment; the most popular formula, which has been adopted, defines the enterprise as an entity functioning in an environment that is divided into a further environment (macro environment) and a closer environment (micro environment) (Gierszewska, Romanowska, 2009; Griffin, 2001) (Fig. 3) (Dudek-Burlikowska, 2019).

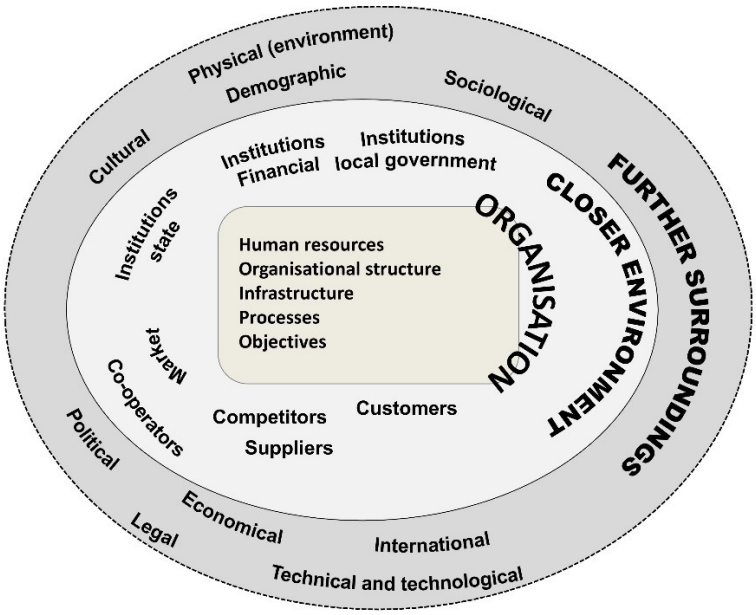



**Figure 3.** The organisation and its environment.

The essence of the further environment is that the managers have the task of constantly observing these conditions, they are aware of the need to take them into account in the planning and operation of the organisation, but have little or no influence to change them. The proximity environment is actually an element of the organisation's strategy, without which it may not be possible to achieve a high market position. Due to the increasing emphasis on the importance of defining states of uncertainty in the organisation, risk management, thus formulating scenarios of possible events, it is worth looking at the environment from the point of view of the behaviour of its elements, hence we can distinguish (Morawski et al., 2010): calm, restless and turbulent environment.

**Table 1.**
*Characteristics of the environment from the point of view of the behaviour of its elements*

| Type of environment | Characteristics | Attributes of the environment |
|---|---|---|
| Quiet surroundings | Stability, lack of close links between elements, static nature of the course of change. | Staticity of change<br>Stability |
| An unsettled environment | Dynamic changes within the elements and the links between them and the organisation. | Dynamics<br>Activity |
| A turbulent environment | Lack of control over the future due to very rapid changes in relation to the elements of the environment as well as the relations between them, taking into account and emphasising the close interdependence between the elements. | Close links<br>Rapid changes<br>Lack of control |

Source: own elaboration based on (Morawski et al., 2010).

Every organisational unit making its decisions and building its strategy is obliged to measure the complexity of its environment and observe the rate of change in its environment. In fact, this is a very dynamic activity and only due vigilance and speed of reaction is a guarantee that managers will do the right thing when it comes to making decisions and building the organisation's strategy. However, each of these decisions is also exposed to risk due to the turbulence and dynamism of the markets. The greater the uncertainty, the greater the risk of a wrong decision or failure.

D. Hubbard thus rightly observed that " Reducing uncertainty is decisive in business. Major decisions made in a state of uncertainty, such as the approval of a major IT project or the introduction of a new product, can be made even a little better by reducing uncertainty. Such a reduction in uncertainty can be worth millions (...)'. According to his approach, measurement does not have to eliminate uncertainty at all, it is important to be able to reduce it (Hubbard, 2013). In order to carry out the aforementioned reduction of uncertainty, and in particular the uncertainty of the environment, appropriate strategic management tools must be used, in this case the scenario method.

### 2.2. Systemic organisation management quality-focused

The contemporary perception of systems thinking in organisations is the unification of the so-called five areas, i.e. systems thinking, personal mastery, mental models, building a shared vision of the future, team learning created at three levels of thinking, and this (Sierpińska, Jachna, 2002): Essence - holism, interrelationships. Principles - structure for influencing behaviour, resistance to changing rules, reinforcement. Practices - systemic archetypes, simulations. Nowadays, any company that sees the need to manage in a flexible and agile manner, as well as the need to develop by forecasting the future - strategic planning - is aware of the need to create and implement a management system that will allow it to realise the defined objectives of the organisation and, at the same time, be able to co-create its success and achieve a high position in global markets.

In the PN-EN ISO 9000:2006 standard, a system is defined as a set of interrelated or interacting elements necessary to establish the policy, objectives of the organisation, as well as to define and specify the processes needed to achieve the set objectives. According to the standard, the elements of a management system are the organisational structure, defined positions with assigned competences and responsibilities, and thus plans, objectives ranging from strategic to operational. In the following definition, special attention is paid to the form in which the management function is defined and applied in quality-oriented organisations.

The literature assumes the existence of two basic types of systems (Robbins, DeCenzo, 2002): a closed system - not subject to any influence from the environment and thus having no relationship with it, and an open system - having dynamic and continuous interactions with the environment. G.A. Rummler and A.P. Bracher point out that "a systemic view of the organisation is the starting point, the basis for designing and managing organisations that will be able to respond to a new reality characterised by ruthless competition and changing customer expectations" (Rummler, Bracher, 2000). It can therefore be assumed that an enterprise is this particular type of system. An enterprise has been described as an open system, i.e. an entity with a set of rules, regulations valid for and applied by all employees, independently setting goals at the strategic, tactical and operational levels, which it is capable of achieving. It also owes its ability to execute them to proper organisational management (Tkaczyk, Dudek, 2001). A management system is the organisation management in a planned, precise, logistical, systematic and consistent manner, excluding voluntary action. This system takes into account in its activity the correctness and cyclicality of the processes occurring in the enterprise, is flexible, reacts quickly to changes in a thoughtful manner, optimises activities and takes into account risk aspects (Maleszka, Łagowski, 2009).

The management system is also an integrated set of processes and tools that the enterprise uses for the development of its strategy, its translation to tactical and operational levels, and for monitoring and improving their effectiveness (Kaplan, Norton, 2008).

A systemic view of organisational management requires a multi-pronged approach and one that is possibly aligned with the following rules, and this (Dudek-Burlikowska, 2010; Dudek-Burlikowska, 2019):

- ✓ For one management system, each management solution should be well thought out, implemented properly as needed. It should not come into negation with the other areas and processes of the organisation operating within the rules and procedures adopted by the management system framework.
- ✓ The implemented standards, principles and ideas should help in the design of the system. They are a source for defining the features of a management system.
- ✓ The formulation of objectives, requirements and rules reflecting the nature of the organisation that are understandable and adapted in their detail to all its employees, regardless of their position, is a must.

- ✓ The correct definition of the organisation's processes, the indication of the information flow paths and the relationships between them through the graphic design of a process map is the basis for the proper functioning of the company.
- ✓ It is necessary to develop a form of system validation to confirm the validity of the requirements defined against it.

S. Tkaczyk rightly notes that the development of the requirements of today's turbulent market, together with the inclusion of a balanced system approach to organisational management, envisages the expansion and integration of a number of organisational management systems, the so-called global management systems, namely: quality, environment, quality costs and finance, occupational health and safety, data security, social responsibility, knowledge and change (Tkaczyk, 2010). This context of organisational perception has a direct impact on the strategy formulation of a company operating in international markets.

In a quality-oriented enterprise, the adopted management path is thus shaped by the perception of its activities and processes, including: defining, operating and monitoring processes; obtaining information from the environment in order to modify and improve processes, developing and maintaining a high level of product quality. From the point of view of the organisation's managers, this form of management takes place at three levels: strategic, tactical and operational levels of the philosophy of management by quality (Hernas, Gajda, 2006; Dudek-Burlikowska, 2010; Tkaczyk, Dudek, 2001).

Referring to the described way of managing an organisation quality- focused, it is also essential to be aware of the creation of knowledge and intellectual capital. Consequently, perceiving quality not only through the prism of a product or service, but through the functioning of the entire organisation, thus achieving a defined and developed maturity of the management system based on quality and implementing the adopted organisational strategy.

## 3. A methodology for assessing the opportunities and threats of a manufacturing organisation in the context of strategic thinking – an author's proposal

The globalisation of markets and the dynamically changing environment has resulted in the need to implement such methods and tools of strategic management in organisations, which on the one hand would provide information for defining its strategy, thereby strengthening its market position, and on the other would influence the formulation of activities to improve its main, management and support processes. At the same time, a modern manufacturing company should also be aware of the importance of implementing the principles and form of self-assessment for the internal needs of the organisation and the possibility of appropriate use of the information obtained for the formulation of strategy. It is therefore obliged to determine the level of risk of its activities, and thus assess the opportunities and threats to the organisation.

At present, there are many proposals in the literature for the application of various forms of planning and thinking concepts referring to the implementation of scenario methods in the area of organisational management, above all in the area of strategic management and the perspective of creating plans for the future. One of the definitions of scenarios adopted in the literature indicates that scenarios are purposeful descriptions of how the environment regarding the activities and operations of interest to the organisation can shape and influence its future, in particular taking into account: a picture of the state of reality at the end of the scenario time as seen through the prism of the changing environment; interpretations of current phenomena and their impact on the future activities of the organisation; and a formulated picture of the organisation in the future time that it wants to achieve and strives for (van der Heijden, Bradfield, Burt, Cairns, Wright, 2002).

Identifying the most important intentions for which scenarios are created, namely: the adaptive learning of the organisation, the development of a strategy for the foreseeable future, the attempt to understand and describe incomprehensible situations (van der Heijden, 2000), it is right to exploit the research gap in the form of the lack of scenarios to assess the opportunities and threats of a quality-oriented organisation. The lack of scenarios is evident in the context of the analysis of the company's internal self-assessment criteria and in the further reasoning of the identification of goals for its internal development for increased competitiveness and activity in the markets.

Thus, the above considerations reinforce the conviction that the application of the proposed author's aspects of scenario methods - scenarios of possible events in a quality-oriented enterprise in a changing environment will be a good management practice. Thus, bearing in mind the need to link the non-formalised self-assessment of the enterprise (MSOP self-assessment model (Dudek-Burlikowska, 2019) with the development perspective, sheets of possible events were developed that add value to the information base when formulating the organisation's strategy. The criteria included in the scenarios were defined on the basis of the AHP multi-criteria analysis indicated in the author's publication (Dudek-Burlikowska, 2023) and their connotation was developed based on the literature, the author's knowledge and the experience of organisations participating in numerous surveys (Dudek-Burlikowska, 2019).

The definition of the attributes was preceded by an analysis in accordance with the Methodology for the Qualitative Grading of the Importance of Attributes/Factors, as well as they were verified in accordance with the proposal for the verification of the evaluation of the selection of criteria according to L. Keeney and H. Raiff (Goodwin, Wright, 2016) in terms of completeness, functionality, independence, lack of redundancy or minimum size.

On the other hand, the factors for the individual criteria included in the scenarios were defined on the basis of the AHP multi-criteria analysis indicated in the author's publications. In order to confirm the validity of the choice of attributes, correlations were also made on the basis of expert analysis of the tendencies of companies' market behaviour and literature research. Thus, the following results were obtained (Dudek-Burlikowska, 2019):

- *Customer orientation* is the proper development of the mutual organisation-customer relationship.
  Confirmation in the literature, successively in: the TQM philosophy, the ISO 9001:2015 standard, the ISO 9004:2018 standard, the Quality Management Principles, and the Quality Function Development - QFD methodology.
- Organisational improvement is the awakening of the employees' need for self-improvement, development and awareness of the continuous improvement mindset.
  Confirmation in literature, successively in: the Deming cycle, Kaizen philosophy, Gemba, ISO 9004:2018 standard and Quality Management Principles.
- Production process and technology management as an organisation's process orientation along the lines of prevent something that has not yet occurred, openness to technology innovation.
  Confirmation in the literature, successively in: the ISO 9000 series standards, monitoring and controlling processes taking into account quality assessment methods, organisation models developed by H. Leavitt; L. Krzyżanowski; D. Katz and R.L. Kahn, the methodology of W. Shewart, J. Juran.
- The strategy and culture of the organisation is the creation of the organisation's strategy is the most important aspect of its success-oriented activities, nowadays the principles of ethics and the formulation of appropriate behaviour, established values in the organisation are an indispensable element of its strategy.
  Confirmation in literature, successively in: Deming's principles, ISO 9000 series standards, the model of organisation by T.J. Peters and R. Waterman, the model of culture levels according to E. Schein, organisation culture as an element of success by M.E. Poter, business ethics - T. Garett, R. Klonoski.
- Intellectual capital management, understood as the proper management of employees' knowledge, opportunities for development, mutual cooperation and employees' self-evaluation, are crucial for the optimal functioning of an organisation.
  Confirmation in the literature, successively in: Maslow's hierarchy of needs, Quality Circles, benchmarking, quality management principles, TQM philosophy, organisation maturity.
- Quality management in the understanding that nowadays every success-oriented enterprise views each of its activities through the lens of quality.
  Confirmation in the literature, successively in: the ISO 9000 series standards.
- Occupational safety and environmental protection in the context of creating appropriate working conditions and caring for the environment confirmed by the high level of maturity of a modern organisation.
  Confirmation in literature, successively in: 5S methodology, aspects of corporate social responsibility, ergonomic principles.

In order to properly perceive the context of the individual attributes, their factors were constated according to the author's knowledge of the literature and experience (table 2).

**Table 2**.
*Factors for individual attributes*

| Attribute | The statement of factors |
|---|---|
| **A: CUSTOMERORIENTATION** | **A1:** *Proper definition and interpretation of customer requirements*. It has to do with every manifestation of customer-related activities, such as researching customer needs, defining and interpreting customer requirements, determining the type and frequency of customer contacts, and observing potential customers.<br>**A2:** *Optimum product price.* Defining the level of sales to determine the price of the product at which the company will meet its objectives, including earning the maximum profit set.<br>**A3:** *Complaint processing time.* Definition of procedures related to the time taken to process complaints. Analysis of complaints in terms of number, non-conformities and any objections from the customer. Development of procedures for warranty and post-warranty actions.<br>**A4:** *Customer satisfaction survey.* Customer satisfaction survey, including having a procedure for measuring and implementing and verifying selected metrics.<br>**A5:** *Timeliness of deliveries.* The organisation is obliged to be proactive according to the principle: delivering the product at the right time, in the right place, according to customer requirements.<br>**A6:** *Flexibility of information flow between customer and organisation.* The client should specify with the organisation the forms and frequency of communication and the possibility and number of client audits.<br>**A7:** *Formal aspect of dealing with customer property*. Have a formalised procedure for dealing with customer property. Identify forms of communication between workstations as to the fulfilment of the requirements in accordance with the order of the client in question. |
| **B: PERFECTION ALENIE** | **B1:** *Compatibility of processes with* the organisation's *objectives.* Processes are reviewed, including an assessment of their compliance with current plans and procedures in order to take corrective and preventive action.<br>**B2:** *Innovation.* Innovation is a skilful response to change, whereby the organisation implements actions to improve the manufactured product or to develop a new, upgraded process, technology, machinery; it is also the management's recognition of the need for these changes and the ability to measure and evaluate the implementation of the transformations made.<br>**B3:** *Assessing the impact of external and internal factors on the organisation's operating strategy, revising the strategy.* It is important for an organisation to develop the right relationship with its stakeholders and to be able to make proper use of information coming in from the downstream environment in order to review the organisation's strategy and objectives on an ongoing basis.<br>**B4:** *Monitoring of organisational processes.* The monitoring of all the organisation's processes is primarily: the identification of outputs, the degree of use of machinery and equipment and the development of procedures for their proper supervision, the exploration and implementation of performance measures for activities and processes, including quality methods, techniques, tools and principles, and the analysis of problems in processes.<br>**B5:** *Management and staff involvement in the implementation of improvement programmes.* Within the organisation, it is essential to involve human resources, including top management, tactical and operational level managers and employees, in the creation and implementation of improvement programmes, and it is important to have a high awareness of the need to identify with the organisation's activities.<br>**B6:** *Organisational self-evaluation.* The organisation should objectively assess its processes and activities according to a chosen or developed cyclical pattern. It should be able to indicate its level of maturity.<br>**B7:** *Training of staff at all levels.* A training system for employees at all levels needs to be developed, with a view to the proper development of the organisation and looking through the prism of achieving a high position in the market while meeting customer requirements. |

Cont. table 2.

| | |
|---|---|
| **C: STRATEGY AND CULTURE OF THE ORGANISATION** | **C1:** *Monitoring the environment.* Monitoring the environment should consist of collecting and verifying information and subjecting it to continuous analysis, taking into account information from the closer and further environment. Responding flexibly to changes, to the dynamics of the environment, assessing the impact of external and internal factors on the organisation's activities, thereby facilitating the definition of appropriate solutions identical to the organisation's strategy and, if necessary, revising it.<br>**C2:** *Stability of the organisation.* Stability is about developing the credibility and sustainability of the organisation, achieving a phase of certainty and constancy in the life cycle of the organisation to achieve the objectives set and to accumulate a group of regular customers.<br>**C3:** *Strategy-process relationship.* The definition of processes and their execution must be strongly positively correlated with the organisation's strategy.<br>**C4:** *Mission and vision versus organisational values.* The proper definition of an organisation's mission and vision influences the perception of its values. The mission is supposed to precisely reflect and express the company's distinctiveness, building its image, it should define the organisation's basic objective and testify to the sense of activity, the raison d'être and development of the organisation. The vision is supposed to characterise the organisation in the future, representing its potential model for long-term action.<br>**C5:** *The organisation's ethics programme/* Organisational ethics is above all the identification of an entity's employees with a defined code of ethical conduct. The code should be a formalised document indicating the core values recognised by the company and expected by the employees, while at the same time giving them a degree of freedom in decision-making. It is important to emphasise that all employee groups should be consulted on the document.<br>**C6:** *Social responsibility.* Corporate social responsibility is one of the factors that contribute to gaining a competitive advantage on the market; it is a strategic element of organisations. Enterprises should take into account in their activities economic aspects on an equal footing with social and environmental aspects, and should try to function in a way that maintains a balance in these areas. When creating corporate social responsibility, it is important to remember about its proper planning, implementation and familiarisation of employees at all levels, as well as proper communication within the organisation and with the external environment.<br>**C7:** *Empathy among employees.* Top management is responsible for the right attitude towards employees, the development of a work motivation system, the right attitude towards opportunities for self-fulfilment and decision-making in accordance with their position. The atmosphere among employees influences the relationship between employees, the relationship of employees with customers, suppliers, stakeholders and the socio-economic environment, and thus the achievement of the organisation's objectives. |

Cont. table 2.

| | |
|---|---|
| **D: PRODUCTION PROCESS AND TECHNOLOGY MANAGEMENT** | **D1:** *Production resources.* Production resources are the backbone of the functioning of a production system. It is essential to plan the number of people employed with the right qualifications, skills and experience, to determine the machines and equipment suitable and necessary for the manufacturing process of products, to select the materials needed for production.<br>**D2:** *Design of processes and products.* Design activities should be a priority for the organisation. According to the principle of prevent what has not yet occurred, the proper definition of aspects of the pre-production sphere and, in particular, the design of processes and products, allows to minimise defects in the technological process.<br>**D3:** *Attractiveness of the technology.* Technological upgrading should be systemic, as far as economic possibilities and intellectual capital are available. Proper understanding and implementation of new technological solutions in production will potentially reduce its costs. Developing a form of technology management will increase the organisation's research and development activity, raise awareness of the importance of deciding not to use technologies that are already obsolete, while at the same time influencing the perception of the enterprise as a competitive unit, open to new solutions and thus dynamically developing in the market.<br>**D4:** *Controlling the production process.* The identification of the need to control the production process demonstrates a correct perception of the importance of monitoring the production process using quality assessment techniques, tools and methods. In addition, it allows for the documentation of the variability of production processes and product characteristics. The aspects indicated serve to optimise the process, reduce its defectiveness and, at the same time, allow for the assessment of its capability and stability and thus shape the quality of the final product.<br>**D5:** *Information systems in production.* The conscious implementation of IT through the implementation of IT tools has the effect of improving the management of production, management and support processes. These tools are intended to facilitate the planning of the organisation's activities and their monitoring, and to increase the flow of information between the various levels of management.<br>**D6:** *Logistics processes.* The processes associated with logistics, broadly perceived, are responsible for the proper transfer of information, raw materials, materials, as well as human, financial resources within an organisation. Each of these aspects should take place according to the Just in Time philosophy. It is also advisable to define a logistics system that facilitates the functioning of the organisation.<br>**D7:** *Compliance of products with requirements.* The organisation should view compliance with requirements as the manufacture of a product adequately to a defined technical specification, according to defined quality standards, standardisation standards, internal organisation documentation, potential required EU directives, and in accordance with an order from the customer. |

Cont. table 2.

| | |
|---|---|
| **E: INTELLECTUAL CAPITAL MANAGEMENT** | **E1:** *Relationship strategy - hr methodology.* The strategy-HR methodology relationship refers to the emphasis within the organisation on the coherence between the human resource management methodology adopted and the organisation's strategy. It is important that employees, according to their job position, are familiar with the organisation's objectives and thus identify with the defined activities of the company.<br>**E2:** *Staff competence.* Employees' skills should be closely related and consistent with their job position. The HR department should have defined procedures for identifying employees' professional and personal skills.<br>**E3:** *Human relations.* Conscious sharing of one's own knowledge, joint problem-solving and the ability to work as part of a team are evidence of the creation of a modern, intelligent organisation focused on success.<br>**E4:** *Employee self-assessment.* Recognising the need for self-evaluation procedures for employees are processes used by developed organisations that have implemented the concept of total quality management and thus define their own level of maturity at a very high level. The organisation should strive for this level.<br>**E5:** *Staff appraisal system.* The organisation should have a systematic solution in place for evaluating employees. This system should be based on a comparison of the employee's performance with the tasks and competencies defined for the job he or she holds. The appraisal system is to be linked to the other elements of human resource management, strategy and culture of the organisation. It is intended to add value, used in the management process and created by comparing the qualities, qualifications, behaviour or performance of the employee with those achieved by other employees or with a defined benchmark. It is advisable to have a system of ongoing and periodic appraisal of employees appropriate to each group of employees.<br>**E6:** *Staff development path.* Employees should know the opportunities for their own development within the organisation. A properly formulated path for each group of employees remains known within the organisation. The motivation system should be linked to job satisfaction.<br>**E7:** *Motivation system.* Nowadays, when defining a motivation system, an organisation is aware that an employee is its internal customer, and therefore the motivation system built should be based on so-called financial aspects, such as pay, discretionary bonuses, cash rewards, and non-financial aspects, such as promotion, training opportunities. |
| **ATTRIBUTE F - QUALITY MANAGEMENT** | **F1:** *Identification of input and output data.* An important aspect of the proper functioning of an organisation's processes is the definition of the source of input and output, as well as the input and output of the recipients, together with a description of the appropriate action.<br>**F2:** *Process relationship - quality strategy.* For the organisation, the indicated relationship should mean a proper correlation between the shaped process map and the developed organisational strategy, quality goals and quality policy.<br>**F3:** *Audits.* Audits in the organisation are carried out according to an established audit schedule (internal audits) and dates agreed with the certification body (external audits).<br>**F4:** *PDCA Methodology.* The organisation is aware that the PDCA cycle should be mandatory throughout the company for each process.<br>**F5:** *Accessibility to QMS documentation, flow of information.* The form of information flow is a specific structure developed by an organisation. The information gathered and accumulated in the company constitutes a set of knowledge necessary for decision-making (know-how), which is why it is so important to develop an information flow system. Thanks to established procedures and tools, information goes directly to designated employee groups and allows for more effective exchange and transformation of transmitted data.<br>**F6:** *Management review.* The organisation should consider management reviews as an added value of the company's activities and an indispensable element of improvement. The purpose of a review is for top management to verify the functioning of the existing, formalised management system in order to confirm its adequacy, suitability and effectiveness, and thus to be able to indicate changes. Each review should be properly planned and conducted. It is advisable to prepare the input data (collection of information) and then collect the data to evaluate and determine the final effect of the output data. It is important to carry out reviews at set intervals.<br>**F7:** *Quality assessment methods for processes.* Quality methods and techniques are an effective tool needed to control, monitor, optimise and improve all the organisation's processes. The selection of quality methods and techniques should be appropriate to the nature of each process and cover the entire product life cycle. The implementation of quality assessment methods is a necessity in organisations focused on success, quality and meeting customer requirements. |

Cont. table 2.

| | |
|---|---|
| **G: SAFETY AT WORK AND ENVIRONMENTAL PROTECTION** | **G1:** *Internal and external communication.* Internal and external communication in the area of health and safety and environmental protection indicates the need for the organisation to develop an information flow system that includes data on potential hazards arising from the job covered, how to prevent and deal with possible accidents and descriptions of how to respond in the event of possible accidents at work.<br>**G2:** *Ergonomics of workstations.* It is the task of top management to define the working environment in an optimal way for each employee, taking into account both physical safety and the opportunity for intellectual, mental and social development. The working conditions developed should be analysed, reviewed and improved according to current needs.<br>**G3:** *Occupational risk analysis.* Risk assessment is a must in a modern organisation. According to it, it should define the hazards, assess them for each workplace in order to minimise the likelihood of harm to workers' health. When assessing occupational risks, a company is obliged to develop so-called 'risk assessment sheets' containing information on the type of hazard, measures to reduce occupational risks, forms of risk assessment and recommendations for the implantation of additional protective measures.<br>**G4:** *Policies, procedures, guidelines.* Adherence to rules and guidelines related to process safety is the responsibility of all employees, and it is also important to participate in the training provided and planned by the organisation's management according to the nature of the work.<br>**G5:** *5S methodology.* The implementation of 5S is aimed at changing the habits and behaviour of employees so that they carry out their activities in an orderly and well-organised workplace. The implementation of the 5S principles improves work efficiency, reduces operating costs, stabilises organisational processes and thus influences product quality.<br>**G6:** *Waste.* Minimising waste allows savings within the organisation and the development of correct relations with the social environment.<br>**G7:** *Noise, vibration, pollution.* Monitoring noise, vibration and pollution levels is the responsibility of every organisation in accordance with current norms and standard. |

Source: Dudek-Burlikowska, 2019.

At a further stage, in the context of shaping the correlation between the management of a contemporary organisation and the creation of its strategic approach, the author's worksheets possible events were proposed for determining the change of a factor for the better - the strength of positive influence (opportunity) and the deterioration of the situation - the strength of negative influence (threat), as well as the author's own assessment scale used referring to similar forms of defining scale in the literature on strategic analysis of enterprises (Table 3).

**Table 3.**
*Scale of evaluation of potential negative and positive impact by point and meaning*

| | | |
|---|---|---|
| **The power of positive influence** | **6** | Maximum |
| | **5** | Very large |
| | **4** | Large |
| | **3** | Average |
| | **2** | Small |
| | **1** | Minimum |
| **The strength of the negative impact** | **-1** | Non-stitute |
| | **-2** | Small |
| | **-3** | Average |
| | **-4** | Large |
| | **-5** | Very large |
| | **-6** | Critical |

In a further stage of the work, a table for trend analysis was formulated (Table 4) and a form for the most positive scenario, most negative scenario and most likely scenario (Figure 6) in the assessment of the organisation was designed, as well as a template for a graph of the strength of influence of a group of criteria (Figure 5).

**Table 4**.
*Trend analysis of attributes and factors*

| Attributes and factors | Trend | The power of influence | PW * |
|---|---|---|---|
| **Attribute A: CLIENT ORIENTATION** | | | |
| **A1:** Proper definition and interpretation of customer requirements | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **A2:** Optimum product price | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **A3:** Complaint processing time | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **A4:** Customer satisfaction survey | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **A5:** Timeliness of deliveries | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **A6:** Flexibility of information flow on organisation – Client interface | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **A7:** Formal aspect of proceedings with customer Property procedure | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **Attribute B: ORGANISATION DEVELOPMENT** | | | |
| **B1:** Compatibility of processes with assumptions organisations | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **B2:** Innovation | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **B3:** Assessing the impact of external factors and internal to the action strategy organisations, revision of strategy | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **B4:** Monitoring of organisational processes | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **B5:** Management commitment and staff in the implementation of improvement programs | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **B6:** Organisational self-evaluation | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **B7:** Employee training all levels | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |

Cont. table 4.

| | | | |
|---|---|---|---|
| **Attribute C: ORGANISATION STRATEGY AND CULTURE** | | | |
| **C1:** Monitoring the environment | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **C2:** Stability of the organisation | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **C3:** Strategy-process relationship | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **C4:** Mission and vision versus values organisations | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **C5:** The organisation's ethics programme | PROGRES | | |
| | EQUIVALENCE | | |
| | REGRESS | | |
| **C6:** Social responsibility | PROGRES | | |
| | EQUIVALENCE | | |
| | REGRESS | | |
| **C7:** Empathy among employees | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **Attribute D: MANAGEMENT OF PRODUCTION PROCESSES AND TECHNOLOGY** | | | |
| **D1:** Production resources | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **D2:** Process and product design | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **D3:** Attractiveness of the technology | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **D4:** Process control | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **D5:** Information systems in production | PROGRES | | |
| | EQUIVALENCE | | |
| | REGRESS | | |
| **D6:** Logistics processes | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **D7:** Compliance of products with requirements | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **Attribute E: INTELLECTUAL CAPITAL MANAGEMENT** | | | |
| **E1:** Strategy-HR methodology relationship | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **E2:** Staff competence | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **E3:** Human relations | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |

Cont. table 4.

| | | | |
|---|---|---|---|
| **E4:** Employee self-assessment | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **E5:** Staff appraisal system | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **E6:** Staff development path | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **E7:** Motivation system | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **Attribute F: QUALITY MANAGEMENT** | | | |
| **F1:** Identification of input data and output | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **F2:** Process-strategy relationship qualitative | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **F3:** Audits | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **F4:** PDCA methodology | PROGRES | | |
| | EQUIVALENCE | | |
| | REGRESS | | |
| **F5:** Accessibility to QMS documentation, flow of information | PROGRES | | |
| | EQUIVALENCE | | |
| | REGRESS | | |
| **F6:** System overview | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **F7:** Quality methods and tools for processes | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **Attribute G: WORKPLACE AND ENVIRONMENTAL PROTECTION** | | | |
| **G1:** In - ex comms for health, safety & environmental protection | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **G2:** Ergonomics of workstations | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **G3:** Occupational risk analysis | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **G4:** Compliance with rules and guidelines for safety in processes | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **G5:** 5S methodology | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |
| **G6:** Minimising waste | PROGRES | | |
| | EQUIVALENCE | | |
| | REGRESS | | |
| **G7:** Level monitoring noise, vibration and pollution | PROGRES | | |
| | EQUILIBRIUM | | |
| | REGRESS | | |

*__PW__ - probability of an event occurring, 0-1 means that the sum of the probabilities in the group - progress, equilibrium, regress is to be 1.

Source: own elaboration (Dudek-Burlikowska, 2019).

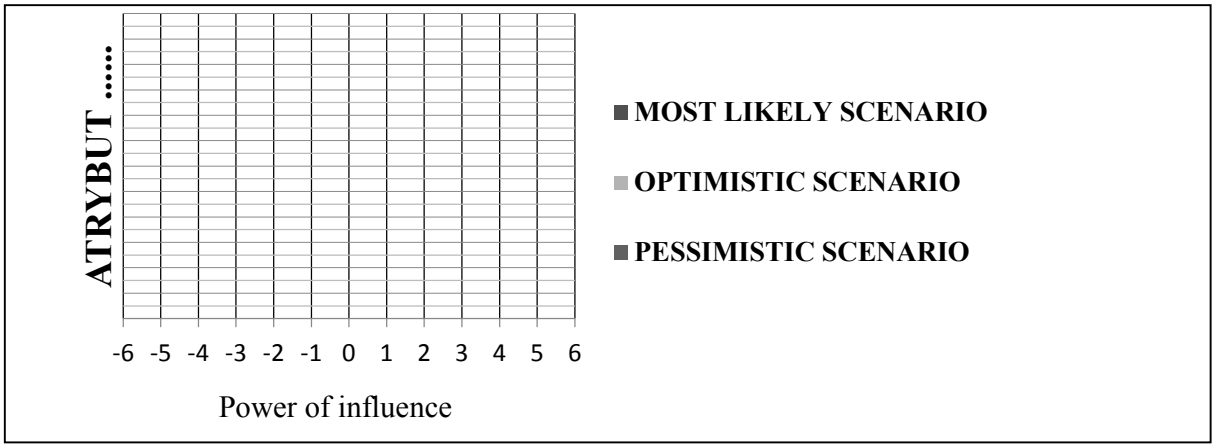



**Figure 5.** Pattern of the criteria group influence diagram.

| | | | ATTRIBUTES AND FACTORS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Attribute A | | | | | | | Attribute B | | | | | | | Attribute C | | | | | | |
| | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | C5 | C6 | C7 |
| SP | THE POWER OF INFLUENCE | | | | | | | | | | | | | | | | | | | | | | |
| SO | | | | | | | | | | | | | | | | | | | | | | | |
| | PW | | | | | | | | | | | | | | | | | | | | | | |
| SNP | THE POWER OF INFLUENCE | POSITIVE | | | | | | | | | | | | | | | | | | | | | |
| | | NEGATIVE | | | | | | | | | | | | | | | | | | | | | |
| | | | Attribute D | | | | | | | Attribute E | | | | | | | Attribute F | | | | | | |
| | | | D1 | D2 | D3 | D4 | D5 | D6 | D7 | E1 | E2 | E3 | E4 | E5 | E6 | E7 | F1 | F2 | F3 | F4 | F5 | F6 | F7 |
| SP | THE POWER OF INFLUENCE | | | | | | | | | | | | | | | | | | | | | | |
| SO | | | | | | | | | | | | | | | | | | | | | | | |
| | PW | | | | | | | | | | | | | | | | | | | | | | |
| SNP | THE POWER OF INFLUENCE | POSITIVE | | | | | | | | | | | | | | | | | | | | | |
| | | NEGATIVE | | | | | | | | | | | | | | | | | | | | | |
| | | | Attribute G | | | | | | | | | | | | | | | | | | | | |
| | | | G1 | G2 | G3 | G4 | G5 | G6 | G7 | | | | | | | | | | | | | | |
| SP | THE POWER OF INFLUENCE | | | | | | | | | | | | | | | | | | | | | | |
| SO | | | | | | | | | | | | | | | | | | | | | | | |
| | PW | | | | | | | | | | | | | | | | | | | | | | |
| SNP | THE POWER OF INFLUENCE | POSITIVE | | | | | | | | | | | | | | | | | | | | | |
| | | NEGATIVE | | | | | | | | | | | | | | | | | | | | | |

| AVERAGE IMPACT | | |
|---|---|---|
| A | B | C |
| D | E | F |
| G | | |

**Figure 5.** Form of scenarios: pessimistic (SP), optimistic (SO), most likely (SNP).

In the author's opinion, the use of scenario methods will allow managers to be more creative when making decisions regarding defining forms of improvement in the organisation's processes, determining the direction of development, as well as identifying real risks during day-to-day activity.

## 4. Conclusions

The presented proposal for the implantation of scenario sheets of possible events in an organisation quality-focused and success, is a modern perspective on the expansion of input data for the formulation of the strategy of a manufacturing organisation.

Using the defined attributes and factors, it will be possible to demonstrate the correlation between the estimated risks and opportunities and threats of a manufacturing organisation. In this regard, an important strength of the organisation is its ability to create knowledge on the basis of, among other things, the proposed methodology, with the simultaneous involvement of employees at all levels in the daily activities to achieve the defined strategic, tactical and operational objectives, as well as its expansiveness in the search for ways to improve. By developing the proposed analysis in the organisation, it is possible to transform the organisation's weaknesses into strengths, thereby reducing threats and increasing opportunities in a dynamic environment.

The integration of quality management and strategic management in a manufacturing organisation, and thus indicating to organisations the possibility of implementing scenario sheets of possible events (Figure 6), thus form the basis for analysing the impact of the environment on the organisation through the prism of opportunities and threats and risk estimation.

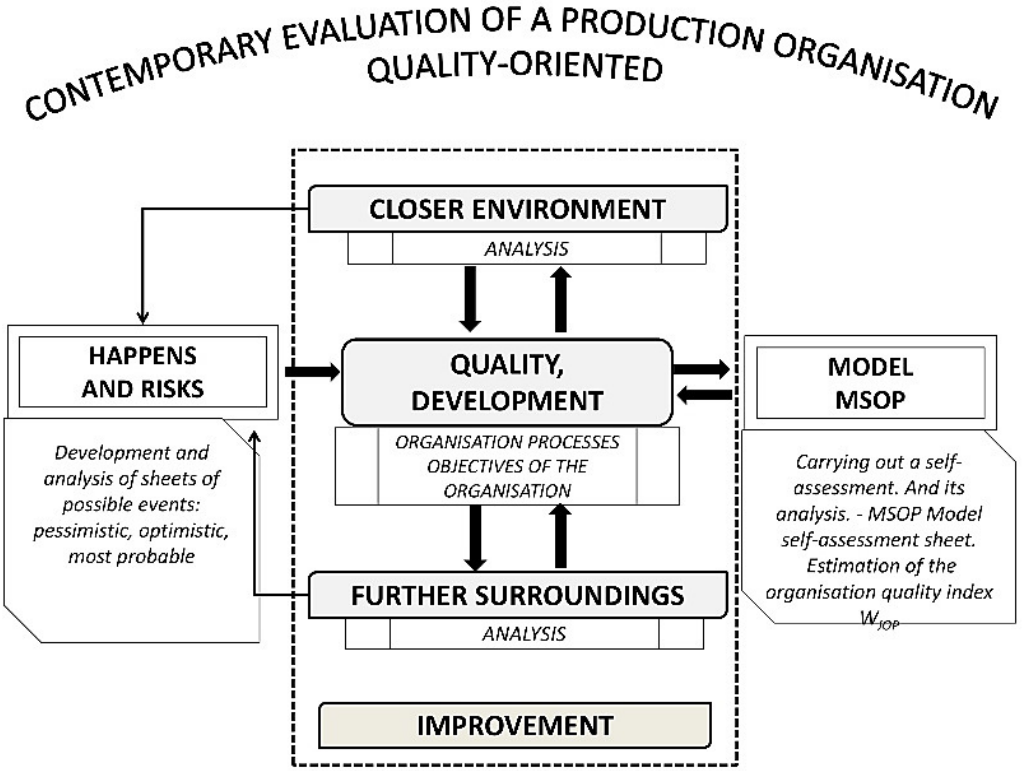



**Figure 6.** Perceptions of a contemporary quality-focused organisation.

The modern form of creating a manufacturing organisation is actually a series of defined assumptions and implemented activities that interact and influence each other, so that changes in one area have repercussions in other aspects of its functioning and improvement.

The pursuit of organisational success and a high market position is therefore the conscious organisation management, characterised by: continuous action, the right relationship between the organisation and the customer, the importance of valuing the creative thinking of employees, the implementation of the organisation's strategy, the maintenance of high quality processes and products.

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# BUILDING THE LEGITIMACY OF AN ENTERPRISE BASED ON SYMBOLS – CONCEPTUALIZATION OF THE PROBLEM

Agnieszka DZIUBIŃSKA[1], Adam JANISZEWSKI[2*]

[1] University of Economics in Katowice; agnieszka.dziubinska@ue.katowice.pl, ORCID: 0000-0003-4385-1123
[2] University of Economics in Katowice; adam.janiszewski@ue.katowice.pl, ORCID: 0000-0003-4730-5410
* Correspondence author

**Purpose:** The intentional use of symbols when preparing messages to stakeholders of modern enterprises could influence texts to become either more powerful or more vague. The purpose of the conducted analysis was to establish what the conditions need to be met for statements being prepared by enterprises to be the source of symbolic values that next could actually impact activities performed by them.
**Design/methodology/approach**: The character of the research problem inclined the adoption of an interdisciplinary approach involving literature review of disciplines, including management science as well as sociology and psychology.
**Findings:** In a highly uncertain conditions of the environment of modern enterprises activities performed by enterprises can be possibly interpreted in many ways. Traditional approach to communicating with stakeholders, which is believed to be based mainly on the presentation of financial data, appears to be too modest to convey effectively the message related to enterprises goals and aspirations. When enriching the descriptive part of their messages in statements of the enterprises, managers can create the context for interpretation aiming at encouraging all stakeholders to more effort being put into daily activities of their enterprises. The arguments presented in the article encourage to recognize symbols and symbolic management as cognitively interesting both in terms of scientific research and actions undertaken by company management boards in practice.
**Originality/value:** When using symbols in their texts in a way leading these symbols to interacting with issues important from the point of view of stakeholders, managers can make stakeholders be sure about the activities undertaken by enterprises. However, only the appropriate use of these interactions, i.e. allowing for the creation of appropriate symbolic values, is to make enterprises actually follow declarations claimed by managers. Otherwise in the long term perspective the stakeholders' trust can be weakened, which can threaten the existence of the enterprise in a contemporary, highly uncertain environment. Hence, the attention paid to the intentional use of symbolic values appears to be not only original but primarily interesting topic for the future research. It may be emphasized that the originality of the presented concept lies in its interdisciplinary assumptions that are to more accurately address the complexity of the challenges facing modern enterprises.
**Keywords:** agency, legitimacy, symbolic management, CEO letter.
**Category of the paper:** conceptual paper.

## 1. Introduction

Increasing globalisation and economic development triggered other processes which resulted in increasingly blunt demands for multinational enterprises (MNEs) to take responsibility for their environmental and social impacts while disclosing their non-financial risks to a greater extent. It is equal to growing expectations of CSR activities undertaken by corporations. Simultaneously, the demands placed on corporations by law are increasing (Berger-Walliser, Scott, 2018). It is significant since CSR can also be used as a tool for "pulling the wool over the eyes." As Beets and Beets (2019) note, the reasons for activities undertaken by corporations, even if they appear to be obvious, may not necessarily be like that (e.g. corporate subsidies to universities may be dependent on the inclusion of specific authors and textbooks in the courses conducted). Furthermore, CSR initiatives may be a result of a reflection and reaction to the institutional environment of the enterprise rather than a result of a thoughtful and voluntary decision taken by the corporation (Matten, Moon, 2008; Yan, 2020).

In the light of the above challenges, there is an issue of communicating the activities of enterprises in a way that allows for legitimacy management involving gaining and/or maintaining and/or repairing legitimacy. In this paper, legitimacy management is understood as a strategic process whose paramount objective is, through learning, to improve legitimate work activities in a way that does not cause the objection of the environment. On the one hand, such communication should reflect the activities actually undertaken or planned. On the other hand, at least in certain cases, it will aim more at shaping the audience's perception of the activities rather than informing about them and influencing them. The process of corporate communication through the tools used by the Management Board in annual reports appears to be especially relevant here. These reports (management board reports and financial statements, especially fragments placed before audited financial statements including important reviews - primarily CEO letters), alongside e.g., CSR reports or press releases and websites, are accounted means of communication with external audiences (Merkl-Davies, Brennan, 2017). With regard to those parts that open annual reports, it is outright stated that they can be regarded as legitimacy builders, in which CEOs can strive to strengthen the audience's confidence in the enterprise or convince the audience to its excellence and future survival (Jonäll, Rimmel, 2010). The discourse led by CEOs interacts with ethical values within enterprises, and can, as a result, contribute to avoiding problematic situations (García-Ortega et al., 2019, p. 2). In this sense, the influence of the reports can be considered in terms of both message-level and process-level impacts, respectively. However, it should be kept in mind that CEO messages may not represent the current situation of the company in an appropriate manner, which implies, inter alia, in the case of sustainability reports, the need for stronger supervisory standards (Na et al., 2020). On the other hand, the significance of messages from CEOs stems from the fact that the quality of strategic communication is regarded as a crucial factor in achieving competitive advantage

and pursuing a strategy of differentiation from competitors on the market (Seo *et al.*, 2021). Other indications to look at the specificity of CEO messages can also be found in the literature (Bournois, Point, 2006; Kiattikulwattana, 2019; Kohut, Segars, 1992). It is worth emphasising that the attention of researchers frequently focuses on aspects of corporate legitimacy using messages formulated by key individuals in enterprises when reporting results (Edgar et al., 2018). The symbolic management for the purposes of the communication should enable managers to build the legitimacy of their activities effectively. Although the authors focus on theoretical considerations, the presented framework proved to have empirical importance (Janiszewski, Dziubińska, 2024).

The presented research results are part of the literature on corporate legitimacy strategies concentrated on legitimacy strategies for communicating activities. The authors of this paper attempt to establish what the conditions need to be met for statements being prepared by enterprises to be the source of symbolic values that next could actually impact activities performed by them. The first section of the paper includes critical literature review focused on a discussion of issues relating to the ways of presenting symbolic management in the literature, and, above all, to diverse types of symbols and possibilities of generating diverse types of symbolic value resulting from it. The second section explains an approach applied to the formulation of the problem in the field of communicating and legitimising corporate activity focusing at the same time on communication tools, especially issues related to CEO letters. The third section elaborates on legitimacy strategies and issues relating to communicating. Next conclusions are presented with regard to how conditions for symbolic values impacting activities performed by companies should be described.

## 2. Symbols and symbolic management as theoretical concepts

In this section the set of prominent body of literature in the field of symbols and symbolic management is analysed which allow for the discussion of sources of legitimate work activities. We understand symbols as textual signs by which the content they refer is signified so that labels and categories created by symbols have meaning in social interactions while possibly combining sufficiently supported statements with those that may lack sufficient support (Janiszewski, Dziubińska, 2024, p. 163). Symbolic management can be conceptualised as a "theory of how organisational representatives seek to influence the perceptions of key stakeholders (and of each other)" (King, 2022, p. 6; Westphal, Park, 2020). In this sense, it makes it possible to complement the explanation provided by the agency theory. Here, the assumption is made that just like between symbol and substance, there is a significant split between appearance and reality. Therefore, symbolic management can be viewed through the prism of "a set of tools, practices and processes that represents attempts to convey the

impression that governance is done as prescribed while still preserving the autonomy and power of those at the helm of the organization" (King, 2022, p. 6). Edgar et al. (2018), noting that impression management has its origins in the social psychology literature, describe the use of these concepts in the research on corporate reporting, especially in cases of unfavourable financial performance, environmental disasters, and major reorganisations (Edgar et al., 2018, p. 1566; Merkl-Davies, Brennan, 2007). Communication strategies applied then are characterised by a discretionary nature of the narratives created in the financial, social, and environmental areas included in annual reports (Edgar et al., 2018; Hooghiemstra, 2000), and managers use them to impact on stakeholder perceptions (Deegan, 2002; Edgar et al., 2018).

Elsbach emphasises that impression management theories (e.g. Goffman, 1973), next to institutional theories (e.g. DiMaggio, Powell, 1983) are the main theoretical perspectives describing organisational legitimacy management (King, 2022). Apart from the role of Goffman's theory of impression management in the development of symbolic management, King emphasises the significance of research on the issues of influence and persuasion conducted by psychologists such as Cialdini. Thus, symbolic management can also be perceived in terms of its significance for embedding shared objectives (Van Knippenberg, 2000) and linking groups to group values (Thompson, Bunderson, 2003). It is worth emphasising that the early interest of theoreticians representing the impression management trend (e.g. Leary, Kowalski, 1990) focused on how people manage their personal legitimacy. Later, it was noted that the same tactic can be used by organisational spokespersons to manage organisational legitimacy (Elsbach, 1994, e.g. Elsbach, Sutton, 1992). Aiming to overcome the ambiguities accrued over the years of research conducted on symbols in different disciplines relating to, inter alia, the meaning of symbols and their relevance to an organisation, Schnackenberg et al. (2019) presented a strategic framework for symbolic management. Mentioned authors define symbolic management through the prism of symbolic creation, symbolic elaboration, and symbolic association between the organisation and stakeholders symbols/or symbolic association between stakeholders and the organisational symbols. In contrast, they present impression management as describing how symbols can be used to influence socially and culturally determined audience's attitudes and beliefs using verbal descriptions and explanations in which symbols are embedded (Schnackenberg et al., 2019). In the literature, symbols are described as bringing additional meaning that is not explicitly presented and therefore, for example, information can be seen as an instrumental resource and also as a symbol of intelligent and competent behaviour. The use of information reduced to a symbolic tool involves signalling rationality, intelligence, and knowledge (Feldman, March, 1981; Sandberg, Alvesson, 2021). Not only can organisational symbolism structure perceptions of organisational activities, but it can also help an organisation to quickly undertake legitimate work activities (Daft, 1983 as cited in: Elsbach, 1994, p. 60).

Another significant issue raised in the literature is how types of particular symbols can be distinguished and how to contribute to value creation for the organisation through their proper use. Zott and Huy understand symbolic activities as the ones "in which the actor displays or tries to draw other people's attention to the meaning of an object or action that goes beyond the object's or action's intrinsic content or functional use" (Zott, Huy, 2007, p. 70). In their opinion those activities can significantly improve potential access to the resources. Schnackenberg et al. (2019) place additional emphasis on the benefits for the organisation that can result from symbolic management such as higher performance, risk avoidance, implementation of organisational and social changes. To provide a comprehensive view of symbolic values generated by symbols, it is proposed to distinguish various types of symbols that can be used by organisations. Among them are: ideological symbols (with assigned extremely significant meanings that are inspiring for stakeholders, deserve respect and resonate among them, and that can also indicate the right thing to do based on beliefs that people find attractive and admired) (Schnackenberg et al., 2019, pp. 381-384), comparative symbols (with meanings given on the basis of better/worse, superior/subordinate resolutions based on criteria that stakeholders find attractive; they may also indicate above average credibility and goodwill) (Elsbach, 1994; Schnackenberg et al., 2019, pp. 381-384) or isomorphic symbols (presenting themselves as understandable and somewhat preconceived without the need for further verification; they convey judgements on the right/wrong, common/uncommon issues based on the prevailing cultural expectations) (Schnackenberg et al., 2019, pp. 381-385). The significant point here is that symbols can convey complex sets of meanings which indicate many forms of ideological, comparative and isomorphic value. The examples include courage, teamwork, pursuing something seemingly unattainable (ideological symbols), technical competences needed to undertake unique ventures (comparative symbols), and social, cultural and political support for particular undertakings (isomorphic symbols) (Logsdon, 1989; Romzek, Dubnick, 1987; Schnackenberg et al., 2019). For the purposes of this paper, it is proposed that symbolic value can be presented as a feature of a message generated by the symbols embedded in it. This value decides upon its impact on other messages and action taken by organisations, as a result of which organisations can generate value for themselves through changes in messages and activities (i.e. changes in legitimacy context). Then it appears to be significant to capture when symbolic values, generated by symbols embedded in messages released for the legitimacy purposes, by impacting on the legitimate context, can constitute a value-creating factor for the organisation.

Attention may be drawn to a dual role of messages conveyed by key managers. On the one hand, they can be regarded as tools that make it possible to generate value for the organisation by embedding symbols in them (Schnackenberg et al., 2019). At the same time, such messages constitute, while more or less accurately reflecting reality, a record of aspirations related to organisational legitimacy management (i.e., gaining, maintaining, and repairing corporate legitimacy), or creating their status and reputation (Bitektine, 2011; Edgar et al., 2018;

Suchman, 1995). By learning and refining legitimate work activities in messages through creating narratives that give meaning to a particular experience (following the Wittgensteinian model in which words cannot carry explicit meaning when separated from their situational use) and by rationally analysing a given experience, organisations generate knowledge (Boland, Tenkasi, 1995; Bruner, 1990). The process encompasses perspective making which indicates how to perceive, comprehend, and evaluate the organisation, but it should also improve the communities of knowing to open to perspective taking (Boland, Tenkasi, 1995). Moreover, the role of sensemaking of collectively understood experiences (Schnackenberg et al., 2019) clarifies the objectives by bringing the causes to the attention of the organisation (Lindenberg, Foss, 2011), whereas considered in the linguistic dimension, makes it possible to distinguish different dominating ways of explaining activities by the organisation (Ashforth, Gibbs, 1990; Basu, Palazzo, 2008). For organisations, social judgements involving stakeholders' opinions or decisions relating to social properties of organisations are significant (Bitektine, 2011; Schnackenberg et al., 2019). In addition to legitimacy, these properties may also include status and reputation, while the constructs of reputation and status can be regarded as complementary to legitimacy, since some of the dimensions responsible for their formation are the same and their operationalisations can be correlated (Bitektine, 2011). It is assumed in this paper that the appearance of identifiable perspective making and sensemaking at the message level should indicate a correlation with legitimate work activities reflecting a more exploratory or exploitative focus on organisational learning (March, 1991). The issues relating to the proper framing of legitimisation of corporate activities are discussed in greater detail in one of the next sections. Adopting a proper point of view in this area helps to frame the appropriate use of symbols for impacting the legitimacy context at both message and activity levels.

## 3. Methodology and the enterprises' statements as tool for communicating and legitimising corporate activity

As the approach that inspired authors to formulate research problem in the current paper, was the one presented by Alvesson and Sandberg (2011) who argued that theories could be more influential when the researchers were to focus more on assumptions underlying existing literature than on how gaps in existing theories can be constructed. The issue is that when attempting to challenge assumptions the authors could make use of the typology of assumptions open for problematization that includes in-house assumptions, root metaphor assumptions, paradigm assumptions, ideology assumptions and field assumptions. Deriving from Suchman's notion that for the correct understanding of legitimacy management it is crucial to consider not only the influence of the messages on the perception of the audience, but also organisational changes, the main proposition is built in the current text. It is proposed that based on the

possibility of the creation of symbolic values by symbols embedded in messages conveyed by managers, who attempt to manage the legitimacy of their enterprises, the assumptions present in impression management body of literature related to the impact of its technique mainly on the perception of the readers, especially shareholders, can be challenged as the in-house assumption existing within a particular school of thought (Alvesson, Sandberg, 2011, p. 254). While noticing that results achieved by the organization can be a means of communication used by this organization, the message conveyed in the form of results is also expected to demonstrate a situation of an enterprise e.g. the increase in uncertainty. In terms of conducted analyses, enterprise' statements should be considered as an important source of data. They may constitute an important element of the presented concept in terms of level of measurement, which refers to "the unit to which the data are directly attached" (Rousseau, 1985, p. 4).

However, while considering the significance of an enterprise' statement as a communication tool, a few issues should be highlighted. As Bournois and Point (2006) note, together with the development of the Internet, the significance of CEO letters as an object of academic analysis has increased. In general, the messages conveyed by the Board play a vital role in PR activities, constitute announcements of remarkable events, justify activities and decisions and are initiatives supporting legitimacy building. Moreover, they define the vision that business leaders want to share with the audiences or impose on those audiences. In addition, an enterprise' statement can also be perceived as means of understanding how an enterprise operates and what perceptions it has of itself or what perceptions it wants to present to others. Bournois and Point's (Bournois, Point, 2006) research also indicated that distinctive styles can be used in an enterprise statement to comment on enterprise performance, and the performance itself can be recontextualised (there may be, for instance, a tendency to adopt an overly positive approach). Furthermore, in an analysis of the influence of financial performance on the issues addressed (i.e., environment, growth, operating philosophy, markets and products, unfavourable financial situation, favourable financial situation) by the CEOs of the 25 best performing Fortune 500 companies, the ability to classify the best and worst performing companies (using return on equity - ROE - to evaluate financial situation) on the basis of the issues addressed in enterprise statement was demonstrated (Kohut, Segars, 1992).

It is important to note that certain types of information contained in messages conveyed by the Board can be regarded as essential factors supporting the ability to foresee financial performance (Che et al., 2020), or as influencing the ability of enterprises to achieve specific financial performance, and thus their competitive advantage (Kiattikulwattana, 2019). Assuming that an enterprise' statement contains information on CSR results that are significant to stakeholders taking decisions about investing in corporations, Che et al. (2020) posed a question how sentimental attributes present in stakeholder letters could allow for anticipating the financial performance of corporations. Based on the appraisal theory and distinguishing 11 categories of attributes, they assumed that enterprises with good performance use a more positive, optimistic tone, whereas enterprises with unfavourable financial performance use

a more active language, since they have to undertake positive activities to improve their image and attract investors. They found that, among all categories of attributes, the most prevalent were positive attitude influence, positive appraisal, attitude appreciation and positive gradation, and that enterprises with poor financial performance used more active language to describe and evaluate their CSR activities. They also established, inter alia, that there is linear performance between sentiment performance and economic performance (Che et al., 2020). In addition, markets may react to the content of stakeholder letters in a negative way. For instance, the more business content is disclosed, the lower untypical feedback may be and a negative correlation with future company performance is noted (Kiattikulwattana, 2019). Depending on the financial performance of enterprises, the response to various issues covered in letters to stakeholders, or the tone in which they have been written, may differ (Kiattikulwattana, 2019). It can be demonstrated that additional insight can be brought to the analysis of the content of corporate reports by viewing their content from the perspective of various types of symbols, which may not necessarily be synonymous with the pursuit of so-called impression management. When being intertwined with social learning processes, these symbols may have not only an informative role but the agentic one as well.

## 4. Results and discussion

Researchers dealing with corporate legitimacy can present it in a theoretical way in accordance with three perspectives, i.e., as *a thing* (then it is viewed through the prism of a company's property, resource, or capability), but also as *an interactive process* or *a form of socio-cognitive perception or evaluation*. Depending on the adopted perspective actors engaged in constructing legitimacy can respectively *possess legitimacy*, *be change agents*, and *get involved mainly in judgement making*. As it can be seen from one perspective, legitimacy can be perceived as a result of a degree of alignment or congruence between material manifestation of legitimacy within the organisation (e.g. products, structures, routines) and normative expectations of the external environment. On the other hand, apart from the appearance of such congruence, the way of achieving it is also significant. This emphasises the role of the subjective agency in explaining how legitimacy is socially constructed. From the perspective of the process, the role of a change agent, who attempts to implement social change regarding how the object of legitimacy (organisation) is appraised by the audience, is articulated to the greatest extent possible. The CEO drafting a message to stakeholders can be perceived through the prism of influencing the process of achieving compliance by participating in decision-making processes with regard to ventures undertaken, as well as by deciding how information about decisions taken is communicated to the stakeholders appraising the organisation (Suddaby et al., 2017). Two perspectives are significant in the context of deliberations

presented. Firstly, they are the strategies used by organisations to achieve fitness with the environment (according to the view of legitimacy as property) (Suddaby et al., 2017). Secondly, they are the processes through which legitimacy of organisational activities can take place (in accordance with legitimacy viewed as a process) (Suddaby et al., 2017).

It can be particularly highlighted that legitimacy can be perceived as a process of collective meaning-making that can occur through language (e.g. Searle, 1969), communication (Suddaby, 2010) and text translation (Czarniawska, Joerges, 1996; Suddaby et al., 2017). It should be emphasised here that since legitimacy is a process in which many actors participate and which takes place on many levels, gaining legitimacy is not a result of an individual actor's efforts (Suddaby et al., 2017). An individual actor who can use language to create meaning with a different level of awareness and agency is not able to control the process of interpretation (Maguire, Hardy, 2009; Suddaby et al., 2017). As it has been noted before, symbolic management is sometimes linked to communication aimed at generating a positive impression among the audiences. The behavioural approach is adopted as the opposite. It indicates that corporate activities are changed to correspond more closely to what the message conveys about them (Kim et al., 2007). It appears to be significant to know to what extent the process of establishing that takes place through language in CEO messages serves the purpose of emphasising and refining various aspects of the organisation's operation that are important for the organisation itself and its audiences (substantive dimension of legitimate work activities, i.e., at the process level), and to what extent the information function of the message subsides under the influence of pursuit of general presentation of the organisation in a positive light (symbolic dimension of legitimate work activities, i.e., at the message level).

Taking into account what has been stated above, it is suggested that when considering the role of symbols embedded in messages about legitimate work activities (undertaken in connection with the implementation of different legitimacy strategies used for the purposes of shaping legitimacy context in real dimension), one should focus not only on embedded symbols as tools for impression making, but ask about their role from the point of view of generating symbolic values as a consequence of their embedding in messages about legitimate work activities and impact on the legitimacy context created by messages about legitimate work activities actually undertaken. The framework for the analysis is presented graphically in Figure 1.

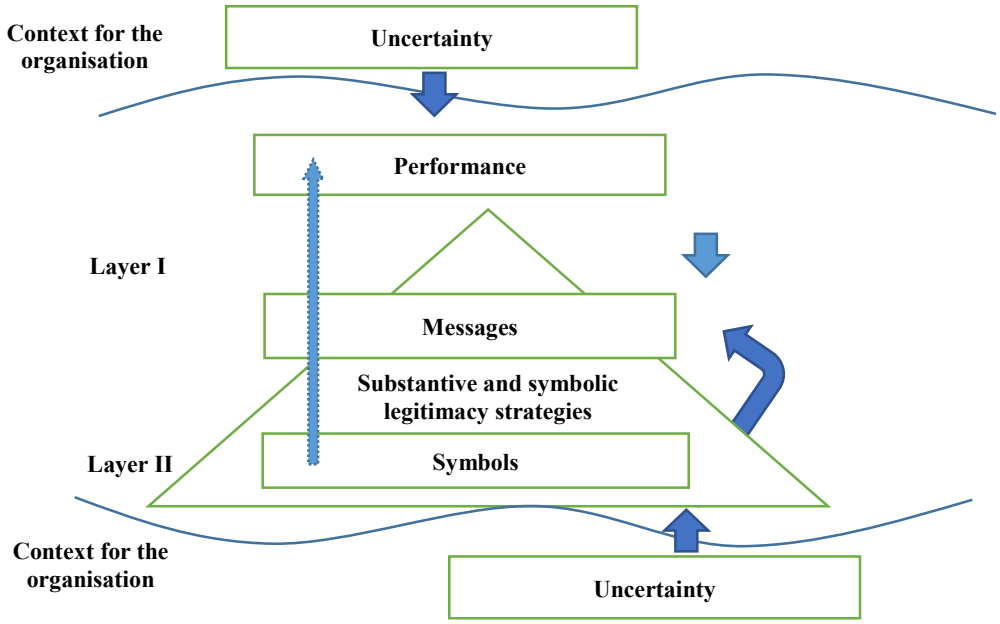



**Figure 1.** Framework for the analysis concerning the field of the communication based on symbols. Source: Own work.

The elements in Figure 1 require further discussion. In the case of many enterprises, the conditions of uncertainty, like e.g. those related to COVID-19 pandemic, translated into uncertainty about the possibility of continuing business activity in the future and made predicting possible financial results extremely hindered. The context of the pandemic and changes in financial performance related to its outbreak can be regarded as the main factor that is regarded as potentially important from the point of view of legitimacy strategies for communicating corporate activities present in enterprises' statements (including diverse types of symbols embedded in messages about legitimate work activities <resulting from the implementation of the legitimacy strategy>). Hence, the relevance of the arrows pointing from context to results (as shown in layer one, i.e., directly exposed by the company) and from results to messages (also contained in layer one) should not raise doubts. High uncertainty, for instance, can negatively affect results and encourage the formulation of messages that emphasise its significance. However, the figure still points out that the formulated messages can be analysed in terms of the symbols they contain (included in layer two, i.e., the hidden layer), regardless of whether symbolic or substantive legitimisation strategies are involved. Simultaneously, an arrow pointing from the message to the results is also proposed as one that encourages people to analyse the role and the possibility of using symbols in the formulated messages.

As it was signalized legitimacy strategies can be exercised as both symbolic and substantive strategies. In the context of symbolic legitimacy strategies, it should be noted that through impression management organisations can change the stakeholder perception (Deegan, 2002; Edgar et al., 2018). In their research, Edgar et al. (2018) note that the benefits brought by public-private partnership projects make it more advantageous for companies to do so than to undertake substantive activities which could basically only come down to the termination of

profitable projects due to the controversy surrounding them. Edgar et al. (2018) emphasise that while impression management in annual reports influences the perception of public policy, it is one of many influences which may prove useful since, inter alia, it reflects what managers may think about the factors influencing public policy (Edgar, 2018). Edgar et al. (2018) note that annual reports, in particular narratives that are not audited, provide an opportunity to use symbolic management through discussion about the positive features of these projects. It should be noted at this point that Suchman (1995) notices that legitimacy management, as majority of cultural processes, is based on, to a considerable extent, communication which requires knowledge of a diversified arsenal of techniques and awareness of the response that a particular situation deserves. As it has already been mentioned in this paper, for legitimacy management, in addition to a convincing organisational communication, a specific organisational change with its later reflection in the right communication is essential (Suchman, 1995). Therefore, it is crucial to note that substantive legitimacy strategies (whose meaning is considered in terms of organisational changes, i.e., at the process level), in addition to symbolic strategies (whose meaning is considered through the influence on the perception of the audience, i.e., at the message level) are also significant for legitimacy management.

It is worth adding that Hahn and Lülfs (2014) identified the techniques for communicating legitimacy that may, by definition, pursue a more symbolic practice (which involves an attempt to influence the perception of specific processes by audiences) or emphasise the significance of the substantive approach (which involves actual change in objectives, structures, actions, or activities). The substantive approach defined as objective may be linked to, for example, the use of a communication technique that assumes presentation of facts through the description that does not contain references to value (Hahn, Lülfs, 2014). An example of use of a communication technique related to the symbolic approach can be, for example, the pursuit of linking negative aspects of the organisation's operation with authoritative persons and legitimate practices. Then they perform a role of "legitimacy clues" and may draw the audience away from an active response to legitimising the activity of such an organisation (Hahn, Lülfs, 2014, p. 413). Decoupling of words from activities, when one would generally expect the messages to link words with the actual behaviour, constitutes a threat related to the use of communication techniques assigned to the symbolic approach (as seen by Hahn, Lülfs, 2014). Such manipulation may also threaten corporate legitimacy. In the case of substantive approaches linking the communicative discourse with actual behaviour such ambiguity does not arise. In other words, some of the techniques of communicating legitimacy instead of acting to profoundly change corporate processes, their practices, objectives, and approaches, are aimed at changing stakeholder perceptions and therefore do not guarantee that the company is held responsible for its negative influence (Hahn, Lülfs, 2014). Substantive strategies are said to be associated with the use of specific communication techniques (Hahn, Lülfs, 2014)[1]. Nevertheless, the question can be asked whether the use of symbols (defined as above, i.e., ideological, comparative, and isomorphic) in messages aimed at legitimising the

company's activities can be used to reinforce intentionally the impact of a substantive strategies as well as can influence actually conducted legitimate work activities when being applied as a part of symbolic strategy for communicating legitimate work activities. The basic characteristics of legitimacy strategies are included in the Table 1.

**Table 1.**
*Legitimacy strategies*

| Strategy | Key characteristics | Functions | Danger signals |
|---|---|---|---|
| Symbolic legitimacy strategies | symbols embedded as triggers of the perception of the audience | general presentation of the organisation in the positive light | identified by stakeholders as a tool for "pulling the wool over the eyes" |
| Substantive legitimacy strategies | symbols embedded to reinforce impact on material processes | refine various aspects of the organisation's operation | too little impact on organizational changes |

Source: Own work.

When referring to the findings of Yan et al. (2019), it should be noted that the presence of impression management in communication in the letters to stakeholders, although sometimes presented in theory as manipulative, in addition to the purposes of self-presentation, can also serve the purposes of information sharing. It is worth mentioning that, in corporate environmental reporting, Chelli et al. (2019) point at substantive disclosures (substantive linguistic strategy) that go beyond the so-called greenwashing and are related to specific activities, i.e., substantive manner of functioning, for instance, environmental activities undertaken (reflected in messages describing successes in sustainability efforts), or activities aimed at educating stakeholders and staff (reflected in messages emphasising development of environmental trainings and education among selected employees and stakeholders) (Thompson, 2007 and Eagleton, 2007 as cited in: Chelli et al., 2019).

From the point of view adopted in the paper it is significant that for legitimacy management the approaches applied require reference to substantive as well as symbolic dimensions. Moreover, the undertaken activities described in enterprises' reports should correspond as closely as possible to what is undertaken by a given enterprise. Simultaneously, the use of specific messages about legitimate work activities is not to be limited to the shaping of impressions, however, by opening the field to various types of symbols (potentially differentiated due to different factors, i.e., uncertainty closely related to changes in financial performance) embedded for the purposes of argumentation in messages may require launching of all three processes discussed earlier, that is perspective making, sensemaking and social judgements.

## 5. Conclusions

The purpose of the conducted analysis was to establish what the conditions need to be met for statements being prepared by enterprises to be the source of symbolic values that next could actually impact activities performed by them. The results of the literature studies open up a new cognitive perspective for managers responsible for preparing financial statements. This perspective can be particularly useful in situations of high uncertainty when it is difficult or even impossible to base interpretation on facts. The intentional generation of symbolic values through the symbols embedded in messages can serve as a valuable tool for supporting the achievement of legitimacy purposes.

The question that can be posed at this point is whether in fact each time ideological, isomorphic, or comparative symbols appear in the messages used by organisations, there is a decoupling between the information layer of the message and the actual behaviour. Alternatively, symbols appearing in the messages, by creating specific values, may be perceived as a tool that reinforces the strength of the messages as triggers of legitimate work activities, especially in those circumstances where they are justified by the external environment in which enterprises operate. What emerges as particularly significant pertains to the focus of the statements contained in the reports, which as a rule may, for instance, place more or less emphasis on describing past experiences or outline a vision of the future. What also matters is how these efforts are described, e.g. by the use of rather concisely outlined suppositions or comments emphasising the unusual nature of the situation. It is postulated that, depending on the approach adopted by the CEO, reports being a significant message for external stakeholders on the one hand can affect internal stakeholders differently. The article emphasises the fact that the description of the indicated approach is possible with the use of the concept of symbols and their different types, i.e., ideological, comparative, and isomorphic. As an example, depending on their selection, the strength of the impact of the messages contained in the reports can be aimed, for instance, at explaining the scale of the difficulty of current changes by referring them (with varying levels of detail and accompanying greater higher or lower suggestiveness of the language used) to the past, or at explaining the scope of plans for the future possibly presented as, for instance, a challenge to the organisation, but also (additionally) as a commitment to the environment. Outlined in this manner, the context for building the legitimacy of the company's statements will each time adopt a set of unique features. Nevertheless, it is worth considering whether among them it is possible to identify such features, whose regularity of co-occurrence can be observed among different authors, and companies and thus adopt as recommendations depending on the objectives assumed by the authors of the message.

In the light of the arguments presented, it seems reasonable to believe that the use of symbols may change communication tools utilized by senior corporate executives depending on the conditions of the environment (e.g. outbreak of the pandemic). More generally, it seems

that there are noteworthy interactions between the used messages about legitimate work activities and diverse types of symbols embedded in them. Symbolic values shape the legitimacy context and thus constitute a value for the organization (Janiszewski, Dziubińska, 2024). It is also worth noting that the research trend on symbolic management is relatively new, so its theoretical framework requires critical attention. Certainly, a factor influencing the effectiveness of actions taken within symbolic management is the cultural context, which significantly conditions the selection and interpretation of the symbols used (Scott, 2014). The issue outlined requires further research, whereas the considerations presented, by pointing out the key building blocks, shed new light on the possible role and scope of the use of symbols in messages created by companies.

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## Footnotes

[1] The technique of detailed corrective action, which, as viewed by Hahn and Lülfs (2014), is the only one associated with the indication of ideas supported by measures of success, may be relevant to this. Among the techniques of communicating legitimate work activities, also the technique of abstraction (attributing company problems to the whole industry), and, to a greater extent, the technique of indicating facts (without hints as to the relevance of the scale of their occurrence) show greater legitimising potential attributed to substantive approaches (Hahn, Lülfs, 2014; Higgins, Walker, 2012).

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# EXPLORING THE METHODOLOGICAL FRAMEWORK AND IMPORTANCE OF STATISTICAL ANALYSIS IN QUANTITATIVE MANAGEMENT RESEARCH

Henryk DŹWIGOŁ[1*], Mariola DŹWIGOŁ-BAROSZ[2]

[1] Department of Management, Faculty of Organization and Management, Silesian University of Technology; henryk.dzwigol@poczta.fm, ORCID: 0000-0002-2005-0078
[2] Department of Management, Faculty of Organization and Management, Silesian University of Technology; Mariola.Dzwigol-Barosz@polsl.pl, ORCID: 0000-0002-5306-3836
* Correspondence author

**Purpose:** This paper aims to examine the key stages and methodological considerations of quantitative research in management sciences. It focuses on how theoretical constructs are translated into measurable variables and investigates the effectiveness and challenges of operationalisation, hypothesis testing, and statistical interpretation.
**Design/methodology/approach:** The study adopts a structured, methodological approach to quantitative research, emphasizing statistical techniques such as correlation and regression analysis. It begins with a literature review, followed by hypothesis formulation, data collection, and statistical testing. The scope encompasses both theoretical underpinnings and empirical practices commonly applied in management research.
**Findings:** The research reveals that while quantitative methods enable the construction and validation of complex models, they also encounter challenges related to multidimensional constructs, sampling limitations, and the risk of statistical errors. Descriptive statistics provide a necessary foundation, but it is the application of inferential methods and careful hypothesis testing that ultimately determine the reliability of research conclusions. The analysis highlights the critical role of aligning research objectives with statistical techniques and managing risks associated with Type I and Type II errors.
**Research limitations/implications:** Limitations include potential sampling bias, issues of representativeness, and the constraints of data collection methods. Future research is encouraged to explore more diverse sampling strategies and integrate longitudinal studies to capture dynamic changes over time.
**Practical implications:** The study provides guidance for researchers and practitioners on enhancing the accuracy and validity of quantitative analysis. It offers methodological insights that can improve the design of data-driven decision-making processes in management and policy formulation.
**Social implications:** Improved methodological rigor in management research contributes to more effective policy-making and organizational practices, thereby supporting evidence-based strategies with broader societal impact.
**Originality/value:** This paper contributes to the literature by offering a critical, structured examination of the quantitative research process in management science. It provides value to

early-career researchers, academics, and practitioners seeking to improve the quality and applicability of empirical research.
**Keywords:** Quantitative research, hypothesis testing, operationalisation, statistical analysis, management science.
**Category of the paper:** Research paper.

## 1. Introduction

W. Dyduch (2016) highlights that the key distinction between qualitative and quantitative research lies in their starting points and methodological treatment. Qualitative research begins with data and information collection, treating findings as "texts", while quantitative research starts with theoretical foundations, applying specific theories and corresponding research methods, treating findings as "numbers". The primary divergence, however, is rooted in the research procedures.

Adopting theories from related disciplines, known as theoretical triangulation, can enrich the research; however, for dissertation work, it is advisable to remain within the boundaries of the primary discipline. Statistical analysis is a critical component of quantitative research, with its main purpose being to generalise the analysed information and maximise the insights drawn from collected data. This conceptualisation frames statistical analysis as a discipline of inference, utilising both primary and synthesized data to draw conclusions through probability theory and inductive reasoning.

A vital element of the research process is the operationalisation of the research problem, which involves thorough preparation. This preparation includes defining the target research community, choosing appropriate research methods and techniques, and selecting relevant indicators and variables.

This paper explores the intricate nature of conducting quantitative research with an emphasis on statistical analysis within management science. The discussion sheds light on the steps and considerations necessary to execute rigorous research that effectively translates theoretical constructs into measurable variables, allowing for deeper insights and robust findings.

The author emphasizes the need to conduct research in the described scope in order to provide guidance to researchers and practitioners on how to increase the accuracy and validity of quantitative analysis, which in turn can improve the design of data-driven decision-making processes in management.

## 2. Quantitative Research Operationalisation in Management Studies

Operationalisation is an essential part of the research process, with the decisions made during this stage directly influencing the outcomes of the research.

The procedure for conducting quantitative research can be outlined through the following steps (Babbie, 2007):

- analysis of the literature on the topic,
- identifying a research gap,
- development of a research model,
- formulation of research hypotheses,
- data collection – conducting the actual research,
- data analysis,
- drawing research conclusions – acceptance or rejection of hypotheses,
- creation of a new model,
- enriching theory through the research findings – contributing to the discipline's body of knowledge,
- highlighting the limitations of the conducted research,
- justification for further research.

The necessity of a research procedure arises from the nature of phenomena encountered in the management of organisations. According to E. Babbie (2007), these phenomena cannot be observed directly (where direct observations involve attributes of an object that can be seen straightforwardly) or indirectly (where indirect observations are based on examining attributes associated with the phenomenon that are of particular interest to the researcher). Constructs, however, represent theoretical interpretations of phenomena that are neither directly nor indirectly observable. In management science, this involves working with the development of a theoretical construct (Babbie, 2007).

A theoretical construct may have multiple dimensions, understood as groupings of similar attributes that are distinguishable from other groupings (Babbie, 2007).

M.H. Moriss and D.F. Kuratko (Czakon, 2016) demonstrated that organisational entrepreneurship is a construct comprising three dimensions: innovation, proactiveness, and risk-taking. Each of these dimensions can be represented by one or more attributes (Czakon, 2016). By defining and representing the dimensions of the construct, researchers can better grasp the complexity and multidimensionality of the phenomenon being studied (Babbie, 2007).

According to K.E. Weick (Dyduch, 2016), theory building involves the creation and subsequent testing of a series of statements that explain or predict a given phenomenon, which are then verified through specific examples. The objective of empirical research is to test these theses, which pertain to the relationships between variables within a theoretical model (Dzwigol, Kwilinski, Lyulyov, Pimonenko, 2024). Achieving this objective involves observing

all independent and dependent measures within the created theoretical model that is to be tested. Empirical research aimed at testing a theoretical model can be exploratory (attempting to understand a previously unstudied phenomenon), descriptive, or explanatory (Babbie, 2007).

A literature review is conducted by examining journals and books published in recent years (ideally post-2000, with exceptions for classic works) in the relevant discipline (Babbie, 2007). Preferably, these sources should include journals from the so-called Philadelphia list, which features titles that have undergone rigorous evaluation and are indexed in the Institute for Scientific Information databases (Babbie, 2007). In Poland, the list of scored journals provided by the Ministry of Science and Higher Education serves as a suitable basis for such analyses. Professional journals, websites, and similar sources should be avoided as primary theoretical references in dissertations (Babbie, 2007). Literature analysis can reveal conclusions about certain phenomena; for instance, while entrepreneurship and efficiency are extensively covered in the literature, their combined analysis is less common, representing a research gap that quantitative researchers may seek to address (Babbie, 2007).

Designing a study necessitates the creation of a research model that describes the relationships between the variables under analysis. It is crucial to identify which variables are independent and which are dependent. In more complex models, contextual, mediating, or moderating variables may also be included (Babbie, 2007). The research model serves as a foundation for formulating research hypotheses—statements that articulate the relationships outlined in the model. Careful attention should be given to the wording of hypotheses, ensuring that multiple variables are not combined within a single hypothesis. Relationships between variables can be tested using methods such as correlation analysis, while the analysis of influence requires at least regression analysis (Babbie, 2007).

Once hypotheses are established, the next step is to collect data to describe the variables (Babbie, 2007). When transitioning from theory to empirical research, theorists and researchers must transform concepts into constructs that can be represented by variables. A concept does not necessarily need to be measured directly (Babbie, 2007).

According to M. Esterby-Smith, R. Thorpe, and A. Lowe (2002), there are several primary methods for data collection, which include interviews (commonly used in market research (Esterby-Smith, Thorpe, Lowe, 2002)), questionnaires (widely employed in quantitative research (Babbie, 2007)), tests (to gauge individuals' opinions on specific issues (Babbie, 2007)), and observations (primarily used in qualitative research but can be standardised and processed quantitatively, similar to questionnaire data (Babbie, 2007)).

The most frequently used techniques in quantitative research are survey questionnaires and interviews, aimed at collecting information about a particular group or population. When the population size ranges from a few dozen to several hundred subjects, it is possible to survey the entire group. For larger populations, a representative sample must be chosen, using either random or purposive sampling methods—or a combination of both for their respective advantages. Due to the typically low return rate of questionnaires, random sampling is not

always feasible. Questionnaires may be distributed by post, allowing for a swift and reactive survey process. Additionally, the distribution should target a relatively homogeneous research group (Babbie, 2007).

Once the completed questionnaires are gathered (ensuring only fully returned questionnaires are used), the data is entered as variables into a spreadsheet for analysis. Depending on the research instrument, three types of variables can be obtained: qualitative (measured on a nominal scale), ordinal (measured on an ordinal scale), and quantitative (measured on an interval scale). The primary aim of employing these methods is to summarise the dataset and draw fundamental conclusions and generalisations from it (Babbie, 2007).

In quantitative analysis, descriptive statistical methods are often the initial and essential step. Commonly used techniques include tabular data description, graphical data presentation, and the calculation of distribution measures (such as measures of central tendency—mean, median, mode—and measures of variation—standard deviation, variance) (Babbie, 2007).

A frequently applied test in quantitative research is the chi-square test of concordance, used to test hypotheses where the test statistic follows a suitable distribution of a random variable (Babbie, 2007).

To assess the degree of relationship between two variables, correlation analysis can be utilised. The Pearson correlation coefficient (r) is the most widely used measure to determine the level of linear dependence between random variables. While correlation analysis indicates the relationship between variables, it does not imply causality (Babbie, 2007).

Regression analysis is employed to examine the simultaneous relationships between multiple variables. It allows researchers to explore the connections among different quantities in the dataset and use this knowledge to predict unknown values based on known quantities. In practice, regression analysis involves constructing a regression model—a function that describes how the expected value of the dependent variable relies on the independent variables. Multiple regression refers to a regression analysis with more than one explanatory variable. For better alignment of the function with the studied variables' relationships, curve fitting analysis may be conducted (Babbie, 2007).

It is worth noting that the outlined research procedure is not a perfect solution for operationalising a phenomenon within management sciences, i.e., converting data to ready variables for subsequent statistical processing. Certain limitations associated with the proposed methodology can also be highlighted. Firstly, given the time constraints, the proposed studies have a cross-sectional, statistical nature, unlike longitudinal studies that analyse the dynamics of the phenomenon over time. They offer a snapshot of the organisations examined and a single-time reflection of the phenomena present at that specific point. Secondly, due to challenges in accessing a sufficiently large group of respondents to form a representative research sample, surveys typically rely on random selection and are often limited to the scope of a single country. Lastly, the use of survey questionnaires results in numerical data that represent managerial

attitudes and opinions, rather than directly measuring the phenomenon under study (Babbie, 2007).

An example of quantitative research operationalisation in management studies can be found in the works of notable researchers who have explored various aspects of the field. For instance, studies on sustainable development management have been conducted by prominent authors who provide valuable insights into how organisations integrate sustainability into their strategic frameworks (Kwilinski, 2023; Kwilinski, Trushkina, 2023; Kwilinski, Lyulyov, Pimonenko, 2024; Kwilinski, Lyulyov, Pimonenko, Pudryk, 2024; Kwilinski, Rebilas, Lazarenko, Stezhko, Dzwigol, 2023; Kwilinski, Abazov, Domaratskiy, Boiko, 2024; Lyulyov, Pimonenko, Chen, Kwilinski, 2023; Lyulyov, Chygryn, Pimonenko, Zimbroff, Makiela, Kwilinski, 2024; Mlaabdal, Kulish, Kwilinski, Chygryn, 2024; Morris, Kuratko, 2002; Weick, 1999; Zimbroff, 2023; Zimbroff, Jorgensen, Callan, 2021; Kwilinski, Vysochyna, 2024). In the area of digitalisation management, researchers have investigated the operationalisation of data collection and analysis to understand the influence of digital transformation on organisational structures and processes (Lee, Lee, Cha, 2023; Kwilinski, Kardas, 2023; Lyulyov, Pimonenko, Infante-Moro, Kwilinski, 2024; Kwilinski, Lyulyov, Pimonenko, 2023, 2024; Lyulyov, Pimonenko, Chen, Kwilinski, Yana, 2024; Kwilinski, Szczepańska-Woszczyna, Lyulyov, Pimonenko, 2024; Kwilinski, 2023, 2024a, 2024b; Kwilinski, Merritt, Wróblewski, 2024; Kwilinski, Pudryk, Eiba, Bourntoulis, 2024; Dzwigol, Kwilinski, Lyulyov, Pimonenko, 2024). Furthermore, entrepreneurship has been a focal point for scholars examining how entrepreneurial attitudes and behaviours can be quantitatively assessed to identify patterns and impacts within different business environments (Dzwigol, 2024, 2023a, 2023b, 2020, 2021; Kwilinski, Trushkina, Birca, Shkrygun, 2023; Zimbroff, Jorgensen, 2019; Zimbroff, Schlake, Anderson-Knott, Eberle, Vigna, 2017; Zane, Zimbroff, 2018). These studies exemplify the application of rigorous quantitative methodologies to various themes within management research.

## 3. Statistical Analysis

Many sciences, including management sciences, involve the observation of surrounding realities or, through experimentation, the verification of theories under study. In management sciences, such research typically pertains to the realities within existing enterprises and their various areas of activity (systems, subsystems). Considering that an enterprise comprises a collection of diverse elements operating together to achieve various functions, objectives, and requirements, a quantitative analysis often necessitates the collection, analysis, and interpretation of a substantial amount of data. To enable such analysis, an appropriate set of tools, grounded in statistical knowledge, is essential (Dźwigoł, 2018).

The term "statistics" originates from the Italian word *stato*, meaning "state". Related terms include *statista*, referring to a person involved with state affairs, and *statisticus*, derived from Latin, signifying a collection of information useful to "statisticians." Initially, "statistician" referred to tabular data collections about the state, a practice dating back to 16th-century Italy, which later spread to countries such as France, the Netherlands, and Germany. Notably, the practice of conducting population censuses and asset assessments can be traced back to ancient Egypt (Hald, 1990).

Statistical inference moves from the data, or sample, to the broader population. The population, seen as a kind of universe, can be defined as the total set of all measurement outcomes or elements that are of interest to the researcher. A sample, in contrast, is a subset of the population chosen according to criteria set by the researcher. The sample should accurately represent the population, with selection conducted randomly so that every possible sample of $n$ elements has an equal chance of being chosen. Such a sample is referred to as a simple random sample. This sample is then studied, and the findings are generalised to the wider population.

A critical aspect of conducting statistical research is the systematisation of results, which should be based on measurement scales. This systematisation involves assigning numbers or symbols to objects (phenomena, etc.) according to established rules and principles (Bielecka, 2005).

This process is referred to as a measurement scale. Measurement scales are classified in a hierarchy from "weakest" to "strongest" (Stevens, 1946):

- nominal scale,
- ordinal scale,
- interval scale,
- ratio scale.

The nominal scale is the weakest measurement scale, where labels (groups, classes) are used instead of names. For instance, if the dataset comprises objects of different colours (e.g., yellow, green, red), each group of objects sharing the same colour is assigned the same number. Yellow objects may be labelled as 1, green as 2, and red as 3. These numbers merely replace the name of the group to which an object belongs. The nominal measurement scale is applied when the resulting observations are qualitative rather than quantitative in nature (Dźwigoł, 2018).

The ordinal scale, on the other hand, is used to rank objects of observation according to their size or importance. If a researcher evaluates three products based on a specific criterion, they can rate these products using the numbers 1 to 3. The researcher assigns these digits to indicate which product is the best and which is the worst (with 1 representing the best and 3 the worst). However, this scale does not inform the researcher by how much one product surpasses another.

An interval scale allows for the assignment of differences between observation results. The observations (expressed in appropriate units) are placed within a numerical interval, where the distance between objects corresponds to the difference in their observation results.

These scales are used for characterisation. For example, if the average value of the Dow Jones index was 3001 points in January 2012 and 2980 points in November 2012, the interval scale allows us to note that the difference between January and November was 21 points (Dźwigoł, 2018).

The quotient scale is the strongest of the scales mentioned. Unlike the interval scale, which measures distances between two observed objects, the quotient scale deals with distance quotients. This means that the relationships between two values (their differences or quotients) have a real-world interpretation. Examples of measurements on the quotient scale include wages (e.g., a salary of $100,000 is twice that of $50,000), prices in gold, electrical voltage, and inflation. The quotient scale includes an absolute zero, signifying that any quantity expressed on this scale can be represented as a multiple of another.

Once the measurement scale for a statistical survey is defined, the subsequent steps of statistical calculations can proceed, aiming to generalise the results from the research sample to the broader population. This process is encompassed within statistical inference, a branch of statistics that, beyond generalising study results, also estimates the errors involved in such generalisation. Reliable results require a proper approach to the analysis and interpretation of research findings, which means basing research on relevant empirical data, formulating appropriate research hypotheses, and verifying them.

To discuss the verification of statistical hypotheses, the basic concepts in this area must be defined. A statistical hypothesis is a conjecture made by the researcher about a population. Hypothesis verification is the process of determining whether the hypothesis posited by the researcher is true, based on results from a random sample (Dźwigoł, 2018).

There are several types of hypotheses, the most important being:

- null hypothesis,
- alternative hypothesis.

During the research process, the researcher proposes a hypothesis to be tested, known as the null hypothesis (denoted as H0). This hypothesis is assumed to be true until sufficient statistical evidence is provided to reject it in favour of an alternative. The alternative hypothesis, denoted as Hj or H1, opposes the null hypothesis by assigning population parameter values that differ from those proposed by the null hypothesis (Aczel, 2000). The null hypothesis and the alternative hypothesis together form a complementary pair covering all possible parameter values. An example of such a pair is:

$$H_0: \mu = 50, H_1: \mu \neq 50 \quad (1)$$

Here, the null hypothesis states that the mean of the population is 50, while the alternative hypothesis suggests otherwise. Only one of these hypotheses can be true. The null hypothesis reflects the researcher's assumption about a phenomenon or situation that they wish to test, determining whether this belief holds or should be rejected in favour of the alternative hypothesis.

The process of testing hypotheses set by the researcher is known as hypothesis testing or test statistics. This testing is conducted based on a test sample, from which the mean value derived from observations is used to determine whether the null hypothesis should be rejected. To make this decision, a predefined rule, known as the decision rule of the statistical hypothesis test, must be followed. This involves checking whether the result obtained from the random sample falls within the rejection region (Aczel, 2000). The rejection region is defined as a range of values such that, if the test result falls within this range, the null hypothesis (H0) should be rejected. For example, in the hypothesis (H0 = 50), a sample decision rule might state: "reject the null hypothesis if and only if x is not less than 45 or greater than 55" (Dźwigoł, 2018).

An important aspect of hypothesis testing is the potential for errors. Consider a courtroom scenario involving a murder trial. In this analogy, H0 could represent the hypothesis that the accused is innocent (assumed true unless proven otherwise), while H1 represents the hypothesis that the accused is guilty. The judge, who is unaware of the actual state of affairs, must decide between finding the accused innocent (not rejecting H0) or guilty (rejecting H0). The outcomes are as follows:

- If the judge rejects H0 (finding the accused guilty) when the accused is actually innocent, a Type I error, or "false positive", has been made.
- If the judge accepts H0 (finding the accused innocent) and the accused is indeed innocent, the decision is correct.
- If the judge accepts H0 (finding the accused innocent) but the accused is actually guilty, a Type II error, or "false negative", has been made.

These scenarios can be represented in Table 1.

**Table 1.**
*Types of errors in hypothesis testing*

| **Actual state<br>The decision to adopt one of the hypotheses** | **Ho** | **H1** |
|---|---|---|
| Ho | The right decision | Error of the second kind |
| H1 | Error of the first kind | The right decision |

Source: own study (Dźwigoł, 2018).

A Type I error occurs when the researcher rejects the null hypothesis (H0) when it is true. A Type II error occurs when the null hypothesis is not rejected even though it is false.

The probabilities of these errors are also significant. Let us denote the probability of making a Type I error as α (the significance level) and the probability of making a Type II error as β. For instance, in the hypothesis H0 = 50, if we do not know the true mean of the population and the mean is indeed 50 but we decide to reject H0, we commit a Type I error. Conversely, if H0 is not rejected and the true mean differs from 50, a Type II error is made.

Researchers should align the null hypothesis (H0) with prevailing assumptions and control primarily for the probability of a Type I error. Standard practice is to set the probability of a Type I error, α, at 0.05 or 0.01.

The probabilities α and β are relative probabilities. Probability α is the likelihood that the null hypothesis will be rejected after sampling and calculation, assuming it is true. Probability β is the likelihood that the null hypothesis will not be rejected after sampling and calculation, assuming it is false (Aczel, 2000). The relationships are as follows (Dźwigoł, 2018):

$$\alpha = P(\text{H0 "rejected} \mid \text{H0 is true"}) \quad (2)$$

$$\beta = P(\text{H0 "not rejected} \mid \text{H0 is false"}) \quad (3)$$

The decision made by the researcher regarding the acceptance or rejection of a hypothesis is part of the process of statistical inference. If the researcher decides not to reject the null hypothesis, it indicates insufficient evidence to reject it. Conversely, if the null hypothesis is rejected, it indicates strong conviction that the hypothesis should be discarded. Thus, a decision not to reject H0 leads to a tentative (weak) conclusion, whereas rejecting H0 leads to a firm conclusion.

The findings of this study reaffirm the critical role of statistical analysis in the effective execution of quantitative research in management science. The operationalisation of constructs—particularly those that are abstract and multidimensional—remains a methodological challenge that requires precise design and thoughtful interpretation. Despite advances in data processing tools and statistical techniques, the process of converting theoretical constructs into measurable indicators is still prone to oversimplification, which may compromise the richness of the original phenomena under investigation.

One of the central contributions of this study lies in the alignment of statistical methods with research objectives. While descriptive statistics offer foundational insights, the reliability and validity of findings largely depend on the careful application of inferential techniques such as correlation and regression analysis. These tools not only test hypotheses but also allow researchers to identify patterns, forecast trends, and assess relationships between variables within theoretical models.

Moreover, the discussion highlights the interplay between methodological precision and practical feasibility. The limitations identified—such as sampling biases, low response rates, and the constraints of cross-sectional studies—underscore the necessity of balancing methodological rigor with accessibility and cost-effectiveness in data collection. Integrating longitudinal approaches and expanding the diversity of samples could significantly enhance the robustness of future research.

The study also draws attention to the epistemological implications of statistical errors. Type I and Type II errors, often treated as purely technical concerns, reflect deeper issues of inference, decision-making, and risk management in empirical research. These errors remind us that statistical analysis, while objective in form, is inherently interpretive and dependent on the researcher's assumptions, thresholds, and theoretical orientations.

Finally, the broader implications of the findings suggest that quantitative methods—when carefully applied—can bridge theoretical constructs and managerial realities. However, this requires not only technical proficiency but also a philosophical awareness of the assumptions embedded in statistical practices. This reinforces the argument that methodological transparency, rigorous model specification, and theoretical grounding are indispensable to high-quality research in management science.

## 4. Conclusion

The application of research methods and techniques depends on the nature of the research, the construction of the research model, the formulated hypotheses, and the research sample. It is the researcher's responsibility to select methods that are appropriate for the planned study, bearing in mind the wide array of available options (Huizingh, 2007; Gatnar, 2000; Kolonko, 1980). Quantitative research, despite its widespread use in management sciences, has both proponents and critics who emphasise the strengths of their chosen approach, often overlooking alternative research perspectives (Babbie, 2007).

Today, statistics has evolved beyond merely collecting information for state purposes; it now focuses on methods of data collection, analysis, presentation, and practical application. Statistics is now recognised as a field of study that can encompass nearly all aspects of human activity. The gathering of numerical information, referred to as data, poses challenges in terms of analysis, synthesis, and multifaceted presentation. This necessity has led to the development of statistical tools, the most prominent of which is statistical analysis.

Quantitative research is an empirical approach involving the measurement of specific variables in a quantitative manner using suitable instruments. It is employed when both the research problem and the resulting findings can be expressed quantitatively (Niemczyk, 2011; Dźwigoł, 2018).

Further research could focus on enhancing the integration of quantitative methods with qualitative insights to provide a more comprehensive analysis of management phenomena. Additionally, exploring advanced statistical techniques and their applications in management studies could help improve the accuracy and depth of data interpretation. Investigating new data sources, such as big data analytics and machine learning, could also offer innovative perspectives and more robust decision-making tools in management science. Lastly, expanding comparative studies across different industries and countries would help reveal cross-contextual insights and improve the generalisability of research findings.

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# QUALITY MANAGEMENT IN CONSTRUCTION PROCESSES – CASE STUDY

Jakub EJDYS

Archime Sp. z o.o.; jakubejdys@archime.pl, ORCID: 0009-0007-7328-5886

**Purpose:** The purpose of this article is to analyze the possibilities for improving construction processes, aiming to identify problems and analyze them using simple quality management tools and methods.
**Design/methodology/approach**: The article examines the need for quality improvement in various construction processes through a literature review and interviews with participants in construction processes. Then, a process for searching improvements in processes is proposed, considering simple quality management methods (flowchart, Ishikawa diagram, FMEA analysis, 5WHY).
**Findings:** The results showed that construction processes are not perfect and contain aspects that require improvement. The proposed sequence of quality management methods provides an opportunity for a quick and easy analysis of the construction process, identifying the causes of errors during project implementation, which in turn allows for proposing solutions.
**Practical implications:** Construction companies can use the simple methods proposed in the article to streamline their operations, enabling them to build more efficiently, safely, and easily.
**Originality/value:** Many construction companies often do not consider process improvements and do not seek solutions that can yield significant effects without large efforts.
**Keywords:** Construction, quality management, construction processes.
**Category of the paper:** Case Study.

## 1. Introduction

Construction has accompanied humankind for thousands of years, originating with the earliest forms of shelter. Today, it constitutes one of the key sectors of the Polish economy, alongside industry and trade and repair services (Perzyna, 2025). Over the centuries, building technologies have significantly evolved, enabling the construction of larger, more durable, and safer structures. Although the use of prefabricated reinforced concrete and steel components has become increasingly common, traditional cast-in-place reinforced concrete and masonry techniques still dominate the industry. Steel and timber frame systems are also utilized, but typically for smaller-scale projects.

The construction process is characterized by a high degree of variability in terms of structure types, functions, materials used, and environmental conditions. Each project has its own budget, schedule, and implementation context. This diversity, combined with the fact that most work is performed on-site, contributes to the complexity of construction processes and increases the risk of errors (Kowalski, 2013).

Even though many construction technologies have been in use for decades or even centuries they still have limitations. While construction today is executed faster and under safer conditions than in the past, numerous aspects of the process still require improvement to reduce costs, enhance quality, and minimize environmental impact.

A significant issue in modern construction is the tendency to submit bids with minimal financial buffers, which encourages cost-cutting measures and accelerated schedules (Syahrizal, 2019). As a result, efforts to optimize processes are often deprioritized in favor of ensuring timely and profitable project completion. This short-sighted approach may overlook the fact that certain issues can be addressed at low cost, ultimately improving the financial performance of construction companies.

To be effective in construction environments, quality management methods must be simple, affordable, and quick to implement. While advanced analytical and statistical tools exist, not all construction managers are able to learn and apply them efficiently. Therefore, it is necessary to adopt practical methods that can be implemented across various projects without the involvement of specialists and with the help of commonly available software. This is particularly important for small and medium-sized construction enterprises, which often face constraints in human and financial resources.

For project managers and site engineers, such methods can support the improvement of overall project execution, profitability, scheduling, and worker safety. Periodic process evaluations conducted by different individuals can help identify new areas for enhancement, gradually bringing operations closer to optimal performance in line with the Kaizen philosophy (Vieira et al., 2022).

This article presents fundamental quality management methods in the context of their applicability to the improvement of construction processes. The analysis of selected tools formed the basis for proposing a methodology for identifying and eliminating problems within construction workflows. The proposed methodology was validated through a case study involving reinforced concrete works—one of the most widely used technologies in structural construction.

## 2. Quality management in construction

The concept of quality was first introduced in ancient Greece. Plato described it as a measurable and assessable attribute (Mackenzie, 1985), while Aristotle considered quality to be what makes a thing what it is (Bulska, 2018). Although many thinkers have addressed the notion of quality, it was only later that the concept of quality management emerged, focusing on how to achieve and maintain excellence in products, processes, or services.

In recent decades, several influential quality management philosophies have been developed, including KAIZEN (Vieira et al., 2022), Six Sigma (Linde, 2020), and TQM – Total Quality Management (Alawag et al., 2023). While they differ in principles, structure, and implementation tools, their shared goal is the continuous improvement of quality.

Quality management encompasses not only broad frameworks but also practical tools and methods for process improvement. These methods are applicable across various sectors – from manufacturing to services, both private and public – including healthcare (Ręba, 2021), education (Nasim, 2019), and industry (Azouza, 2023). However, in construction, the use of quality management tools is far less common due to the unique challenges of project-based work.

Modern civil engineers face increasing pressure to reduce both costs and completion times. Project management in construction must be comprehensive, covering everything from design and construction to quality control and real-time decision-making. This must all be achieved within the "iron triangle" of budget, time, and quality (Pollack, 2018).

The standard construction project lifecycle includes five stages: initiation, planning, execution, monitoring, and closure. However, this model should be extended to include a sixth stage: improvement. Rather than limiting quality management to post-completion reviews, it should be integrated throughout project execution, when real-time feedback is most valuable.

The quality of design, planning, and construction directly affects a structure's durability, safety, and long-term usability. Studies on the causes of building failures show that:

- about 40% result from design errors not caught in the design phase,
- 25-30% stem from construction execution errors,
- 15% are due to poor material quality,
- 9% are caused by operational misuse,
- the remaining are mostly due to incorrect material application (Kowalski, 2013).

Each of the aforementioned groups of errors and problems is influenced by numerous factors, and their cumulative effect determines the final quality of a construction project. One effective way to prevent such errors and their underlying causes is the implementation of quality management methods.

Quality management tools can generally be divided into two main categories: “traditional” and “new.” The first group often referred to as the “Seven Basic Tools” or the “Old Seven” includes:

- Process Flowchart – a graphical representation of the process flow (Anjard, 1998).
- Ishikawa (Fishbone) Diagram – a tool for visualizing cause-and-effect relationships (Botezatu et al., 2019).
- Pareto Chart – a bar chart identifying the most significant factors in a process (Alkiayat, 2021).
- Histogram – a visual representation of data frequency distribution across intervals (Li, 2019).
- Scatter Diagram – a plot showing correlation between two variables (Gogtay, 2017).
- Check Sheet – a structured form for collecting data about a specific process.
- Control Chart – a chart used to monitor process performance and detect variation within tolerance limits.

The “new” tools of quality management primarily rely on verbal and conceptual relationships, making them particularly useful in areas such as brainstorming, design, and opinion gathering. These tools include:

- Relations Diagram – illustrates interrelationships among multiple factors.
- Affinity Diagram – groups data or ideas into categories for clearer analysis.
- Arrow Diagram – displays the sequence and duration of project activities.
- Decision Tree – helps determine the most favorable solution for a given problem.
- Matrix Diagram – visualizes relationships between multiple variables or groups.
- Process Decision Program Chart (PDPC) – maps out steps in a decision-making process and possible outcomes (Tsironis, 2018).

In addition to these, two other notable methods are frequently used in quality management:

- 5WHY– a simple yet powerful technique involving repeatedly asking “Why?” (typically five times) to identify the root cause of a problem (Siwiec, Pacana, 2021).
- Failure Mode and Effects Analysis (FMEA) – a method that identifies potential failure modes within a process, their causes, and consequences. Each failure mode is assigned a numerical score based on predefined criteria (severity, occurrence, detection), and these values are multiplied to calculate a Risk Priority Number (RPN). The issue with the highest RPN is prioritized for corrective action, as it poses the greatest risk to the process (Koprivica et al., 2024).

## 3. Proposal of an original methodology for Quality Management in construction processes

Assuming that the proposed methodology should be simple and quick to implement—given the often limited human resources in construction companies—a four-stage process has been developed for introducing quality management into construction processes.

Stage 1: Identification and graphical representation of the process using a flowchart.

Stage 2: Problem identification and classification using the Ishikawa diagram.

Stage 3: Root cause and solution analysis using the FMEA method.

Stage 4: In-depth analysis of key issues using the 5WHY method along with proposed corrective actions.

The implementation of this quality management methodology should begin with a thorough understanding of the process: its sequence, complexity, interdependencies, working environment, the number of personnel involved and their responsibilities, tools used, and so on. For an engineer supervising a construction process, this step should be relatively straightforward. An essential task at this stage is to transform the acquired knowledge into a flowchart that reflects the sequence of activities, relationships between stages, and control points.

This process mapping provides the basis for the identification and classification of issues. At the second stage, the Ishikawa diagram (also known as the fishbone diagram) may be applied. This tool can be used not only to identify and categorize problems but also to trace and classify their root causes. In construction, such classification might include categories such as: personnel, tools and equipment, working conditions, construction materials, and management/design teams.

The issues identified in Stage 2 are then subjected to FMEA analysis in Stage 3, which helps determine their causes and possible solutions. For each identified problem, both the cause and the resulting effect should be evaluated using the following criteria:

- Severity of the effect (1 – negligible, 10 – extremely severe).
- Probability of occurrence (1 – unlikely, 10 – very likely).
- Detection difficulty (1 – easy to detect, 10 – very hard to detect).

The product of these three values results in a Risk Priority Number (RPN). FMEA analysis also helps highlight the most critical issues, which should then be further analyzed using the 5WHY method (Stage 4). This final stage involves repeatedly asking the question “why?” in order to trace problems back to their root cause. The answers obtained can usually be grouped into categories such as financial, managerial, social awareness, nature of the work, etc.

Focusing on key problems is particularly relevant in the context of limited financial, temporal and material resources. The study should conclude with a summary of the most significant issues along with proposed corrective actions. Implementing these improvements

may lead to enhanced quality, greater efficiency, and improved working conditions. Repeating this type of analysis periodically is recommended to foster continuous improvement and move the process closer to optimal performance.

## 4. Case study

The proposed methodology was verified using a case study involving reinforced concrete works supervised by the author of this paper, who was employed as a construction engineer by the general contractor. Direct involvement in the process allowed for a detailed understanding of the workflow and identification of significant issues, which enabled a thorough examination and the identification of weak points in the analyzed process.

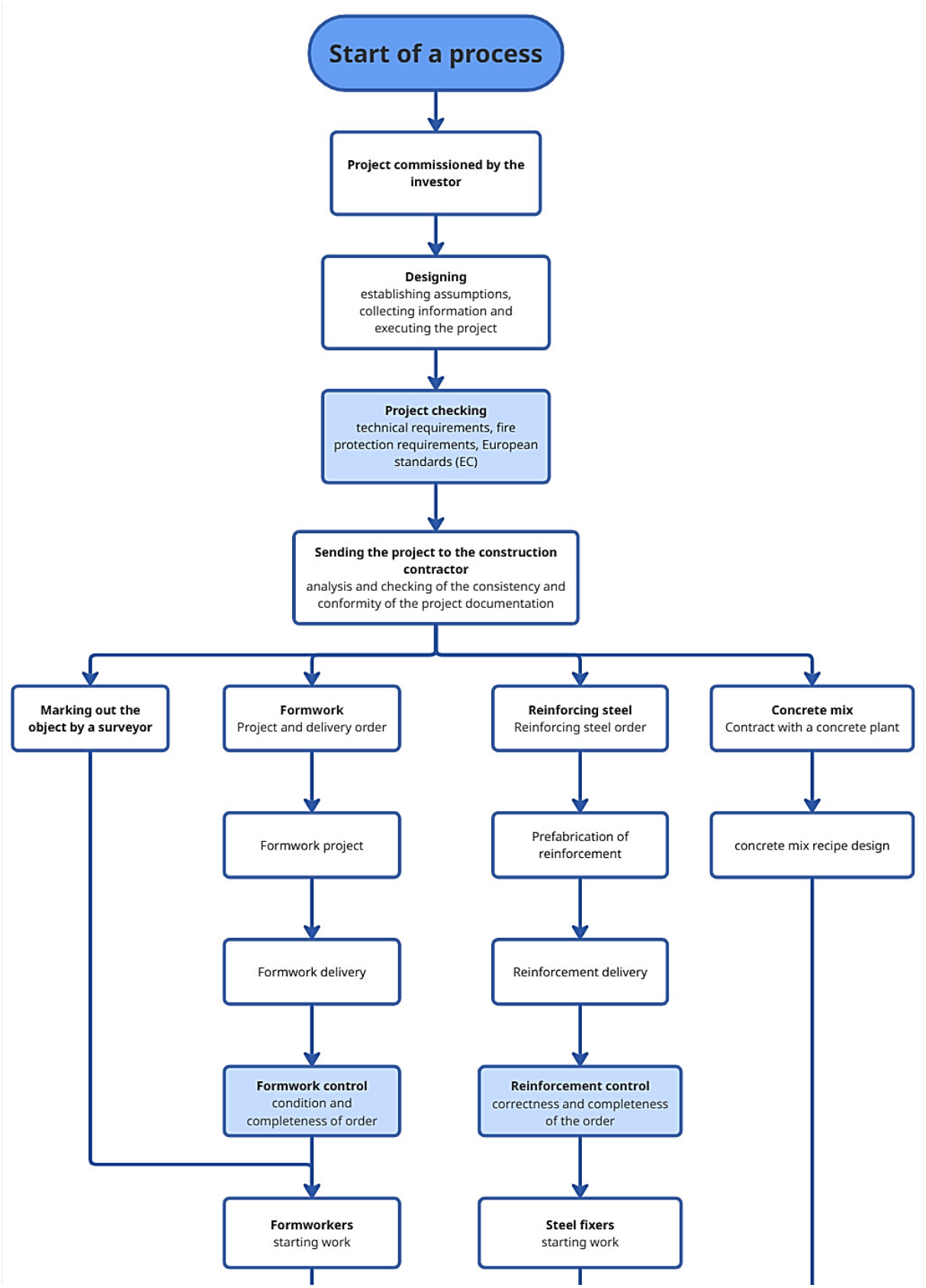
The subject of the study was a residential investment comprising five above-ground floors and two underground floors. The reinforced concrete works included, among others, diaphragm walls, columns, beams, slabs, external and internal walls. The methodology was applied to analyze a specific process — the construction of a reinforced concrete column or wall. The advantage of this approach is the focus on a detailed, narrowly defined area of operation rather than the entire activities of the construction company.

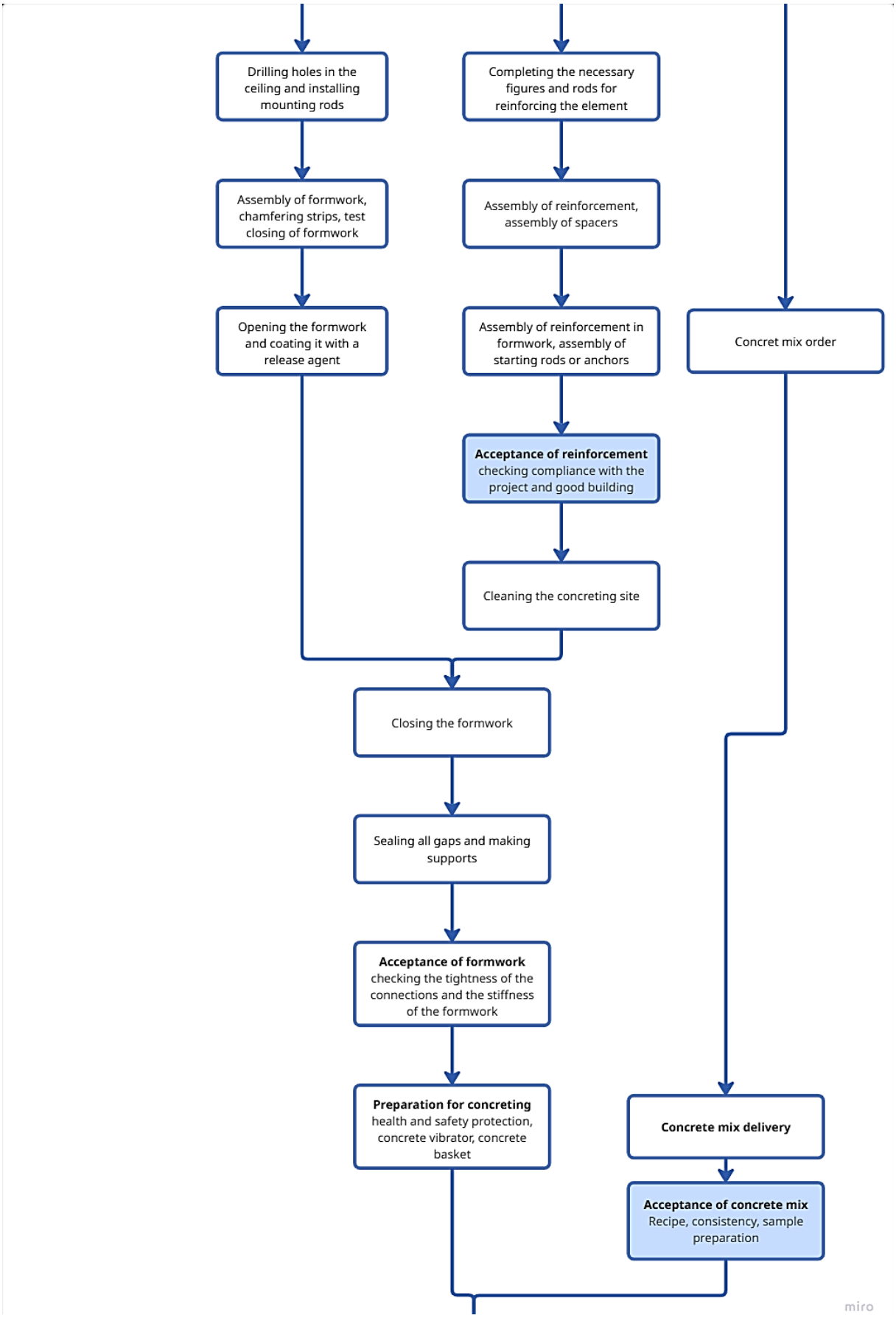
**Stage 1. Identification and graphical presentation of the process using a flowchart**

The process of constructing a reinforced concrete column begins with the design of the structural element by a designer with appropriate building qualifications. The design assumptions depend on factors such as the building's intended use, the investment's location, and the operational conditions. Key parameters affecting the quality of the structure include: the appropriately selected dimensions of the element, the correct amount of reinforcement, and the concrete class.

At the preparation stage, consultations with branch designers responsible for sanitary, electrical, and fire installations are also crucial to avoid potential design collisions. The next step in the process is ordering the reinforcement steel and concrete mix with parameters in line with the project requirements.

Correctly executed stages of design and planning form the foundation for the efficient and proper execution of the reinforced concrete element. The detailed process flowchart for constructing a reinforced concrete column is presented in Figure 1.


Start of a process
Project commissioned by the investor
Designing
establishing assumptions, collecting information and executing the project
Project checking
technical requirements, fire protection requirements, European standards (EC)
Sending the project to the construction contractor
analysis and checking of the consistency and conformity of the project documentation
Marking out the object by a surveyor
Formwork
Project and delivery order
Reinforcing steel
Reinforcing steel order
Concrete mix
Contract with a concrete plant
Formwork project
Prefabrication of reinforcement
concrete mix recipe design
Formwork delivery
Reinforcement delivery
Formwork control
condition and completeness of order
Reinforcement control
correctness and completeness of the order
Formworkers
starting work
Steel fixers
starting work


Drilling holes in the ceiling and installing mounting rods
Completing the necessary figures and rods for reinforcing the element
Assembly of formwork, chamfering strips, test closing of formwork
Assembly of reinforcement, assembly of spacers
Opening the formwork and coating it with a release agent
Assembly of reinforcement in formwork, assembly of starting rods or anchors
Concret mix order
Acceptance of reinforcement checking compliance with the project and good building
Cleaning the concreting site
Closing the formwork
Sealing all gaps and making supports
Acceptance of formwork checking the tightness of the connections and the stiffness of the formwork
Preparation for concreting health and safety protection, concrete vibrator, concrete basket
Concrete mix delivery
Acceptance of concrete mix Recipe, consistency, sample preparation
miro

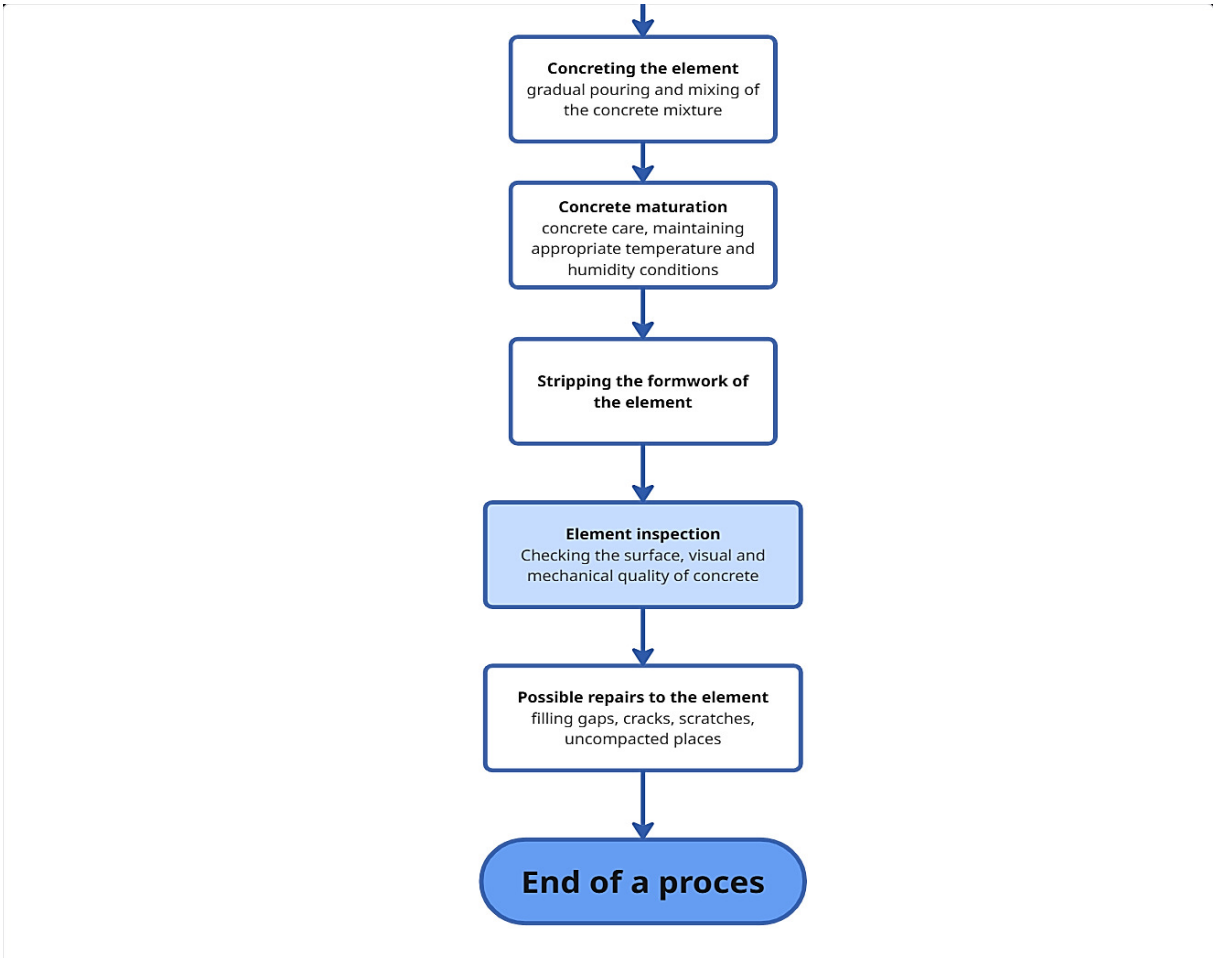



**Figure 1.** Flowchart of the reinforced concrete works process.
Source: author's own elaboration.

**Stage 2. Identification and classification of problems using the Ishikawa Diagram**

The Ishikawa diagram was used to classify the problems related to the analyzed process of reinforced concrete works (Figure 2).

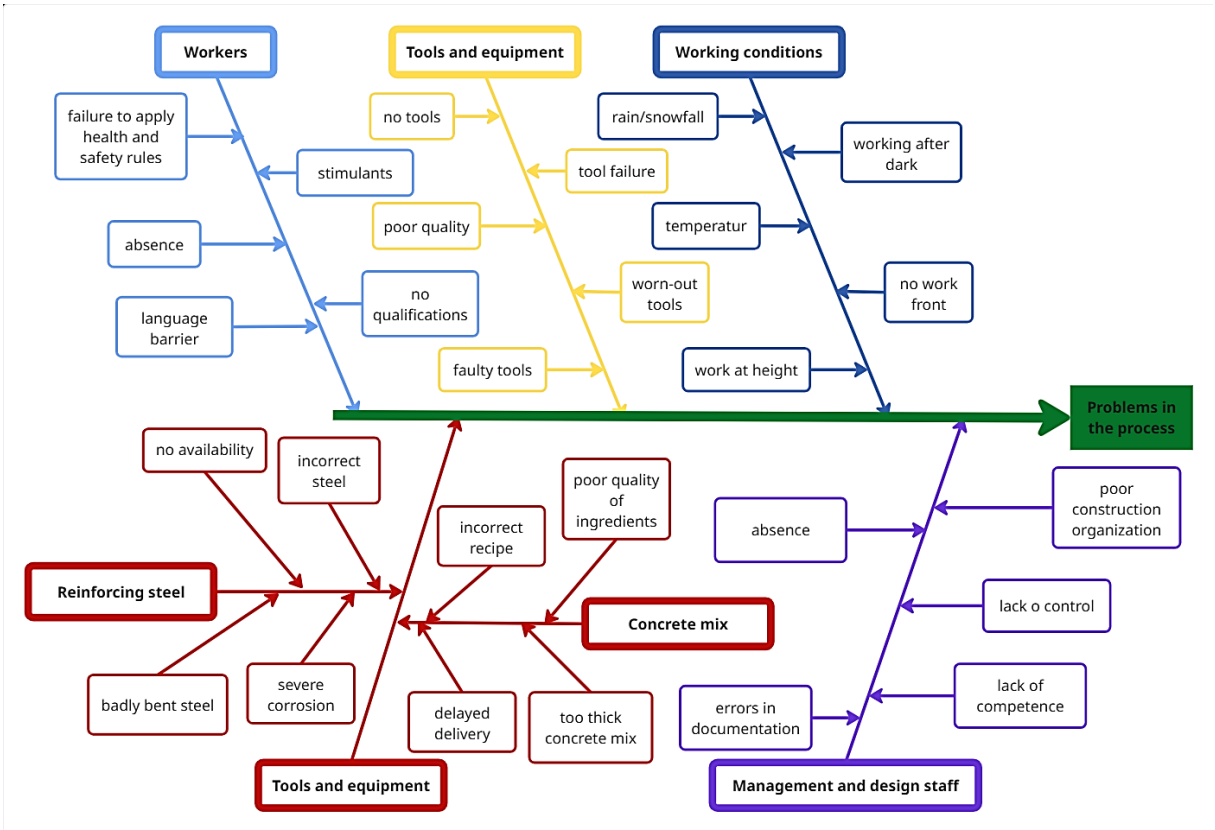



**Figure 2.** Ishikawa Diagram for the Reinforced Concrete Works Process.

Source: author's own elaboration.

The diagram briefly presents the issues within the analyzed process. Below, selected problems are described.

Workers:

- stimulants – alcohol problems among construction workers are common;
- failure to apply health and safety ruler – this stems from ignorance of the law, lack of awareness about the consequences of actions, or shortcuts in procedures;
- absence – companies often handle multiple construction sites at once, leading to a fluctuating number of workers on different days. additionally, construction firms increasingly face worker shortages in various positions;
- no qualifications – the current labor market issues cause a shortage of skilled workers;
- language barrier – construction sites often employ workers from various nationalities, including Belarus, Ukraine, Georgia, Turkey, and Kazakhstan.

Tools and Equipment:

- no tools – sometimes basic tools are missing due to the company's limited resources or the need to allocate tools across multiple sites,
- tool failure – working on a construction site requires durable equipment, which is subject to heavy use and thus prone to failure,
- poor quality – resulting from cost-cutting measures by company owners,

- worn-out tools – due to being used to the limit for cost-saving purposes,
- faulty tools– intense use leads to equipment wear and tear, resulting in many items becoming non-functional.

Working Conditions:

- rain/snowfall – reinforced concrete work is mainly performed outdoors, and precipitation often halts work,
- working after dark – large concrete pours in periods when the sun sets early require work to continue after dusk,
- temperature – excessive heat in the summer and extreme cold in the winter cause problems in maintaining proper conditions for concrete setting,
- no of work front – poor construction management or delays from other contractors sometimes cause stoppages, delaying subsequent stages of work,
- work at height – big element demand working at heights. a lot of work has to be done above safe height.

Materials:

- reinforcing Steel:
  - no availability – an increasingly common issue due to a shortage of raw material deliveries to steel mills,
  - incorrect steel – incorrectly selected steel grade or errors in ordering,
  - badly bent steel – errors made in the factories that fabricate reinforcement,
  - severe corrosion – poor storage of steel over time can lead to corrosion, making it unusable,
- concrete:
  - incorrect mix – errors at the concrete plant in selecting components and proportions for the concrete mix,
  - poor quality ingredients – Low-grade raw materials, which are often cheaper,
  - too thick concrete mix – results in difficulties with proper vibration and extends the concreting time,
  - delayed delivery – can lead to excessive waiting time for the workers and premature setting of concrete in the truck mixer.

Management and Design Team:

- poor construction organization – incorrect time allocations for specific stages, lack of space on the site, and poor communication between subcontractors,
- absence – construction managers often oversee multiple projects simultaneously and cannot be present at all times,
- lack of control – a heavy workload or excessive trust in staff results in insufficient monitoring of some stages,

- errors in documentation – complex projects often contain mistakes that only emerge during construction,
- lack of competence – sometimes, young engineers are assigned tasks without sufficient experience, and no guidance is provided on how to complete the tasks.

**Stage 3. Analysis of causes and solutions for problems using the FMEA method**

The application of the FMEA method was conducted in relation to the problems previously identified and described in Stage 2, concerning the "Management and designing staff" category. A crucial part of this stage is the proposed solutions for the identified issues, which are presented in the last column of Table 1.

**Table 1.**
*FMEA Analysis for the "Workers" Category*

| Category | Problem | Effect | Cause | S | P | D | RPN | Proposed Solutions |
|---|---|---|---|---|---|---|---|---|
| Management and designing staff | Poor construction organization | Delays, lack of efficiency, etc. | Lack of experience | 4 | 3 | 4 | 48 | - Experienced management<br>- Verifying knowledge during hiring<br>- Training for management team |
| | Absence | Employee neglect, lack of control | Managing multiple construction sites at the same times | 4 | 3 | 4 | 48 | - Fair compensation for working on a single construction site<br>- Requirement for the presence of management on-site during worker shifts |
| | Lack of Control | Construction errors | Lack of time for management, insufficient stuff | 6 | 3 | 5 | 90 | - Establish stages requiring inspection approval<br>- Hire a construction supervision inspector<br>- Adjust staff size in accordance with the size of the project |
| | Errors in documentation | Lack of consistency between disciplines | Incompetent designer, making changes without verification | 7 | 6 | 6 | 252 | - Use experienced design office<br>- Implement BIM technology<br>- Verify the design by different specialists before the work begins |
| | Lack of competence | Execution and design errors | Lack of proper education, lack of worker in the labor market | 7 | 5 | 3 | 105 | - Verify knowledge before hiring<br>- Do not leave young employees alone<br>- Provide support for inexperienced employees |

After conducting the analysis, the RPN values were obtained, indicating the significance of each cause of problems within the process. The highest results from all categories are as follows:

- Errors in documentation – 252.
- Failure to apply safety regulations – 196.
- Incorrect concrete mix recipe – 180.
- Worn-out tools – 160.
- No work front – 144.

**Stage 4. Analysis of key problems using the 5WHY method along with proposed solutions**

The FMEA analysis, through a quantitative (point-based) evaluation of identified problems, makes it possible to identify key and most critical issues requiring urgent preventive or corrective actions. A complementary method is the 5WHY approach, which allows for an in-depth and reflective analysis of the causes of observed phenomena, problems, and their origins. Repeatedly asking the question "Why?" forces all participants in the process to reflect on the root causes. Only by reaching the root causes can one ensure that similar problems are avoided in the future.

An example of using the 5WHY method in relation to a specific problem — errors in documentation — is presented in Table 2.

**Table 2.**
*5WHY analysis for the problem "errors in documentation"*

| Problem | 1. Why? | 2. Why? | 3. Why? | 4. Why? | 5. Why? |
|---|---|---|---|---|---|
| **Errors in documentation** | Inaccurate review of the project before construction began | Lack of time for project verification | No checking designer was hired | No requirement | A building with a simple structure |
| | | | | Failure to hire a reviewing designer | Cost savings |
| | | | | | Desire to release the project as quickly as possible |
| | | | Checking designer signed the documents without actually checking | Laziness | Old age |
| | | | | | Desire to earn easy money |
| | | | | Trust in the design office | Connections among designers |
| | | | | | Relying on the reputation of the design office |
| | | Lack of time for project verification | Work overload | Working on multiple projects at the same time | Desire for high profit |
| | | | | | High expectations from the company management |
| | | | | Sudden need to introduce corrections to old projects | Previously poorly executed project |
| | | | | | Introducing changes in already completed projects |
| | | | Small number of experienced designers | Not hiring new employees | Lack of experienced designers |
| | | | | | Cost savings |
| | | | | Training newly hired employees | Lack of experience |
| | | | | | Low level of education |

Cont. table 2.

| | | | | | |
|---|---|---|---|---|---|
| | Introducing changes to the project | Poorly thought-out initial solutions | Failure to consider all aspects | Limited experience | Rarely used solutions |
| | | | | | Low level of education |
| | | | | Demanding project | Rarely used solutions |
| | | | | | Specialized facility, e.g., hospital, military facility |
| | | | Highly demanding building | Complicated building structure | Architect's creativity |
| | | | | | Investor's request |
| | | | | Required advanced installations | Specialized facility, e.g., hospital, military facility |
| | | | | | Modern building |
| | | Changes to the design and assumptions in the project | Looking for alternative solutions | Seeking cost savings | Desire for higher profit by the contractor |
| | | | | | Desire to save money by the investor |
| | | | | Looking for alternative solutions | Greater efficiency and better adaptation to the investment |
| | | | | | Unavailability of originally planned solutions |
| | | | Change in functionality and purpose | Change of concept by the investor | Desire for higher profit by the investor |
| | | | | | Desire for faster project completion |
| | | | | Changes proposed by the contractor | Poorly designed building |
| | | | | | Difficult-to-execute design |

Source: author's own elaboration.

After analyzing the problem of errors in documentation, 31 potential causes of this issue were identified. Most of these causes can be grouped based on a common feature:

- green represents the connection to finances. In construction, money plays a crucial role, leading to a conflict between the investor, who wants to spend as little as possible, and the contractor, who aims to maximize profits. Frequent cost-cutting measures in a project lead to changes in the structure, material solutions, and other building aspects. Additionally, using cheaper design firms often results in either a lack of experience or a minimal amount of time dedicated to the project, which can result in an underdeveloped design,
- blue is associated with education and experience. Lack of experience is a common problem that can lead to a range of difficulties, from minor issues to even construction disasters. Young, inexperienced workers need to be constantly monitored by more experienced individuals, which allows them to develop and improve their skills,
- orange is linked to the complexity of the project and situations where the likelihood of making errors is high due to the type of building and its characteristics. Specialized structures, such as sewage treatment plants, hospitals, or other buildings with non-standard solutions, are not built frequently. Consequently, design firms often have limited experience, significantly increasing the risk of problems.

After conducting an FMEA analysis for each category using the Ishikawa diagram, several critical issues were identified. Subsequently, the 5WHY method was employed to gain a deeper understanding of these problems and break them down into their root causes. The gathered information should be sufficient to identify solutions.

For the most serious issue, namely errors in documentation, the ideal solution would be the implementation of BIM technology in both design and construction processes. This technology involves creating 3D models that contain more easily accessible information. Specialized software enables checking for clashes between installations and the structure. Specific elements can be assigned details such as reinforcement cover thickness or mix composition, which significantly reduces the risk of errors during the construction phase.

## 5. Conclusion

This article proposes a quality management methodology that can be applied during various stages of design and construction processes. The suggested solution is quick and can be effectively handled by anyone performing tasks or supervising the respective process. The presented case study confirms that the sequence of applying quality management methods is efficient and allows for an in-depth analysis of the scope of work. The obtained information is sufficient to propose solutions to problems that can significantly impact efficiency, project costs, and workplace safety.

The versatility of the proposed methodology is demonstrated by its applicability to various construction processes. The proposed methodology could be subjected to further research in the form of case studies in other areas of construction. Additional analysis of the impact of its implementation on quality indicators such as execution time, costs, and the number of accidents would help confirm its actual influence on construction processes. If these studies were able to determine the savings generated by the changes, along with the implementation costs of the methodology, it would be possible to assess the financial viability of introducing these quality management methods.

The proposed solution is intended for small and medium-sized enterprises, where the number of personnel is limited and quality management specialists are rarely employed. As a result, quality management responsibilities often fall to civil engineers. The methodology could be implemented through its inclusion in training programs or by developing industry guidelines and best practices for management personnel. Collected data and outcomes from various construction sites and companies could be compiled into a shared knowledge base. The exchange of information and experiences would contribute to the overall development of the construction sector.

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# THE INTERNATIONAL ROLE OF THE EURO AND THE COVID-19 PANDEMIC – CRISIS EXPERIENCE AND OUTLOOK FOR THE FUTURE

Juliusz GIŻYŃSKI

University of Gdańsk, Faculty of Management; juliusz.gizynski@ug.edu.pl, ORCID: 0000-0002-8547-6854

**Purpose:** The main study objective is to examine the impact of the COVID-19 crisis on the euro's international position, primarily in comparison with the financial and debt crisis, against the backdrop of the overall evolution of the euro.
**Design/methodology/approach**: In accomplishing this objective, a critical study of international economics and finance literature was carried out, followed by an analysis of mainly the European Central Bank data characterizing the euro as an international currency, against other international currencies. To confirm the main research hypothesis - *the COVID-19 crisis caused a decline in the euro's importance as an international currency* - an analysis of the composite index of the euro's international role was conducted.
**Findings:** In the eurozone authorities' response to the COVID-19 crisis, crucial to mitigating the effects and facilitating economic recovery were the mutually reinforcing stability-oriented fiscal and monetary policy instruments. Indicated is that the above instruments impacted positively the international role of the euro in some of its functions, and contributed to the growth of its composite index in 2020-2022. The main research hypothesis was therefore not confirmed. During the global financial and debt crisis, the euro area was hit by asymmetric shocks, to which its authorities failed to react appropriately. This led to deep economic, social and political divisions, and consequently to a decline in the composite index between 2009 and 2016. Although not all crises are equally severe, the eurozone authorities can adapt to them easily. The prerequisite entails a joint, swift and decisive response with the right policy tools, often contributive to the international role of the euro. Faced with new shocks since 2022, such as Russia's invasion of Ukraine, the euro area authorities should intensify their commitment to fostering the common currency's development. To strengthen its internationalization, steps should be taken to complete the *Capital Markets Union*, complementing it with, first and foremost, a European *safe asset* and a *fully-fledged banking union*, along with the adoption of a *central bank digital currency*. The target audience here is the eurozone's policy makers and institutions.
**Originality/value:** The article highlights the euro's weaknesses, particularly against the U.S. dollar, which prevent its international role from increasing, and formulates a set of recommendations aimed at breaking this deadlock.
**Keywords:** euro; currency internationalization; coronavirus crisis.
**Category of the paper:** Research paper.

## 1. Introduction

The common euro currency, functioning as an international currency, is attributed with particular features distinguishing it from other global currencies. The most salient of these features is the divergence between monetary sovereignty and fiscal sovereignty. By adopting the euro, the respective countries transferred their key national monetary policy powers to a supranational level, while retaining control over their public finances. Concerns about the feasibility of the common currency project have therefore persisted from the outset. Even since prior to its adoption, discussions regarding the currency's sustainability have been raised, drawing on the roots (Sayuri, 2024, p. 5), namely the theory of *optimum currency areas* (OCA) (for more, see Mundell, 1961, pp. 657-665). Many point out that neither the euro area (EA) fulfills the criteria of this theory nor have adequate mechanisms been adopted to compensate for these shortcomings. Consequently, skepticism persisted that without fiscal and political integration, the common currency could in future face a crisis it would not be able to overcome. Despite persistent doubts, European integration - the cornerstone of the euro - has deepened, mostly as a result of crises (Sayuri, 2024, p. 5) which forced the eurozone authorities to reform the system of economic governance. The debt crisis that unfolded in some EA countries in 2010-2012 (De Grauwe, 2022b, p. 275) in particular exposed its institutional weaknesses (Sayuri, 2024, p. 6), both structural and functional. These indirectly contributed to the decline of the international role of the euro throughout 2009-2016, while just a few years earlier, it had been growing significantly (see Giżyński, Wierzba, 2018, pp. 183-201). It should be remembered that the euro's internationalization has been a derivative of its internal *success* (for more, see Skopiec, 2017, pp. 180-187).

The rapid outbreak of the coronavirus pandemic in March 2020 initially raised concerns over a potential debt crisis within the Economic and Monetary Union (EMU), also known as the euro area. The first wave of the pandemic severely affected such EA member states as Italy and Spain, characterized at the time by high levels of public debt. Although these countries were, due to their high tourism dependency, much more vulnerable to the economic consequences of the pandemic, their limited fiscal space impeded effective policy action. This fact exacerbated the economic difficulties faced by these countries and raised renewed concerns that the euro area would once again suffer a debt crisis (Sayuri, 2024, p. 6), translating into a decline in the currency's international importance.

In view of the above, the main research hypothesis put forward in the article has been formulated as follows: *the COVID-19 crisis caused a decline in the euro's importance as an international currency*. To confirm this hypothesis, an analysis into the formation of the composite index of the international role of the euro was carried out. The article is structured in seven parts, starting with an introduction and ending with research conclusions. Section two presents selected theoretical aspects relevant to international currency, including the benefits

involved in issuing such a currency, as well as the risks it poses to the economy, especially in times of crisis. Sections three, four and five address the evolution of the euro's international position. Part three outlines the currency's position between 1999 and 2019, with a focus on analyzing the impact of the financial and debt crises on this position. Parts four and five analyze and assess the impact of the COVID-19 crisis on the internationalization of the single currency, comparatively in relation to the aforementioned crises, which constitutes the main objective of the present article. The fourth section covers the year of the pandemic outbreak, i.e. 2020, followed by the fifth, focusing on the period of recovery, i.e. 2021-2022. These parts include an analysis of stabilization instruments, mainly of a fiscal and monetary nature, adopted in response to the pandemic, at both supranational and national levels in the EA. It is indicated that the use of these instruments indeed impacted the individual functions of the international euro currency and, consequently, the value of its composite index. Section six, in turn, describes the overall euro area situation after the lifting of the coronavirus pandemic emergency, highlights a number of the common currency's weaknesses reducing its potential for internationalization, as well as outlines the possible directions of its evolution within the international monetary system. To increase the euro's significance within the system, several key measures have been recommended, all of which are aimed at strengthening the process of European integration.

## 2. Selected aspects of international currency and its significance in a time of crisis

An international currency is a monetary unit used outside a country or economic area (Markiewicz, 2015, p. 36). Its denominance is determined by the size of an economy, confidence in the currency thereof, or the size of its financial market (Krugman et al., 2018, p. 563). It is therefore indicated that the internationalization of a currency results not from the fact of its formal status, but from the actual use thereof in foreign exchange turnovers (Markiewicz, 2015, p. 36). Within the private sphere, it is used primarily by companies, financial institutions, including banks, and individuals. The official sphere, in contrast, comprises central banks and other official institutions. In describing the functions of an international currency, reference can be made to the traditional functions of money, i.e. a *unit of account*, a *medium of exchange* and a *means to store value* (for more, see Giżyński, Wierzba, 2018, pp. 180-182). Importantly, these functions are closely interrelated, which is why they should not be analyzed separately (Giżyński, Wierzba, 2013, p. 167). Although this strong interrelation prevails primarily within the official sphere, the functions within this sphere are also linked to the role of currency within the private sphere The more widely an international currency is used within the private sphere, the greater its significance within the official sphere

(Giżyński, Wierzba, 2018, p. 182). While the above functions of international currency are mutually reinforcing, most currencies can only serve some of these functions (for more, see Benassy-Quere, 2015, pp. 2-3). It is therefore necessary to distinguish between the concept of international currency and that of world currency, which are often used interchangeably. This is because a world currency is a means of payment valid worldwide, examples of which were gold or the U.S. dollar in the post-World War II era. An international currency, in turn, represents international money functionable regionally or, as mentioned already, performing only some of that currency's functions (Twarowska-Mól, 2021, p. 13).

Issuance of a currency that is widely used in international trade and financial transactions not only brings benefits to a given economy, but also a number of risks, especially during times of crisis. A point to keep in mind is that prior to the global financial crisis (of 2007-2009) the most substantial benefits of issuing such a currency had included: a) high seigniorage for the central bank and, consequently, for the taxpayers of the issuing country; b) lower transaction and hedging costs for its users; and c) *exorbitant privilege* (Panetta, 2024, p. 2), i.e. the ability to issue low-interest debt securities to non-resident investors and subsequently invest the proceeds in higher-yielding foreign assets (ECB, 2015, p. 9; Giżyński, Wierzba, 2018, p. 183; see Dabrowski, 2020, p. 30). The main risks to an international currency issuing country, in turn, caused by external changes in demand and risk appetite, had involved greater volatility in its monetary aggregates and capital flows. The global financial crisis, however, necessitated a revision of the above. It turned out that *exorbitant privilege* can develop into *exorbitant duty* in times of international stress, when the dominant economy grows into a global bank and experiences rapid exchange rate appreciation (Panetta, 2024, p. 2). This resulted in additional responsibilities and challenges in mitigating the risk of international currency illiquidity, which can interfere with domestic monetary policy objectives (ECB, 2015, p. 10; Giżyński, Wierzba, 2018, p. 183). By the same token, the international reserve currency was observed to reduce the transmission of exchange rate shocks onto domestic inflation during the aforementioned crisis, rendering foreign exchange volatility less burdensome. What is more, this currency, under the conditions of a financially integrated world, can amplify the impact of monetary policy during a crisis, by causing positive spillovers and spillbacks (see Twarowska-Mól, 2021, pp. 241-242). In view of the above experience, it can be concluded that the economic benefits of issuing an international (reserve) currency should far outweigh the associated dangers (risks) (for more, see Panetta, 2024, pp. 2-3).

It is further indicated, which follows likewise from the above considerations, that the benefits and costs of issuing an international currency change over time. Mostly, they are dependent on the current stage of the currency's life cycle. In the early stages, the gains from seigniorage and the increased policy flexibility of the issuing country are highest. In the later stages, the external constraints increase, however. Let us not forget that if the initial gains from seigniorage are generated by capital inflows, the risk that these capital inflows will be reversed arises subsequently. Other factors, independent of the given currency, can likewise lead to over-

time changes. One such example is the abandonment of banknotes in favor of electronic payments, which reduces seigniorage potential. Moreover, the development of analytical tools in monetary policy and financial globalization may result (in the context of all currencies) in reduced danger of sudden (highly volatile), e.g. crisis-caused, capital flows (Beckmann et al., 2020, p. 15).

A country issuing international currency, owing to its financial power, can influence various developments in the world. The country's rulers, however, should wield this privilege with due diligence. This is because international relations constitute part of a *repeated game*, while *weaponization of a currency* on the one hand reduces its global attractiveness and promotes the emergence of alternatives on the other. One example of this is China's currency - renminbi (for more, see Panetta, 2024, pp. 3-4). Economic history shows, however, that significant changes in the position (significance) of currencies within the international monetary system occur very rarely, which is rooted in the so-called *network externalities*. In other words, a currency's utility mainly derives from the fact that other entities use the same currency. The more entities use it, the greater its utility for all the users thereof. This means that whenever one of the currencies, currently the dollar, plays a dominant role, this very fact renders it largely usable. Under such conditions, market participants will not easily (swiftly) switch to another international currency (De Grauwe, 2022a, p. 271), especially during times of crisis (see Skopiec, 2023b).

## 3. The international position of euro vs financial and debt crisis

Since 1999, i.e. since its launch, the euro has assumed the status of the second international currency, after the U.S. dollar (USD). It has outperformed the British pound (GBP) and the Japanese yen (JPY). The reason for this lies in the fact that the euro replaced eleven existing currencies at the time. The replacement of the German mark or the French franc with the common currency prompted central banks to instantly begin to maintain their reserves in the very currency. Some countries adopted it as an anchor for the exchange rate. The international role of the common currency quickly extended beyond the above functions, however (Giżyński, Wierzba, 2018, pp. 183-184). This was reflected in the composite index of the international role of the euro[1], inter alia. During 1999-2005, a significant increase in this index transpired, i.e. from 18.13% to 24.14% (see figure 1), that is, by more than 6 pp, at the current exchange rate. It should be unequivocally emphasized that the eurozone did meet the criteria at the time to grant its currency the status of an international currency by a wide margin. The currency was

[1] The index is calculated as the arithmetic average of the euro share ratios, at current (and fixed) exchange rates, in: a) international bonds issued; b) loans granted by non-eurozone banks to borrowers, also outside the eurozone; c) deposits with non-eurozone banks by creditors, also outside the zone; d) global foreign exchange settlements; e) global foreign exchange reserves; as well as f) global exchange rate regimes (see e.g. ECB, 2024h, p. 3).

also considered a factor in balancing the position of the U.S. dollar, which was dominant globally at the time. The euro was also expected to reduce systemic risks associated with the global economy's dependence on a single dominant currency (Skopiec, 2017, p. 172).

The growth of the euro currency's internationalization in its early days was hampered by a crisis. It was compounded of the global financial crisis of 2007-2009, as well as the eurozone debt crisis observed in some of the member countries in 2010-2012. The crisis exposed both the economic and institutional weaknesses in the functioning of the eurozone. Moreover, as a result of the crisis, a decline in foreign investors' confidence in the common currency ensued, reflected in decreased transactional and investment demand for the currency. Consequently, the international role of the euro in most monetary functions declined (for more, see Giżyński, Wierzba, 2018, pp. 186-201), which was evidenced by the various indicators (Table 1, figure 1) characterizing these functions. It is emphasized that during the crises (financial and debt), the eurozone was hit by asymmetric shocks[2], which policy makers failed to respond to appropriately (Panetta, 2024, p. 4; see also Mankiw, Taylor, 2022, p. 527). On the one hand, the support of the zone's economies through domestic fiscal policy instruments was short-lived, only to morph into procyclical fiscal consolidation not long after. On the other, the interventions undertaken were uncoordinated and inconsistent with the desired supranational fiscal stance. As a result, a fault line developed between the so-called *core* and the *periphery*[3] (for more, see e.g. Gräbner, Hafele, 2020, p. 12). This triggered deep economic, social and political divisions within the eurozone. A substantial number of investors were even considering a breakup of the zone at the time (Panetta, 2024, p. 4). The situation on the financial markets settled down only after the decision of the European Central Bank (ECB). At the end of July 2012, the Bank's president, M. Draghi, announced readiness to provide unlimited financial support to eurozone countries (ECB, 2013, p. 16; Krugman et al., 2018, p. 713). This subsequently convinced investors of the European monetary union's ability to survive the crisis (Panetta, 2024, p. 5).

In analyzing the composite index of the euro currency's international role, noted should be that the period of 2009-2016 is characterized by a decline of as much as 6.42 pp, i.e. from 24.36% to 17.94%, at the current exchange rate (figure 1). In addition to the crises, the sources

[2] Asymmetric shock can be defined as the difference (of opposite sign) between the deviation from the trend in a member country's GDP growth rate and the deviation from the trend in the eurozone-wide GDP growth rate. (Rosati, 2017a, p. 7). Finance theory defines asymmetric shocks as abrupt changes in the operating conditions of an economy (currency area) independent of that economy. The various economies respond differently (non-symmetrically) to these changes (Giżyński, 2013, p. 35). Two measures of asymmetric shocks are typically specified. The first is based on exponential trend values, and the second on moving-average values of the trend (Rosati, 2017a, p. 7).

[3] The patterns of political and economic polarization in European Union (EU) countries, including the eurozone, have been the subject of recent research. Some relevant works identify the financial crisis of 2008 as the main source of these polarizations. Others indicate that the polarization is rooted in the decade preceding the above crisis (Gräbner, Hafele, 2020, p. 3). Gräbner and Hafele (2020, pp. 6-7), for instance, included Austria, Belgium, Finland, France and Germany among the *core* eurozone countries, classifying Cyprus, Greece, Italy, Portugal and Spain among the *periphery* countries.

of this decline ought to be traced to internal factors, pertaining to the construction and operation of the eurozone (institutional factors). They contributed indirectly to the euro's decline as an international currency during the above period, for the currency's role derives from internal *successes*. Among these factors were unconventional conduct of monetary policy[4] and lack of fiscal discipline due to fiscal policy management decentralization[5]. The decline in the internationalization of the euro was likewise spurred by external factors, pertaining to the development trends of the modern global monetary system, involving the continued rise of China's currency within the system and the persistent hegemony of the U.S. dollar (Skopiec, 2017, pp. 182-187; Giżyński, Wierzba, 2018, pp. 186-187). After a temporary weakening of the U.S. currency's position in favor of the euro, a resurgence in its use followed in subsequent years (see Table 1). The dollar's advantage, however, was only partially explicable by economic factors, including: the size of the U.S. economy, its international trade share, trade and financial ties, liquidity, or the security of and confidence in the currency. Hence, in addition to these factors, the focus was also on those of a geopolitical nature, i.e. the country's strategic, diplomatic and military strength (for more, see Twarowska-Mól, 2021, pp. 238-239).

After the period of significant decline in the index of the euro's international role, a partial rebound followed in 2017-2019. During that time, the index rose from 17.94% to 19.11%, i.e. by 1.17 pp, at the current exchange rate (figure 1). The dollar, in turn, was characterized by a particularly strong position as a reserve currency and the currency of international debt instrument issuance during that period.

## 4. The euro's international position and the COVID-19 pandemic outbreak

In March 2020, Europe was overtaken by the COVID-19 pandemic. The outbreak of the pandemic triggered an extraordinary global health crisis. Consequently, a sharp decline in global economic activity, including in the euro area countries, ensued in 2020. Real GDP in the

[4] It is indicated that the European Central Bank took several misguided decisions on the euro area's monetary policy at the time, primarily regarding increases in the key interest rate. One such interest rate increase was introduced in July 2008, and two more, in March and July 2011, respectively. Confirming that the latter two increases were superfluous is the fact that not long thereafter, i.e. two months later, the ECB completely changed the direction of its policy and began to rapidly cut the interest rates. This decision was precipitated by the rapidly deteriorating financial market conditions. Worth noting is that the usual response time of an economy to monetary policy impulses ranges from four to six quarters. Another controversial ECB decision taken during the crisis was not to reduce the interest rate to below the level of 1%, while the Federal Reserve or the Bank of England introduced such reductions (Rosati, 2022, p. 82).

[5] Between 1999 and 2007, the degree of fiscal discipline varied across the euro area countries. Only Ireland, Luxembourg and Finland managed to achieve a medium-term surplus in their budgets. The remaining EA countries experienced relatively frequent public finance sector deficits during this period, whereas Greece never once reduced the indicator below the reference value of 3% of GDP (Wierzba, 2011, p. 260). It is indicated that the authorities in Greece, but also in Italy or Portugal, disregarded the EU fiscal rules established at that time, which stipulated the member countries' adherence to the reference values of budget deficit (3% of GDP) and public debt (60% of GDP) (Rosati, 2022, p. 77).

EA as a whole fell by 6.1% at the time[6] (Giżyński, 2024b, pp. 68, 77). The significant, sustained supply shocks not only greatly reduced economic activity, but also increased the uncertainty. This increase was in many aspects much greater than that of a decade prior, i.e. caused by the global financial crisis. The pandemic likewise immobilized many production lines and disrupted trade flows. This time, however, the EMU authorities were better prepared to deal with the crisis, countered by strong and consistent policy responses, both at the national and supranational levels (Panetta, 2024, p. 5). Of substantial support was the new governance system adopted after the debt crisis of 2010-2012, enabling the use of innovative fiscal (by the European Commission) and monetary (by the European Central Bank) stabilization instruments. In result, the risk of instability within the euro area was reduced significantly (De Grauwe, 2022b, p. 275). It is indicated that owing to the introduction of the above instruments, the COVID-19 crisis did not weaken the international role of the euro (Panetta, 2024, p. 5) in 2020. Some indicators, at the current exchange rate, even show its strengthening[7] (see Table 2), reflected at the time directly in the value of the index of the euro's international role. In the year of the pandemic outbreak, the index rose from 19.11% to 19.34%, i.e. by 0.23 percentage points, at the current exchange rate (figure 1). The euro thus remained the world's second most important international currency in 2020. The U.S. dollar retained its hegemony, despite a decline in its share in most of the indicators characterizing the degree of its internationalization, at the current exchange rate (for more, see Table 2).

The relative resilience of the euro currency's global appeal is remarkable, given the scale of the pandemic shock. This resilience differs markedly from previous major crisis episodes (ECB, 2021, p. 7), and the aforementioned debt crisis that unfolded in some of the member countries in particular (for more, see section 3 of the present article and e.g. Rosati, 2022, pp. 74-79). That crisis was, in fact, as highlighted earlier, associated with a considerable decline in the role of the euro as an international currency. Given the crisis experience, the COVID-19 pandemic forced the EA policymakers to respond strongly with fiscal and monetary policy tools. These tools were intended to counteract the economic effects of the crisis. It is indicated that several anti-crisis measures taken by the European Commission and the European Central Bank in 2020 impacted (positively) the international status of the common currency (ECB, 2021, pp. 7, 41, 48).

[6] Strongly emphasized needs to be the fact that in 2020, the impact of the COVID-19 pandemic on individual euro area economies varied greatly. Large declines in real GDP, i.e. significantly above average, were recorded at the time, mainly in the aforementioned peripheral countries, i.e. Greece (-9.0% of GDP), Italy (-9.0% of GDP), Portugal (-8.3% of GDP) and Spain (-11.3% of GDP). Considerable declines in GDP were also observed in France (-7.8% of GDP) and Malta (-8.3% of GDP) (for more, see e.g. Giżyński, 2024b, p. 93).

[7] The increases in individual indicators are mentioned further in this chapter. One of the indicators that declined significantly, i.e. by 1.9 pp, in 2020, was the share of the deposits made in banks outside the euro area by creditors outside the euro area, at the current exchange rate. The share of the U.S. dollar in this ratio increased, in turn, by 1.1 percentage points at the time (see Table 2) (ECB, 2024h, p. A7).

In analyzing the 2020 supranational fiscal policy efforts within the euro area, it should be emphasized that these responses were decisive and complementary to national-level interventions. At the national level, the member countries launched, inter alia, emergency fiscal packages and large-scale liquidity support measures (in the form of deferred taxes and state guarantees) (ECB, 2021, p. 41). The impact of discretionary support on the budgets in these countries, amounting to an average of 3.3% of euro area's GDP (see e.g. Giżyński, 2024b, pp. 77-78, 94), was unprecedented, compared to previous crises[8]. Crucially, the above support was complemented by new instruments at the supranational level, using debt issuance by the European Commission. These instruments include, first and foremost, two temporary programs for member countries, i.e. the *Support to mitigate Unemployment Risks in an Emergency* (SURE) and the so-called *Next Generation EU* (NGEU) programs (ECB, 2021, p. 41).

The SURE scheme was launched in September 2020, to provide financial assistance in the form of union-level loans up to €100 billion. The main beneficiaries were small and medium-sized companies, particularly those operating in the sectors most affected by the pandemic, i.e. accommodation and food services, wholesale trade, retail trade and manufacturing. It is estimated that in addition to the fact that in 2020 the SURE program benefited approximately 31.5 million people and 2.5 million companies, funds from, inter alia, this program effectively contributed to preventing unemployment for about 1.5 million people (for more, see European Commission, 2024g). To finance the SURE scheme, the European Commission issued so-called *social bonds*[9]. The NGEU program, in turn, was launched in late 2020, to remedy the direct economic and social damage caused by the COVID-19 pandemic. The main component of the NGEU scheme was the *Recovery and Resilience Facility* (RRF)[10]. The value of the program was ultimately set at €806.9 billion, at the current prices (equivalent to €750 billion at 2018 prices), with the RRF set at €723.8 billion. These funds are to be mobilized by 2026, as part of a differentiated financing strategy (European Commission, 2024e). The implementation of the NGEU instrument entailed a debt-based fiscal expansion, the size of which was estimated to average around 1% of the euro area's GDP in 2021-2024. With these estimates, it was assumed that the support would be allocated to finance additional

[8] By comparison, at the height of the global financial crisis in 2009, the total amount of discretionary stimulus measures across all EU countries equaled 1.5% of GDP. Although in Luxembourg alone these measures were estimated at over 3% of GDP at the time, some countries never implemented any such measures and even introduced consolidation measures (see e.g. Haroutunian et al., 2021, p. 85).

[9] The SURE *social bonds* are an ESG (*Environment, Social, and Governance*) debt instrument. This type of instrument allows investors to allocate funds to social needs in the member states affected by the COVID-19 crisis. The social bond market promotes transparency in the use of the proceeds from these instruments, on the one hand, and the measurement of the social impact of the financed expenditures on the other (for more, see European Commission, 2020, p. 5).

[10] To receive funds under the RRF, the euro area countries were required to develop special plans outlining how the funds would be invested. Moreover, before receiving any RRF disbursements, they were obligated to achieve, satisfactorily, relevant objectives (the so-called *milestones* and *targets*). The achievement thereof was assessed by the European Commission. For more on individual EA countries' plans and a review of disbursements to date (European Commission, 2024e) see the European Commission's interactive scoreboard (European Commission, 2024d).

spending at the national level. To a large extent, the aim was to finance such investments and structural reforms (ECB, 2021, p. 41) in the member countries which, on the one hand, would increase the growth potential of their economies and reduce the divergences within the euro area, on the other. It was also assumed that these countries would be required to earmark a significant portion of the funds for the so-called *green transformation* (at least 37% of the funds) and *digital transformation* (at least 20% of the funds). The NGEU program thus carried the potential to increase both the resilience of the euro area's economy to global shocks and the attractiveness of the euro as an international investment currency (ECB, 2021, p. 42).

It should be strongly emphasized that the issuance of bonds under the SURE and NGEU programs has increased the global supply of *safe assets*[11]. This is because the issuer, i.e. the European Union, enjoys the highest creditor status assigned by most rating agencies[12]. The new bond (EU bond) issuances were the largest-ever euro-denominated issues at the supranational level. In 2020, the first SURE bond issuances totaled nearly €40 billion (see European Commission, 2024b). They attracted significant attention from non-euro area investors at the time. The share thereof in the total demand for these new (at the time of issuance) bonds ranged from 31% (20-year maturity) to 60% (5-year maturity). It should be specified that the higher demand from international investors for bonds with shorter maturity is positively correlated with a higher share of official investors (central banks, inter alia) in these issues. This is because official investors are less risk-inclined, compared to other market participants, which confirms that EU bond issues provide the potential to strengthen the euro's status as a major international reserve currency (ECB, 2021, p. 42). Moreover, as Table 2 shows, in 2020, the ratio of the euro currency's share in global foreign exchange reserves increased by 0.7 pp, at current exchange rate, which can be partly linked to the issuance of *safe assets* by the Euroland authorities.

In addition to fiscal measures, the ECB's policy - an important element of the EA's response to the COVID-19 pandemic in 2020 - yielded further implications in terms of the euro's international status. In analyzing the Bank's efforts at the time, it should be noted that, from the outset of the pandemic crisis, it undertook measures to eliminate tail risks on the financial markets, ensure the supply of credit and stabilize the EMU economy. The above measures specifically covered three interventions. The first two targeted the zone's economy directly, and involved asset purchases and lending operations. The third measure consisted in the provision of euro liquidity to central banks outside the EA, through the use of the so-called

[11] The so-called *safe assets* are characterized by stable nominal payoffs, high liquidity and minimal credit risk. These *assets* gain in significance in times of financial market stress. This is because during such times they retain their nominal value, while the value of other assets usually declines. Among the most popular *safe assets* are U.S. Treasuries (Habib et al., 2020, pp. 2-6, 24-25).

[12] This refers to the Fitch, Moody's, Scope and DBRS agencies. Currently, they assign the following (highest) ratings to the EU: AAA, Aaa, AAA and AAA (stable outlook). A rating slightly lower, i.e. AA+ (with a stable outlook), than the highest (AAA), the EU has been assigned by S&P (European Commission, 2024a).

*swap*[13] and *repo*[14] lines. These operations were introduced to prevent indirect negative feedback effects from non-euro area economies to the euro area economy (ECB, 2021, p. 45).

Taking a broader look, with the ECB's first action in March 2020, the Bank expanded its *asset purchase program*, abbreviated APP, and launched the *pandemic emergency purchase program*, abbreviated PEPP. The program was intended to stabilize the conditions on the financial markets, ease the overall monetary policy stance, and counteract major risks to the functioning of the euro area in the future (ECB, 2021, p. 45). Initially, the PEPP was set at €750 billion. After two decisions to increase its value, the total amount was ultimately set at €1850 billion in December 2020 (Giżyński, 2024b, p. 80). The innovativeness of the PEPP was reflected in the fact that the ECB imposed no conditions on the purchases of member states' government bonds. This was a significant change in the Bank's policy, resulting from the negative experience in implementing a similar program in 2012. The result of launching the PEPP entailed a rapid decline in the spreads between the 10-year government bonds issued by euro area countries, particularly Greece and Italy, and the 10-year bonds issued by the German government, considered risk-free securities. At the end of 2020, these spreads were even lower, compared to those recorded a year earlier. Consequently, the risk of instability within the EMU, arising from a potential crisis on its member countries' government bond markets, decreased significantly (De Grauwe, 2022b, pp. 273-275).

The ECB's second action, in turn, involved a change in the structure and price of longer-term liquidity refinancing operations. It was intended to provide commercial banks with access to central bank liquidity and thus aid the supply of credit to the euro area economy during the pandemic. As part of this measure, the ECB lowered the interest rates during the pandemic, increased the debt limit, established new operations, expanded the collateral group for *Targeted Longer-Term Refinancing Operations*, abbreviated TLTRO III (ECB, 2021, p. 45), and adopted new non-targeted *Pandemic Emergency Longer-Term Refinancing Operations*, i.e. PELTRO in short (ECB, 2021, p. 46; Benigno et al., 2021, pp. 8-9; Kowalewski, Lepczyński, 2023, pp. 587-588). The TLTRO III program comprised a series of ten operations. Each was due to mature in three years (the previous two editions were four years). Of note is that operations under this program had begun even before the pandemic, i.e. in September 2019. After the pandemic broke out, the TLTRO III program was modified three times, i.e. in March, April and December 2020. Its operations represented one of the main anti-crisis tools provided by the European Central Bank to the euro area during the pandemic. At the time, banks operating in the zone were able to borrow funds from the ECB at a favorable interest rate of as low as -1%, which was 0.5 pp

[13] A currency *swap* agreement, entered into by two central banks, refers to an arrangement whereby one of these banks (the borrower) obtains another currency and, in exchange, transfers its own as collateral. At an agreed date, the transaction is reversed, the borrowed currency is repaid, along with the agreed interest (ECB, 2021, p. 50; 2024b).

[14] A *repo* line is an arrangement whereby a central bank (lender) provides access to its currency for another central bank. Here, the assets denominated in the same currency provide collateral for the lender. On an agreed date, the borrowed currency is repaid with interest (ECB, 2021, pp. 47, 50; 2024b).

lower than the ECB deposit rate. Banks in the EA were able to take advantage of the reduced interest rate, provided they maintained lending activity in the economy. The attractive financing terms became available as of June 24, 2020 (ECB, 2024g; 2024i). New refinancing operations under the PELTRO program, in turn, were announced in April 2020. The development and course of the COVID-19 pandemic, admittedly, forced the ECB authorities to take further action. These operations were then proposed as part of seven tenders, and began to be implemented as of May 21, 2020. The four subsequent tenders were held in December 2020 (for more, see ECB, 2020a, 2020b). The operations involved in these tenders were similar to those proposed under the first seven, and were to be implemented in 2021 with a *one-year term*. The main purpose of the PELTRO refinancing operations was to prevent liquidity bottlenecks, by keeping the money markets liquid at the onset of the COVID-19 pandemic (Benigno et al., 2021, p. 9; Kowalewski, Lepczyński, 2023, pp. 587-588). Through these operations, the ECB provided the EA banks with liquidity at fixed interest rates, mostly negative. The amount of the funds transferred was, as in other LTRO programs, limited only by the demand from these banks (Benigno et al., 2021, p. 9).

A point to highlight is that through the above two actions, providing significant amounts of liquidity, the ECB mitigated the negative effects of the 2020 pandemic shock to the EA economy. These efforts increased the common currency's stability, which potentially translated into strengthening its international status (ECB, 2021, p. 48). As Table 2 shows, the ratio of the euro's share in outstanding international debt securities[15] increased by 1.2 pp at the time, while the ratio of outstanding international loans by banks outside the euro area to borrowers outside the euro area increased by 1.1 pp (both at the current exchange rate) (ECB, 2024h, pp. A4-A6). Indeed, the international currency benefits from the central bank's actions, which in times of crisis provide a reliable mechanism to secure liquidity in the financial system, especially in the context of debt currency choices (by firms) on international markets (ECB, 2021, p. 48).

The ECB's third action was to provide euro liquidity to non-euro area central banks, using the so-called *swap* and *repo* lines. These operations were intended to contain the potential negative impact of the COVID-19 crisis on the zone's economy, and aided the ECB in achieving its monetary policy objectives. In particular, they prevented euro liquidity shortages from developing into a threat to financial stability. Thus, both forced sale of assets and negative spillovers from the use of the euro currency by non-EA residents (as a funding or investment currency) were avoided (ECB, 2021, p. 46). Worth noting is that the ECB renewed existing *swap* agreements early in the COVID-19 pandemic. At that time, it also entered into new agreements, both *swap* and *repo*, with the central banks of several European Union countries

[15] This indicator draws on a *narrow* definition of international debt issuance, referring to the foreign currency principle. Bonds denominated in euros issued by a German company, for instance, are not included in the *narrow* definition, regardless of whether they were issued outside the euro are (e.g. in the U.S.) or within it (e.g. in France) (for more see, ECB, 2022, p. 19).

(e.g. the Bulgarian National Bank or the Danish National Bank) and the central banks of non-EU countries located in Southern and Eastern Europe (e.g. the Bank of Albania or the National Bank of North Macedonia) (see ECB, 2021, pp. 46-47). Moreover, the ECB adopted a new temporary *repo* instrument, the *Eurosystem Repo Facility*, abbreviated EUREP. It was intended to provide euro liquidity to those non-euro area central banks (for more, see Beck et al., 2021, pp. 50-51) which did not meet the bilateral liquidity line criteria under the ECB's rules (ECB, 2021, p. 46). Although in 2020 the above liquidity lines were only used intermittently, for relatively small amounts (see ECB, 2024d), the mere availability thereof was effective in easing the tensions on euro-denominated funding markets, while preventing tighter lending and funding conditions in economies maintaining strong economic and trade ties with the EA (ECB, 2021, p. 46). The estimates provided by the ECB show that in the two weeks following the Bank's announcement of liquidity lines, an estimated decline (in absolute terms), of up to 20 basis points, in the currency basis for the countries which the lines had been agreed with occurred. The event analysis sample, covering daily data over the period 2010-2020, comprised: Bulgaria, Croatia, Denmark, Hungary and Romania. Based on this analysis, it can be inferred that an announcement of a liquidity line agreement during a pandemic reduces the cost of euro funding on the foreign exchange markets of the countries which the lines were agreed with. Moreover, evidence has been provided that currency *swap* lines and international use of the currency are characterized by positive correlation. The direction of causality remains a subject of debate, however. This is because some economists consider the ECB's *swap* lines an *exorbitant duty*. Other observers, in contrast, note that these instruments increase the level of the currency's internationalization. Undeniably, nonetheless, both currency *swap* lines as well as the currency's international status tend to be mutually reinforcive (ECB, 2021, pp. 48, 51-52), as possibly reflected by the 2020 increase in the index of the euro's international role.

## 5. The international status of the euro and recovery from the pandemic

The development and coordinated distribution of vaccines as well as the start of mass vaccination campaigns in all euro area countries at the end of 2020 proved to be a game changer in the fight against the epidemic. This enabled the reopening of these countries' economies in 2021. Despite some disruptions, due in part to the emergence of a new coronavirus variant (Omicron), economic growth for the entire EA reached 5.3% of GDP that year, relative to 2020 (Giżyński, 2024b, p. 81). It must be emphasized that the recovery was one of the most rapid in the history of the common currency area. It is indicated to have been possible owing to the aforementioned implementation of significant fiscal and monetary policy measures. Noted should be that the reopening of European economies was accompanied by a significant increase in global inflation. The inflation rate rose rapidly due to higher energy costs, supply

bottlenecks and the normalization of demand. These events did not, however, lead to major changes in the index of the international role of the euro in 2021. The index increased at that time from 19.34% to 19.53%, i.e. by 0.19 pp, at the current exchange rate. The euro thus remained the second key currency in the international monetary system that year (ECB, 2022, pp. 2-3). The U.S. dollar, in turn, continued to play the leading role, as reflected in the main indicators, at the current exchange rate, characterizing the degree of currency internationalization (see Table 2).

In analyzing the share of the common currency in selected indicators comprising the index of the euro's international role, at the current exchange rate, an increase in 2021 was observed, both in outstanding international loans by banks outside the euro area to borrowers outside the euro area, i.e. by 1.2 pp, as well as in the ratio of deposits with banks outside the euro area by creditors outside the euro area, i.e. by 0.2 pp. The indicators showing a decline during that period include, inter alia, outstanding international debt securities (a decrease in the share of the euro by 1.2 pp) and global foreign exchange reserves (a decrease in the share of the euro by 0.7 pp[16]) (see Table 2).

Worth mentioning is that even during the recovery, the ECB measures contributed to maintaining favorable financing conditions in all sectors of the eurozone economy. As a result, fiscal stimuli could be transmitted more effectively across the entire euro area economy. Simultaneously, the European Commission and the member states' governments continued to support the transmission of the ECB's monetary policy through expansionary fiscal tools (for more on the nature of these tools, i.e. SURE, NGEU (including the RRF), PEPP and TLTRO III, see section 3 of the present article). This strong complementarity enabled a parallel implementation of both policies and effectively mitigated the economic damage triggered by the pandemic (Giżyński, 2024b, p. 82), while supporting the international role of the euro.

In 2021, jobs continued to be protected under the SURE scheme, especially in the first half of the year, when the COVID-19 pandemic prevented the EMU economy from functioning properly. The funds from this program provided support to around 9 million people and over 900 000 companies (for more, see European Commission, 2022a, 2024c). In order to finance the SURE instrument, the European Commission continued to issue social bonds (see European Commission, 2024g). Throughout 2021, it raised around 130 billion euros, i.e. 50 billion euros for the SURE program, 71 billion euros for the NGEU scheme, with 12 billion euros in the form of the so-called *green bonds*[17], and 12 billion euros for other loan programs. Within a short period of time, the Commission became one of the largest issuers of new debt in euros and the

[16] The indicator decreased due to the depreciation of the euro against the U.S. dollar, i.e. by approx. 8 pp. Indeed, as in previous years, lower and negative yields on the euro-area fixed-income markets may have been one of the main factors reducing the euro's attractiveness as a reserve currency. What is more, official reserve managers continued, at the time, to diversify their portfolios through non-traditional reserve currencies, primarily including the Chinese renminbi (see Table 2) (for more see, ECB, 2022, pp. 12-13; Longaric, Di Casola, 2022, pp. 14-17).

[17] *Green bonds* are considered one of the most prominent financial innovations of recent times. It should be emphasized that the instrument is structured similarly to traditional bonds. The difference lies in the purpose the funds raised are allocated to, namely environmental, climate and social projects (Sobik, 2023, pp. 291-292).

world's largest *green bond* issuer[18] (European Commission, 2022b, p. 2). Moreover, in 2021, most national-level discretionary measures, directly affecting the member states' budgets, were based on additional spending, as in 2020. The temporary emergency measures in the euro area as a whole amounted to 3.3% of GDP at the time (Giżyński, 2024b, p. 81).

In addition to significant asset purchases under the PEPP program (for more, see ECB, 2024e), the ECB's measures in 2021 consisted of the provision of liquidity to euro area banks on very favorable terms. The main instrument used was the TLTRO III[19]. The ECB at the time eased the collateral requirements for these liquidity operations (European Commission, 2021a, p. 17). Furthermore, the PELTRO program, which provided loans to eurozone banks, was continued (Kowalewski, Lepczyński, 2023, p. 588). The measures adopted by the ECB contributed to the absence of turmoil on the government bond markets in the euro area countries in 2021. The interest rates on these securities were, at the time, subject to further convergence. At the end of September 2021, the spreads were even smaller, compared to the pre-pandemic levels (De Grauwe, 2022b, p. 274). Importantly, the aforementioned ECB measures, consistent with the *accommodative* monetary policy stance[20], supported the euro's resilience on international credit markets in 2021. The volume of euro-denominated loans granted by non-euro area banks to non-euro area borrowers also increased by approx. 8% that year, thereby contributing to the aforementioned increase in the individual indicator of the euro's internationalization within the scope of loans. This increase was possible precisely because the ECB maintained an *accommodative* monetary policy, which eased the financing conditions on the euro credit markets at the time (ECB, 2022, p. 25).

Apart from the abovementioned fiscal and monetary policy instruments, the European Commission provided significant support for the internationalization of the common currency, by issuing a *Communication* in January 2021 (European Commission, 2021b) on the adoption of a new strategy, aimed, inter alia, at promoting the strengthening of the euro's international role. The Communication also set out a series of measures geared towards achieving this goal (for more, see ECB, 2021, pp. 49-50). It further served as input for the Euro Summit in March 2021. The statement concluding the summit reiterated the member states' commitment to the objective of enhancing the common currency's international role, in the context of strengthening the EU's strategic autonomy, including the single currency area, and reaffirm several points from the Commission *Communication* (ECB, 2021, pp. 41, 49-50).

[18] In 2021, more than a third of the investors purchasing *green bonds* were from non-euro area investors, mainly from the UK (29% share). The Commission plans to issue a total of up to 250 billion euros in such bonds under the NGEU scheme, which could globally position it as a leading issuer of such bonds (ECB, 2022, p. 22).

[19] The last operation under the TLTRO III program was carried out in December 2021 (ECB, 2024i).

[20] *Accommodative* monetary policy stance (e.g. within the euro area) refers to the lowering of interest rates by the central bank to a sufficiently low level, in order to stimulate strong economic growth, which in turn reduces unemployment or prevents it from becoming more severe (Board of Governors..., 2024).

At the beginning of 2022, the COVID-19 pandemic was still exerting a significant impact on the euro area economy. By the second half of 2022, however, consumers enthusiastically resumed spending, especially on services, following the easing of the pandemic restrictions (Giżyński, 2024b, pp. 82-83). Throughout 2022, real GDP in the euro area increased by 3.5%, mainly reflecting the strong contribution of domestic demand. At the end of the year, production in the euro area exceeded its pre-pandemic level by 2.4%, compared to the last quarter of 2019 (ECB, 2023a, pp. 8, 11). It should be emphasized, however, that in 2022 the recovery of the eurozone economy from the pandemic was accompanied by new shocks. Russia's invasion of Ukraine, the introduction of new economic sanctions and the significant increase in geopolitical risk led to serious negative consequences for the international monetary system (ECB, 2023b, p. 2). As a result, economic growth in the euro area decelerated in the second half of 2022, mainly due to the effects of Russia's invasion of Ukraine[21] (ECB, 2023a, p. 8). Despite these difficulties, no change in the world's major currency mix occurred. The euro currency proved resilient and remained second in 2022. The index of the euro's international role rose at that time by 0.18 pp, i.e. to 19.71%, at the current exchange rate (figure 1). This resilience is particularly noteworthy in view of the growing global inflationary pressure, caused in part by the increase in energy and food prices triggered by the Russian invasion (for more, see Giżyński, 2024a, pp. 149-150). These conditions necessitated a tightening of monetary policy in major global economies, and consequently an interest rate increase for major international currencies (ECB, 2023b, pp. 2-3), including the euro.

To combat the exceptionally high inflation caused by Russia's invasion of Ukraine and the lasting effects of the COVID-19 pandemic, the ECB continued to normalize the euro area's monetary policy in 2022. Although this process had already begun in December 2021, the *accommodative* nature of the policy was still maintained in the first half of 2022. In March of the same year, gradual withdrawal of collateral easing measures, constituting one of the ECB's key response tools to the pandemic, was announced. These measures facilitated access to the Eurosystem's[22] credit operations for banks operating in the euro area, as well as increased the volume of eligible collateral (ECB, 2023a, pp. 11, 29, 37-38). The phasing out of these measures entailed a gradual return to the pre-pandemic levels of risk tolerance in credit operations. Moreover, in the first half of 2022, the ECB ended several programs aimed at counteracting the economic impact of the crisis. The net asset purchases under the PEPP scheme were discontinued at the end of March[23] (ECB, 2023a, p. 29). In the second half of June, the attractive financing conditions for euro area banks under the TLTRO III program ended

[21] It should be emphasized that economic growth rates varied widely across the euro area countries in 2022, due to the different economic structures in these countries, as well as the extent to which, on the one hand, they benefited from the reopening of the service sector, and became adversely affected by Russia's invasion of Ukraine, on the other (ECB, 2023a, p. 11).

[22] The Eurosystem is the central banking system of the euro area. It consists of the ECB and the national central banks of those EU member states which have adopted the euro (for more, see ECB, 2025).

[23] The decision was made in December 2021 (Giżyński, 2024b, p. 82). The maturing capital portion of these assets was to be reinvested until mid-2024 (ECB, 2024e).

(ECB, 2024g; 2024i). In early July, in turn, the APP ended. In the second half of 2022, the ECB accelerated the withdrawal of monetary policy support in unprecedentedly large steps. The rising energy and food prices, supply bottlenecks and post-pandemic recovery of demand led to further price pressure and an increase in the eurozone inflation rate during the summer (ECB, 2023a, pp. 11, 29, 33). Consequently, at the last four meetings (in July, September, October and December) of 2022, the ECB Governing Council raised its key interest rates by a total of 250 basis points (see ECB, 2023a, pp. 32-34), representing the largest individual rate increases in the Bank's history. In October 2022, in turn, the euro area inflation rate reached a historic high of 10.6%. Throughout 2022, this rate stood at 8.4%, while in 2021, it was still 2.6%. Furthermore, by the end of 2022, the ECB had reduced the Eurosystem's balance sheet total to 8.0 trillion euros, down from a historically high 8.8 trillion euros in June. The reduction in the balance sheet total largely resulted from maturing operations and early repayments under TLTRO III operations (ECB, 2023a, pp. 8, 29, 32-34). Additionally, the PELTRO program ended in December 2022. Under this program, i.e. since May 2020, the ECB provided loans totaling nearly 30 billion euros to eurozone banks (Benigno et al., 2021, p. 9; ECB, 2023a, p. 37; Kowalewski, Lepczyński, 2023, p. 588).

Apart from the above decisions restoring the ECB's monetary policy to its pre-COVID-19 state, it is worth mentioning the instruments the Bank had not discontinued by the end of 2022. They included the aforementioned *swap* and *repo* liquidity lines with non-euro area central banks[24] (see ECB, 2024b). The liquidity lines left in place served to prevent the liquidity shortages of the common currency from becoming a threat to financial stability, which could have potentially jeopardized the euro's international role as a financing or investment currency.

In 2022, the euro-area national governments were confronted, for the third consecutive year, with new challenges, this time requiring reactive fiscal policies, potentially also affecting the euro' role as an international currency. The fiscal measures introduced in these countries in response to the COVID-19 pandemic were withdrawn at the end of the year, only to be partially replaced by new support measures (cf. ECB, 2023a, p. 15). At the end of 2022, pandemic-related national budget expenditures at EA level as a whole corresponded to 0.7% of GDP, while the measures mitigating the impact of high energy prices amounted to 1.3% of GDP (European Commission, 2023b, pp. 16-18). The latter expenditure[25] was intended to counteract the rising energy prices and the consequences thereof, in particular the increased cost of living for households and the higher operating costs for companies in the eurozone. Smaller amounts were allocated towards (ECB, 2023a, p. 15) the sheltering and integration of those fleeing the

[24] As of August 8, 2024, the ECB maintained eight *swap* liquidity lines and the same number of *repo* liquidity lines (sixteen agreements in total) with central banks of non-euro area countries. Each agreement was concluded with a different central bank (for more, see ECB, 2024b).

[25] The *energy support measures* adopted in the euro area countries were largely non-targeted, rather than aimed at protecting the most economically vulnerable households and companies. They also failed to incentivize lower energy consumption (ECB, 2023a, p. 12). More information on the controversy surrounding the energy *measures* adopted in the euro area countries can be found, e.g. in the work of Giżyński (2024a, pp. 154-155).

war in Ukraine, estimated at 0.1% of GDP, at the time (European Commission, 2023c, p. 56). The reduced spending translated into the fiscal policy stance in the EA, tightened moderately in 2022 for a second consecutive year. This does not, however, change the fact that, by the end of that year, only a little over a third of the fiscal easing measures from 2020 had been withdrawn in the member states (ECB, 2023a, p. 15). Simultaneously, the structural policy measures aimed at increasing the growth potential of the euro area were continued. This was largely achieved through the implementation of investment plans and structural reforms in individual euro area countries under the *Next Generation EU* scheme (ECB, 2023a, p. 12). At the end of 2022, the total amount available through this instrument equaled 162.6 billion euros, with over 138 billion euros provided under the RRF. Despite the difficult market conditions that year, NGEU transactions continued to draw significant interest from a wide range of investors across the globe. Approximately 35% of these were international investors, including roughly 25% from the UK and nearly 10% from other countries, mainly in Asia. Over 70% of the EU bonds issued were purchased by *buy-and-hold* investors, including central banks, insurance companies, pension funds and fund managers (for more, see European Commission, 2023a, p. 4), which contributed to the internationalization of the euro as an investment currency. While the NGEU program is scheduled to continue until 2026 (European Commission, 2023a, p. 2), the availability of the SURE program ended in December 2022 (see European Commission, 2024c). To finance it, bonds worth 8.7 billion euros were issued throughout 2022 (European Commission, 2023a, p. 2). As a result, around 350 000 people and 40 000 companies benefited from the support at the time (for more, see European Commission, 2024g). It should be emphasized that the purchase of these securities in the second half of 2022 involved significantly higher costs of interest and debt management. Moreover, the pace of interest rate increases for all issuers, including the euro area, has been one of the most rapid on the financial markets in recent decades. The interest rate on 10-year EU bonds at the inaugural issuance under the NGEU program, i.e. in June 2021, had been 0.09%, whereas at the issuance in November 2022, it hit 2.82%. Comparable increases were observed at the level of the euro area countries, i.e. the issuers of highly rated government bonds. In Germany, for instance, the interest rate for such 10-year bonds rose from around -0.20% in June 2021 to over 2.56% at the end of 2022 (European Commission, 2023a, p. 5).

Although the euro area interest rates and government bond yields (of high-rated bonds) rose to positive levels in 2022, these values remained lower than in other major economies (ECB, 2023b, p. 13). Consequently to the fact that long-term interest rates in the United States were approx. 200 basis points higher, the value of the euro fell by 6% against the dollar. The value was more stable in nominal terms, however, increasing by 0.8% despite the significant fluctuations throughout the year. The dollar also increased in value against most other

currencies[26]. Although the euro came under pressure from high energy prices and the deteriorating economic outlook in the EMU, it did gain value, compared to other major currencies, i.e. the pound sterling, the Japanese yen or the Chinese renminbi (cf. Table 2) (ECB, 2023a, p. 10). It is indicated, however, that the higher interest rates in the United States may have discouraged official reserve managers outside the euro area from balancing euro-denominated assets (ECB, 2023b, pp. 13-14, A1; see Arslanalp et al., 2022, pp. 1-23), which may have contributed to the decline, by 0.2 pp, to 20.4%, of the euro's share in global foreign exchange reserves, at the current exchange rate (see Table 2).

The share of the euro in outstanding international debt securities increased by 0.3 pp, to 22.0%, in 2022, at the current exchange rate (see Table 2). After analyzing the detailed data, however, it can be noted that e.g. the volume of international bond issuance, denominated in foreign currencies, fell significantly during that time. This decline was triggered by concerns over the economic outlook, the (tightening) financial conditions in developed economies, and the risk of geopolitical fragmentation (ECB, 2023b, pp. 26, A4). What is more, in 2022, significant declines (in absolute terms) were observed, inter alia, in the international issuance of *green bonds*[27]. In relative terms, however, the shares of these bonds, denominated in euros and U.S. dollars, remained stable at the time, accounting for 31% and 51% of the total issuance of these securities, respectively (for more, see ECB, 2023b, pp. 27-28).

In 2022, the share of euro in outstanding international loans by banks outside the euro area to borrowers outside the euro area continued to increase, by 1.6 pp, to 19.2%, at the current exchange rate (see Table 2). The share of the U.S. dollar, in turn, despite a large decline that year, i.e. by 2.1 pp, to 53%, continued to dominate international credit markets by a wide margin. Recent research (see e.g. Emter et al., 2023, pp. 63-75) has shown that the demand for international euro-denominated and, to a lesser extent, U.S. dollar-denominated loans is typically influenced by such factors as geographical distance and complementarity with trade invoicing patterns (ECB, 2023b, pp. 29, A6).

The share of the euro in deposits with banks outside the euro area from creditors outside the euro area likewise continued to increase in 2022. This indicator increased by 0.7 pp, to 17.4%, at the current exchange rate (Table 2). Worth mentioning is that the share of the U.S. dollar in this indicator had declined for a second consecutive year. In the year under review, it fell by 0.7 pp. The main reason for this decline is believed to lie in the investors' reduction of deposits denominated in this currency accumulated as liquid assets during the pandemic. Despite the

[26] The 2022 change in the U.S. monetary policy stance was associated with increased exchange rate volatility and lower bond prices. The U.S. central bank raised its interest rate by as much as 4.5 pp over the course of the year, which at the time translated into a significant nominal appreciation of its currency by 8 pp (for more, see den Besten et al., 2023b, p. 20). The strong U.S. dollar and large fluctuations in the prices of bonds (issued by major economies) prompted official reserve managers to take a more active approach to managing their asset portfolios in 2022. They increased their net purchases of non-dollar-denominated assets, thereby offsetting the valuation effects of the dollar's appreciation (at current exchange rate) (for more, see ECB, 2023b, pp. 4, A1).

[27] International issuance of *green bonds* refers to the issuance of foreign currency securities, based on the nationality or the parent entity of the issuer (ECB, 2023b, p. 28).

above, the dollar's share in this indicator remained close to the pre-pandemic level, i.e. nearly to 52% of all international deposits, at the current exchange rate (ECB, 2023b, pp. 30, A7).

Lastly, it bears mentioning that the impact of Russia's invasion of Ukraine begun in February 2022 on the internationalization of the common currency was particularly noticeable in the temporary increase in the cumulative net shipments of euro banknotes outside the euro area[28]. This increase was observed in the first half of 2022 and is suspected to stem from precautionary motives (see Beckmann et al., 2023, pp. 37-40). In the second half of 2022, this phenomenon was reversed, however, due to an increase in interest rates and the opportunity cost of holding cash. Another noteworthy development in 2022 was the diversification into gold by countries with close geopolitical ties to China and Russia. This move is suspected to have been aimed at reducing the risk of exposure to sanctions (imposed in connection with the invasion). Nevertheless, overall, nearly a year after the invasion began, the available data showed no significant changes in the use of international currencies (cf. Table 2) (ECB, 2023b, pp. 5-6). What is more, it was indicated at the time that the invasion revealed the lack of obvious alternatives to major international currencies, in the foreseeable future at least (see den Besten et al., 2023a, pp. 41-53). At the same time, the euro area's economic and financial resilience to these geopolitical challenges emphasized the importance of the euro as an international currency (ECB, 2023b, p. 5).

## 6. The international status of the euro and new post-pandemic challenges

### 6.1. The post-pandemic landscape and the common currency's internationalization

In May 2023, the World Health Organization (WHO) declared the end of the COVID-19 pandemic public health emergency (European Commission, 2024f). Thus far, the pandemic had caused almost 7 million deaths worldwide, including nearly 900 000 in the euro area countries (see World Health Organization, 2025). As emphasized, the pandemic affected all member states. From its outbreak onward, supranational and national authorities undertook joint action to protect the health and well-being of citizens, strengthen national health systems and reduce the spread of the virus. Simultaneously, the pandemic response was coordinated at the supranational level, to mitigate its socio-economic impact and support the recovery of member states (European Commission, 2024f). After 2022, the multiannual financial framework and the *Next Generation EU* program (for more on the nature of this tool, see section 3 of the present article) have been expected to play a major role in the implementation of the post-pandemic recovery package for these countries. The recovery package serves as a response to the socio-

[28] A detailed analysis of this indicator is not included in the present article, due to the lack of such an indicator in the composite index of the international role of the euro.

economic impact of the pandemic. The legal commitments under NGEU were adopted until the end of 2023, with payments to be effected through 2026. The package is primarily aimed at building a greener, more digital and more resilient euro area (European Commission, 2025, p. 5).

The nature of the shocks and the policy responses in the euro area were of key consequence in both the financial and debt crisis as well as the COVID-19 crisis. The point to bear in mind is that the EA is prone to turbulence that splits its economy and financial markets along the borders of individual member states. These difficulties become exacerbated in the absence of proper coordination among the countries, and may even prevent effective policy responses. Nevertheless, as the above considerations show, the euro area can easily withstand significant crises. The prerequisite in this regard entails a concerted, rapid and strong response, based on properly selected policy tools (Panetta, 2024, p. 5). In responding to the COVID-19 crisis, the mutually reinforcing effects of the monetary and fiscal policy measures in the EA were of paramount importance in mitigating the impact of the crisis, as well as in supporting the economic recovery in its member states (Giżyński, 2024b, p. 82), and thus the international role of the euro.

It ought to be borne in mind that not all crises are of equal magnitude and that not all crisis response tools are of equal nature (Panetta, 2024, p. 5). What is more, the new shocks that emerged in 2022 have forced European decision-makers to become more involved in shaping the conditions for further development of the common euro currency. The reason for this lies in the fact that continued European economic and financial integration will be crucial in increasing the resilience of the euro's international status in the potentially more fragmented global economy (ECB, 2023b, p. 2; for more, see den Besten et al., 2023a, pp. 41-53). Furthermore, it needs to be emphasized that despite the lack of significant impact of the COVID-19 pandemic on the international status of the euro, the currency is still characterized by many weaknesses, especially when compared with the U.S. dollar. The euro is, first and foremost, issued by a monetary union in which decisions are made by bodies composed of member state representatives, often pursuing divergent interests. For this reason, the euro is sometimes referred to as a *currency without a state*. Other weaknesses of the EMU include the varying levels of its member states' economic development (Skopiec, 2023b), lack of consistency in meeting the nominal convergence criteria (see e.g. Ministerstwo Finansów…, 2023, pp. 27-28; European Council, Council of..., 2024), different economic structures or, as aforementioned, lack of fiscal discipline due to decentralization of fiscal policy. It is indicated that these factors hinder the implementation of a uniform monetary policy throughout the euro area and reduce the common currency's internationalization potential (Skopiec, 2023b). It can therefore be argued that only decisive political and reform-oriented measures would allow the euro's global potential to be exploited (ECB, 2021, p. 7).

The history of the international monetary system shows (see e.g. Kowalewski, 2001, pp. 17-66; Budnikowski, 2021, pp. 397-409; Twarowska-Mól, 2021, pp. 13-21; Skopiec, 2023a, pp. 36-38) that international currency status is variable, non-linear and less predictable than one might believe (Panetta, 2024, p. 9). Consequently, it is not fixed once and for all (see e.g. De Grauwe, 2022a, p. 271). It can therefore be predicted that over the next few decades, the status of the euro as an international currency may follow one of three different scenarios (directions) of development, i.e. it may: 1) maintain its international status; 2) move to the periphery of the global monetary system; or 3) gain importance in the center of the system (Panetta, 2024, p. 9). The third scenario seems to be the most desirable.

### 6.2. Towards increasing the international role of the euro - recommendations

To increase the significance of the euro as an international currency, the authorities of the single currency zone should focus their efforts on three key factors: (1) macroeconomic stability; (2) liquid and integrated capital markets; and (3) modern payment and market infrastructures.

The first and most obvious factor is macroeconomic stability (Panetta, 2024, p. 5). It can be defined as the long-term balance in the key interdependencies within the economy. This primarily refers to the balance between domestic demand and domestic production, the balance of payments, government budget revenues and expenditures, as well as savings and investment (Stachowiak, 2023, p. 13). To ensure economic stability, eurozone countries should pursue effective macroeconomic policies (Panetta, 2024, p. 9). These policies are viewed as an important impetus for state interference in economic processes, in order to restore internal and external balance (Stachowiak, 2023, pp. 12-13). Borne in mind should be that when euro-denominated assets are purchased by foreign investors, a stake in the eurozone economy is in fact acquired. The dividend expected by these investors, in turn, is economic growth as well as low and stable price growth within the member countries. The only means of guaranteeing this dividend is for these countries to implement credible, effective and countercyclical macroeconomic policies. Even if a hypothetical country (or currency zone) did enjoy a sound economic structure, it would face extreme difficulty in maintaining its international role, were it to experience frequent recessions or sudden spikes in inflation or deflation (Panetta, 2024, pp. 5-6). This means it is critical to properly select the macroeconomic policy tools, i.e. the monetary policy and fiscal policy under the so-called *policy mix* (for more, see e.g. Rosati, 2017b, pp. 152-163). As it is highly likely that the eurozone will again face a crisis requiring a concerted response at the supranational level by means of both monetary and fiscal policy tools, the response to the COVID-19 pandemic sets a certain template for how a crisis in the eurozone should be managed. The sovereign debt crisis, by contrast, is an example of how not to proceed (Panetta, 2024, p. 6).

The second key factor in strengthening the international role of the euro entails completion of the *Capital Markets Union* (CMU), launched in 2015 (for more, see European Commission, 2024h). Eurozone countries need liquid and integrated capital markets to sustain domestic investment and attract foreign investors. These markets, however, are still significantly underdeveloped compared to other (major) economies (Panetta, 2024, p. 6). Among other things, this leads to significant corporate financing differences in these economies. Thus, for example, in 2023, the share of eurozone countries in global *Venture Capital* funds was only 5%, with 52% share of the United States or 40% share of China (Draghi, 2024, pp. 21, 25). Despite efforts to harmonize the rules and integrate capital markets under European law (Panetta, 2024, p. 6), progress toward the creation of a single capital market within the member countries has been limited in recent times (see Lindner, Mack, 2024, p. 3). It is indicated that the current level of capital market integration in Europe is comparable to the state of affairs back in 2003-2004. To accelerate this integration, attention should be given to two serious deficiencies, in the context of the euro's international role, namely the European *safe asset* and a *fully-fledged banking union* (Panetta, 2024, pp. 6-7).

A *safe asset* in the form of a common risk-free benchmark is instrumental in critical financial activities. These can include, e.g. the pricing of risky financial products, i.e. corporate bonds or derivatives, stimulating the growth thereof (for more, see Panetta, 2024, p. 7). The scarce supply of euro-denominated *safe assets*, in turn, is probably the most serious constraint to the completion of the CMU, and thus to the growth of the currency's global significance (Panetta, 2024, p. 7). It has been indicated that issuance of a common *safe asset* would greatly facilitate the achievement of the CMU and render it more complete (Draghi, 2024, p. 60). The one-time bond issuance under the *Next Generation EU* program (for more, see e.g. European Commission, 2024e) is the first and desired step in this direction (Panetta, 2024, p. 7). Nevertheless, in order to stimulate the development of the *Capital Markets Union* and strengthen the international role of the euro, a steady and predictable supply of *safe assets* would need to be ensured (Panetta, 2024, p. 7), not only through the NGEU program.

The second major constraint on capital market integration in the eurozone is the lack of a *fully-fledged banking union* within the zone (see Lindner, Mack, 2024, p. 9; Draghi, 2024, pp. 60-61). Although, following the financial crisis, the *Single Supervisory Mechanism* and the *Single Resolution Mechanism* were established, viewed as a milestone towards the creation of a single banking market within the eurozone, the above measures proved insufficient in completing the construction of this market. What is more, the European banking sector remains significantly fragmented along the lines of member country borders. In 2021, the banks comprising the sector held domestic assets valued at four times higher than non-domestic euro-area assets. Strongly emphasized should be the fact that such a circumstance inhibits the creation of a true CMU. This is because banking institutions play a central role in all major financial centers, and provide services, often leading in such key areas as asset management, bond underwriting and market-making services. A true CMU, therefore, cannot be formed

without banks capable of operating efficiently throughout the eurozone, and thus without a *fully-fledged banking union* (Panetta, 2024, p. 7), including, inter alia, a deposit insurance system (De Grauwe, 2022a, p. 274).

The third key factor in strengthening the international role of the euro is modern payment and market infrastructures. Of relevance is the fact that these infrastructures allow the financial system's smooth operation. The digitization process improving the operation of this system, in turn, represents one of the present-day challenges and is underpinned by profound transformation. Digitization, indeed, has a very significant and complex impact on society. Payments are no exception here, as the demand for digital payment services has increased significantly worldwide, especially in consequence of the COVID-19 pandemic. One support solution to such a situation may be a *central bank digital currency* (CBDC) (Panetta, 2024, pp. 7-8). This currency, given its potential and capacity to perform the functions of money, is more resemblant of the current traditional fiat money (it appears it would be capable of performing all the functions thereof). Moreover, a CBDC is launched to maximize its information storage function. Should this be achieved, money would gain an additional (new) function, i.e. a *means of storing information* (Twarowska-Mól, 2021, p. 278).

CBDC is currently a matter under consideration by the Eurosystem (see ECB, 2024c), namely a CBDC for both retail and wholesale customers. One recent study indicates that roughly 30% of central banks in developed economies and 20% of central banks in emerging markets are working on retail CBDCs (Kosse, Mattei, 2023; ECB, 2024h, p. 23). As of the end of September 2023, five countries worldwide had completed the implementation stage; three of them successfully. As such, a retail CBDC has been widely available in the Bahamas (*Sand Dollar*) since October 2020, in Nigeria (*eNaira*) since October 2021, and in Jamaica (*Jam-Dex*) since May 2022. Ecuador and Venezuela, by contrast, were unable to implement it. In terms of wholesale CDBCs, i.e. high-currency payments, twenty-two central banks publishing information on ongoing work in this area, including the ECB, were still at the research and testing stage in 2023 (Żak, 2023, pp. 38-39).

From the perspective of the euro's international role, a digital euro currency could provide ample opportunities or be used for cross-currency payments, if made available outside the single currency area (Panetta, 2024, p. 8). Moreover, a retail form of CDBC could yield strategic benefits. It is expected to strengthen the autonomy and resilience of Europe, including eurozone countries, whilst reducing their dependence on private third-party providers. This can be of particular relevance in the context of a potential crisis or geopolitical tensions (ECB, 2024h, p. 25). The same is true for wholesale market CBDCs (Panetta, 2024, p. 8; see ECB, 2024f). Building on the experience of the TARGET (*Trans-European Automated Real-Time Gross Settlement Express Transfer System*) infrastructure (for more, see Guideline (EU) 2022/912...), the Eurosystem institutions are currently conducting research on new solutions based on distributed ledger technology (DLT) and the interaction thereof with the existing TARGET system. This research encompasses tests and experiments aimed at creating a so-called

*technological bridge* between the central bank's currency settlement system and external private DLT platforms. These platforms are used to manage tokenized digital assets (Panetta, 2024, p. 8). Tests have already been conducted independently by several Eurosystem member banks, including Germany's central bank (Deutsche Bundesbank) in 2021 (see Deutsche Bundesbank and…, 2021) or the central bank of France (Banque de France) in 2022 (see Szymula, 2022). These and other solutions (for more, see Panetta, 2024, pp. 8-9), in addition to supporting the international role of the euro, should further the development of global cross-currency payments. Currently, these payments are considered expensive, slow and not very integrated (Panetta, 2024, p. 9).

It must be unequivocally emphasized that the common feature underlying the above recommendations entails the strengthening of the integration process. If the above-mentioned initiatives prove successful and build on the achievements so far, it would bring the EMU to closer to a truly integrated monetary, fiscal and political union (Panetta, 2024, p. 9). A strengthened process of integration would certainly produce additional benefits enhancing the role of the euro in the global monetary system.

## 7. Conclusions

An international currency is used outside the borders of a particular country or economic area. The degree of a currency's internationalization reflects its actual use in monetary transactions. The currency can function regionally or only partially fulfill its function. It can also bring a range of benefits, such as high seigniorage, to the issuing country. In times of global tensions, additional responsibilities may arise, however, in connection with rapid currency appreciation or liquidity risk mitigation. Crisis experience shows, nevertheless, international currencies limit the transmission of exchange rate shocks into domestic inflation, thus reducing the burden of exchange rate fluctuations. It can also amplify the impact of monetary policy during such periods by creating positive side effects. The benefits of issuing such a currency, although variable over time, should therefore outweigh the risks.

Right from its launch, the euro has acquired the status of the second international currency. The common currency area, i.e. the euro area (EA for short), largely met the criteria allowing its currency to be considered an international currency. In the initial period of its existence, the euro gained increasing importance in all functions of international money, which translated directly into the value of the composite index of the euro's international role, at the current exchange rate. Between 1999 and 2005, this indicator rose from 18.13% to 24.14%, i.e. by more than 6 pp. The initial upward trend in the euro's internationalization was halted, however, by the global financial crisis of 2007-2009 and the debt crisis suffered by some member states in 2010-2012. These turbulences led to a decline in foreign investors' confidence in the common

currency. As a result, its international role diminished in most monetary functions. Between 2009 and 2016, the euro's internationalization index fell by as much as 6.42 pp, from 24.36% to 17.94%. Apart from the crises, the causes of this decline are to be sought in internal factors. It is argued that during these crises, the EA was hit by asymmetric shocks, which lacked an adequate political response. On the one hand, the fiscal tools deployed by national policymakers to support their economies were too short-lived, only to be followed by a pro-cyclical fiscal consolidation. On the other hand, the measures adopted in these countries lacked adequate coordination and consistency with the desired supranational fiscal stance. This resulted in deep economic, social and political divisions within the euro area. Its collapse in 2012 was prevented by the decision of the European Central Bank (ECB for short), expressing its readiness to provide unlimited financial support to member states, which convinced investors of the EA's ability to survive the crisis. After a period of significant decline in the international role of the euro, the index saw a partial rebound between 2017 and 2019. The dollar, meanwhile, remained the world's dominant currency.

In March 2020, the COVID-19 pandemic took hold of Europe. Its outbreak triggered an extraordinary global health crisis. As a consequence, economic activity declined significantly in 2020. Real GDP in the euro area as a whole dropped by as much as 6.1% at the time. The pandemic caused significant and lasting supply shocks. This time, the EA authorities were prepared much better to combat the crisis. Of great support turned out to be the new economic governance system adopted after the debt crisis (2010-2012). It enabled the use of innovative stabilization instruments. Such monetary instruments as the *pandemic emergency purchase program* (PEPP for short) and the *third series of targeted longer-term refinancing operations* (TLTRO III for short) were adopted by the European Central Bank. The European Commission, in turn, instituted fiscal measures, such as the *Support to mitigate Unemployment Risks in an Emergency* (SURE for short) and the *Next Generation EU* (NGEU for short) programs. The Commission's instruments complemented the national-level measures, which mobilized much larger fiscal packages than in previous crises. It is argued that this support, at the supranational level in particular, prevented the weakening of the euro's international position in 2020. Some of the indicators characterizing it even increased during that time, which translated directly into an increase in the international role of the euro index by 0.23 pp, i.e. to 19.34%. The euro thus maintained its second international currency position. The U.S. dollar continued to play a dominant role, in turn, despite a decline in its share in most internationalization indicators.

At the end of 2020, a mass vaccination campaign was launched in all euro area countries. This enabled the reopening of these economies in 2021. Despite some disruptions, economic growth in the EA as a whole amounted to 5.3% of GDP, compared to the previous year. It is indicated that this growth was largely possible owing to the implementation of fiscal and monetary policy measures. Moreover, the ECB measures were also a contributing factor in maintaining attractive financing in all economic sectors of the euro area during the recovery

period. This enabled a more effective transmission of fiscal stimuli across the entire economy. The European Commission and the member states' governments at the same time continued to support the transmission of the ECB's monetary policy, through expansionary fiscal measures (the SURE program ended at the end of the year). This strong complementarity provided leeway for a parallel operation of both policies and effectively mitigated the economic damage caused by the pandemic, simultaneously supporting the international role of the euro. In 2021, its index increased by 0.19 pp, reaching 19.53%. The euro thus remained the second key international currency, while the U.S. dollar continued to play the leading role. Another important factor supporting the internationalization of the common currency in 2021 was the Commission's adoption of a new strategy, aimed in part at promoting greater internationalization of the currency. After the first half of 2022, it became apparent that consumers had enthusiastically resumed spending, following the easing of pandemic restrictions. Throughout 2022, real GDP in the euro area rose by 3.5%, reflecting mainly the strong contribution of domestic demand. At the end of the year, production in the EA exceeded the pre-pandemic rate. The eurozone economy's recovery from the pandemic coincided with new shocks, bringing negative consequences for the global monetary system. In 2022, Russia invaded Ukraine; new economic sanctions were introduced while geopolitical risks significantly increased. Despite these shocks, the international currency system remained unchanged, and the invasion revealed the lack of obvious alternatives to its main currencies. The index of the euro's international role increased by 0.18 pp that year, to 19.71%. This resilience was a notable outcome, given the growing inflationary pressures around the world, partly caused by the rise in energy and food prices, triggered by the Russian invasion. These conditions led to a tightening of monetary policies in the core countries of the global economy in 2022, and consequently to increased interest rates for major international currencies, including the euro. The ECB discontinued several measures that year, including the PEPP and the attractive financing for euro area banks under the TLTRO III program. Moreover, these challenges at the time called for a reactive fiscal policy in the EA countries. The national pandemic measures were, on the one hand, terminated at the end of 2022, and only partially offset by new support measures, on the other. Despite the uncertain circumstances, no significant changes in the international currency system were noted nearly a year after the start of the invasion.

In May 2023, the World Health Organization lifted the public health emergency of international concern due to the COVID-19 pandemic. In responding to the pandemic crisis, the mutually reinforcing effects of the fiscal policies and the EA's monetary policy proved crucial in mitigating the effects of the crisis and supporting the member states' economic recovery. Thus, a joint, prompt and decisive response, based on suitably selected policy tools, is a prerequisite in countering major crises within the eurozone. Indicated is that the above measures impacted positively the international role of the euro in some of its functions, and contributed to the growth of its composite index in 2020-2022. The main research hypothesis was therefore not confirmed. Moreover, the multiannual financial framework, along

with the NGEU scheme, is expected to play a major role in the implementation of the post-pandemic recovery package. Although the COVID-19 crisis has not affected the euro's international role significantly, the currency continues to be characterized by a number of weaknesses, compared to the U.S dollar in particular. These weaknesses include the varying levels of EA countries' economic development and the lack of sustainability in meeting the nominal convergence criteria. These factors hamper the pursuit of a uniform monetary policy throughout the zone, reducing the common currency's potential for internationalization. Worth keeping in mind is that not all crises exert the same impact, and not all response tools are alike. The new shocks of 2022 have forced the EA authorities to engage more in creating favorable conditions for the development of the euro. Further European economic and financial integration is to be of great significance in strengthening the resilience of the currency's international role, in the event of a greater fragmentation of the global economy.

In order to increase the common currency's internationalization, the euro area authorities should focus their activities on three factors, i.e. macroeconomic stability, liquid and integrated capital markets, as well as modern payment and market infrastructures. When foreign investors purchase euro-denominated assets, they are actually acquiring a share in the zone's economy. To ensure economic stability in the euro area, member states should pursue an effective macroeconomic policy. Of key significance here is the appropriate selection of monetary and fiscal policy tools, as part of the so-called *policy mix*. As the EA is likely to face another crisis, the response to the COVID-19 pandemic sets a certain pattern for proper crisis management. The sovereign debt crisis response, in turn, is a good example of how not to deal with a crisis. The second key factor in strengthening the euro's internationalization are liquid and integrated capital markets. Completion of the *Capital Markets Union* (CMU for short) within the euro area can ensure this. Capital markets in the EU remain significantly underdeveloped, compared to other major economies, e.g. the United States. To accelerate their integration, these markets need to be supplemented with a European *safe asset* and a *fully-fledged banking union*. A *safe asset* in the form of a common risk-free benchmark is of major relevance in critical financial activities, e.g. corporate bond valuations. To stimulate the development of the CMU, and to strengthen the euro's internationalization, a steady and predictable supply of *safe assets* should be ensured, not only under the NGEU program. Furthermore, a true CMU cannot be built without banks that can operate effectively across the EA, i.e. without a *fully-fledged banking union*, including a common deposit insurance system. The third major factor in strengthening the international role of the euro are modern payment and market infrastructures. The demand for digital payment services has increased significantly worldwide in recent years, not least due to the COVID-19 pandemic. A *central bank digital currency* would certainly be of benefit in this situation. From the perspective of the international role of the euro, it could offer many possibilities if made available outside the EA or used for cross-currency payments. It could also strengthen the euro area countries' autonomy and resilience by reducing their dependence on external private suppliers, which could prove highly beneficial in the event of a potential crisis or geopolitical tensions.

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# Appendix

**Table 1.**
*Selected 2007-2012 indicators included in composite index of the euro's international role, at current exchange rates*

| Currency | 2007[1] [1] | 2008[2] [2] | 2009[3] [3] | 2010[4] [4] | 2011[4] [5] | 2012[4] [6] | [2-1] | [3-2] | [4-3] | [5-4] | [6-5] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Global holdings of foreign exchange reserves - currency shares, in % | | | | | | Difference in pp | | | | |
| EUR | 26.1 | 26.2 | 27.7 | 25.8 | 24.4 | 24.1 | 0.1 | 1.5 | -1.9 | -1.4 | -0.3 |
| USD | 63.9 | 63.8 | 62.2 | 62.2 | 62.7 | 61.5 | -0.1 | -1.6 | 0.0 | 0.5 | -1.2 |
| JPY | 3.2 | 3.5 | 2.9 | 3.7 | 3.6 | 4.1 | 0.3 | -0.6 | 0.8 | -0.1 | 0.5 |
| GBP | 4.8 | 4.2 | 4.3 | 3.9 | 3.8 | 4.0 | -0.6 | 0.1 | -0.4 | -0.1 | 0.2 |
| | Outstanding international debt securities (narrow measure, end of period), in % | | | | | | Difference in pp | | | | |
| EUR | 32.1 | 32.2 | 31.5 | 27.7 | 25.7 | 25.1 | 0.1 | -0.7 | -3.8 | -2.0 | -0.6 |
| USD | 43.3 | 44.7 | 45.8 | 48.7 | 50.8 | 52.5 | 1.4 | 1.1 | 2.9 | 2.1 | 1.7 |
| JPY | 5.3 | 6.7 | 5.7 | 6.2 | 6.1 | 5.0 | 1.4 | -1.0 | 0.5 | -0.1 | -1.1 |
| Other | 19.2 | 16.3 | 17.0 | 17.4 | 17.4 | 17.5 | -2.9 | 0.7 | 0.4 | 0.0 | 0.1 |
| | Outstanding international loans by banks outside the EA to borrowers outside the EA[5] (end of period), in % | | | | | | Difference in pp | | | | |
| EUR | 20.8 | 16.2 | 14.8 | 13.1 | 14.2 | 12.9 | -4.6 | -1.4 | -1.7 | 1.1 | -1.3 |
| USD | 47.5 | 53.2 | 53.9 | 55.0 | 54.9 | 57.0 | 5.7 | 0.7 | 1.1 | -0.1 | 2.1 |
| JPY | 4.3 | 4.3 | 2.7 | 2.7 | 3.1 | 3.0 | 0.0 | -1.6 | 0.0 | 0.4 | -0.1 |
| GBP | - | 1.0 | 1.3 | 1.2 | 1.0 | 1.7 | - | 0.3 | -0.1 | -0.2 | 0.7 |
| | Outstanding international deposits with banks outside the EA from creditors outside the EA[6] (end of period), in % | | | | | | Difference in pp | | | | |
| EUR | 21.5 | 21.9 | 22.5 | 20.7 | 19.0 | 17.8 | 0.4 | 0.6 | -1.8 | -1.7 | -1.2 |
| USD | 54.4 | 54.4 | 51.9 | 54.5 | 56.5 | 55.6 | 0.0 | -2.5 | 2.6 | 2.0 | -0.9 |
| JPY | 2.1 | 2.9 | 1.9 | 1.5 | 2.1 | 2.5 | 0.8 | -1.0 | -0.4 | 0.6 | 0.4 |
| GBP | - | 5.1 | 5.0 | 4.4 | 3.8 | 5.0 | - | -0.1 | -0.6 | -0.6 | 1.2 |

Notes:
[1] The cut-off date for the statistics was 23 April 2021.
[2] The cut-off date for the statistics was 30 April 2022.
[3] The cut-off date for the statistics was 30 April 2023.
[4] The cut-off date for the statistics was 30 April 2024.
[5] Excluding loans to/from Japan, Switzerland, the United Kingdom and the United States in their domestic currency.
[6] Excluding deposits to/from Japan, Switzerland, the United Kingdom and the United States in their domestic currency.

Source: Own preparation based on ECB (2021, pp. A1, A4, A6, A7; 2022, pp. A1, A4, A6, A7; 2023b, pp. A1, A4, A6, A7; 2024h, pp. A1, A4, A6, A7).

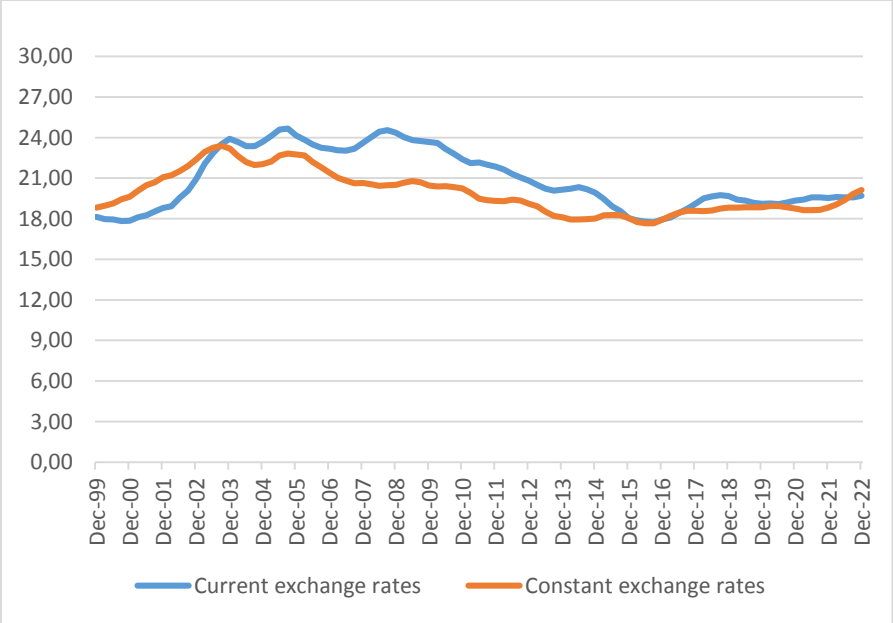
**Table 2.**
*Selected 2019-2022 indicators included in composite index of the euro's international role, at current exchange rates*

| Currency | 2019 [1] | 2020 [2] | 2021 [3] | 2022 [4] | [2-1] | [3-2] | [4-3] |
|---|---|---|---|---|---|---|---|
| | Global holdings of foreign exchange reserves - currency shares, in % | | | | Difference in pp | | |
| EUR | 20.6 | 21.3 | 20.6 | 20.4 | 0.7 | -0.7 | -0.2 |
| USD | 60.7 | 58.9 | 58.8 | 58.5 | -1.8 | -0.1 | -0.3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| JPY | 5.9 | 6.0 | 5.5 | 5.5 | 0.1 | -0.5 | 0.0 |
| GBP | 4.6 | 4.7 | 4.8 | 4.9 | 0.1 | 0.1 | 0.1 |
| CNY | 1.9 | 2.3 | 2.8 | 2.6 | 0.4 | 0.5 | -0.2 |
| | Outstanding international debt securities (narrow measure, end of period), in % | | | | Difference in pp | | |
| EUR | 21.7 | 22.9 | 21.7 | 22.0 | 1.2 | -1.2 | 0.3 |
| USD | 64.3 | 63.4 | 65.4 | 65.6 | -0.9 | 2.0 | 0.2 |
| JPY | 2.4 | 2.3 | 1.9 | 1.8 | -0.1 | -0.4 | -0.1 |
| Other | 11.6 | 11.4 | 11.0 | 10.7 | -0.2 | -0.4 | -0.3 |
| | Outstanding international loans by banks outside the EA to borrowers outside the EA[1] (end of period), in % | | | | Difference in pp | | |
| EUR | 15.3 | 16.4 | 17.6 | 19.2 | 1.1 | 1.2 | 1.6 |
| USD | 56.6 | 54.3 | 55.1 | 53.0 | -2.3 | 0.8 | -2.1 |
| JPY | 2.5 | 2.4 | 2.0 | 2.5 | -0.1 | -0.4 | 0.5 |
| GBP | 1.5 | 1.5 | 1.6 | 1.4 | 0.0 | 0.1 | -0.2 |
| | Outstanding international deposits with banks outside the EA from creditors outside the EA[2] (end of period), in % | | | | Difference in pp | | |
| EUR | 18.6 | 16.5 | 16.7 | 17.4 | -2.1 | 0.2 | 0.7 |
| USD | 53.1 | 54.2 | 52.6 | 51.9 | 1.1 | -1.6 | -0.7 |
| JPY | 2.2 | 1.7 | 2.7 | 3.5 | -0.5 | 1.0 | 0.8 |
| GBP | 2.0 | 1.9 | 1.8 | 1.6 | -0.1 | -0.1 | -0.2 |

Notes:
The cut-off date for the statistics was 30 April 2024.
[1] Excluding loans to/from Japan, Switzerland, the United Kingdom and the United States in their domestic currency.
[2] Excluding deposits to/from Japan, Switzerland, the United Kingdom and the United States in their domestic currency.

Source: Own preparation based on ECB (2024h, pp. A1, A4, A6, A7).




Notes:
In %, at current and constant Q4 2023 exchange rates; four-quarter moving averages. The cut-off date for the statistics was 30 April 2024.

**Figure 1.** 1999-2022 composite index of the international role of the euro.

Source: Own preparation based on ECB (2024a).

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# BRAND MANAGEMENT IN CRISES

Hanna GÓRSKA-WARSEWICZ

Management Institute, Warsaw University of Life Sciences; hanna_gorska-warsewicz@sggw.edu.pl,
ORCID: 0000-0002-5110-7583

**Purpose:** Brand management is an essential issue for academic researchers and managers. The aim of this study was to determine the state of development of the topic of brand management in crisis situations with particular reference to the thematic areas, based on a bibliometric analysis.
**Design/methodology/approach**: A bibliometric analysis was used with five stages: design, compilation, analysis, visualization, and interpretation. A total of 624 and 572 publications were obtained through an advanced search in the Scopus and Web of Science databases, respectively. Publication- and citation-related indicators and science mapping in the context of keyword co-occurrence were applied.
**Findings:** The first publication on brand management in crises and indexed in the Scopus or Web of Science database was published in 1985. 17 and 16 clusters of keyword co-occurrence were identified for publications indexed in the Scopus and Web of Science databases, respectively. Cluster analysis conducted for three time periods identified 4 clusters in 1985-2008, 11 clusters in 2009-2019, and 12 clusters in 2020-2024 for keywords in publications indexed in the Scopus database. For publications indexed in the Web of Science database, 3, 13, and 15 clusters were obtained, respectively.
**Research limitations/implications**: Bibliometric analysis was performed for different brands, but the division between luxury and economy brands and between corporate and product brands was not analyzed. Second, scientific mappings were presented for all items in the period under study. Cases of individual brands and types of crisis situations were not considered either.
**Practical implications:** The practical implications relate to crisis management, image shaping, and technological transformation. Companies should create data-driven strategies for creating proactive communication strategies, segmenting, and personalizing customers. In addition, companies should integrate social responsibility into their core strategy and establish moral standards in response to rising social standards and laws.
**Originality/value:** This bibliometric analysis fills a research gap because there aren't many studies on brand management in crises in the literature. The study indicates thematic clusters throughout the period studied, as well as in the three periods separated by the financial crisis and the pandemic outbreak.
**Keywords:** brand management, crises, bibliometric analysis.
**Category of the paper:** literature review.

## 1. Introduction

The significance of brand management is a crucial topic for academic researchers and managers (Banerjee, 2008; Beverland, 2021; Heding et al., 2008; Kapferer, 2004; King, 1991; Muller, 1998). This is due to the perception of the brand as a combination of tangible and intangible elements (Romero, Yagüe, 2016; Sammut-Bonnici, 2015) and the function of the brand for consumers and entrepreneurs. The most well-known brands can create a special relationship with consumers based on intangible qualities that evoke strong emotional responses (Holt, 2003; Su, Reynolds, 2017). In addition, brands enable the identification of products and market assortment from different producers (Alnawas, Altarifi, 2015; Appiah et al., 2019), create consumer experiences (Lin, 2015), and differentiate products by introducing distinction and differentiation (Aaker, 2004; Ishola, 2022).

The literature points to different approaches to brand crisis management, identifying various types of crises. These include crises of an internal nature and those resulting from external circumstances. Many difficulties that affect brands may significantly impact their reputation and financial success. Effective crisis management is necessary to minimize harm and restore brand value. Effective crisis management includes proactive planning (De Matteis et al., 2023; Deveney, 2018), crisis response strategies (Caulton et al., 2022; Dutta, Pullig, 2011), open communication (Doberstein, 2018; Morgan, Wilk, 2021; Ren, Yan, 2024), and post-crisis recovery (Doberstein, 2018; Srivastava, 2019). Each time a crisis occurs, it is necessary to adopt a specific plan of action. However, bibliometric analyses and/or systematic literature reviews relating to brand management in crisis are lacking in the literature. The available publications refer to specific crisis situations, specific industries, geographical regions, social groups, or specific brands.

Therefore, the aim of this study was to determine the state of development of the topic of brand management in crisis situations with reference to the thematic areas, based on a bibliometric analysis. The following research questions were developed:

1. What is the state of development of the research area on brand management in crises?
2. What thematic areas have been analyzed in the context of brand management in crises?
3. Are there differences in the thematic areas of brand management in crisis situations in different periods of time?

The structure of this publication is as follows. After the introduction, a literature review is presented in subsection two. In subsection three, the methodology is given. Subsection four describes the results and includes three sections on the number of publications and citations and thematic clusters of publications indexed in the Scopus and Web of Science databases. The next subsection includes a discussion of the results and practical implications. The final section is conclusions, limitations, and direction for future research.

## 2. Literature review

In the literature, brand management is widely analyzed, indicating the definitions, determinants, and evolution of this process (Beverland, 2021; Górska-Warsewicz, 2025; Kapferer, 2012; Paek et al., 2020; Pereira-Villazón et al., 2021). One of the earlier studies distinguishes four eras of brand management. The first era was dominated by company-owner-entrepreneurs and high-level manufacturers in the United States and the successes of nationally branded consumer products. In the second era, from 1915 to 1929, the focus was on managing existing brands and introducing new ones to the market in cooperation with advertising agencies. The third era lasted until 1949, with the period of war, crises, and economic changes. In the fourth stage, which continues to this day, brand managers were introduced, new types of brands appeared, and at the same time loyalty to brands decreased (Low, Fullerton, 1994).

Defining brand management has been intensifying in recent years (Kasemsap, 2018; Kulkarni et al., 2023; Lee et al., 2008; Rahman et al., 2018; Yanenko et al., 2020). For example, it was indicated that one aspect of marketing is brand management, which employs strategies to gradually raise a product line's or brand's perceived value (Saraf, Sujatha, 2018). It necessitates a comprehensive understanding of the market, taking into account both the competitive environment and the changing consumer preferences (Cain, 2014). The positioning of brands in the marketplace, including intangibles like consumer perceptions and brand equity as well as tangibles like price, packaging, and the marketing mix, is another definition of brand management (Cain, 2014). In this concept, brand management is seen as a top management task, involving strategic, visionary, and multifunctional processes (Tollin, 2007). Additionally, any organizational culture, system, or structure that supports a company's brand operations is referred to as brand management (Lee et al., 2008). It includes components such as brand-oriented organizations, culture, and brand knowledge (Gisip, Harun, 2013; Lee et al., 2008), as well as marketing capabilities, brand orientation, and innovations (Gisip, Harun, 2013).

The literature provides various elements of brand management, including brand positioning, messaging, differentiation, communication, monitoring, and identity development (Kulkarni et al., 2023; Yanenko et al., 2020). Brand monitoring is the process of continuously evaluating the brand's performance and making necessary adjustments to strategies (Kulkarni et al., 2023); positioning is perceived as establishing a unique place for the brand in the market in comparison to competitors; messaging is the process of crafting and communicating the brand's message to resonate with the target audience; differentiation is defined as highlighting unique features and benefits that set the brand apart from competitors; and communication is described as engagement of customers through various channels to reinforce the brand's message and values (Kulkarni et al., 2023), and identity development is the process of creating a distinctive brand identity through elements like logos, symbols, and slogans (Yanenko et al., 2020).

The importance of brand management relates to several aspects. Strong, devoted customer relationships are created by efficient brand management through consistent brand experiences and favorable brand associations (Kulkarni et al., 2023; Saraf, Sujatha, 2018). It improves brand equity, which is the brand value perceived by consumers (Cain, 2014; Rahman et al., 2018). In a crowded market, a well-managed brand is a source of competitive advantage (Kulkarni et al., 2023; Yanenko et al., 2020). In this aspect, increased revenue, a larger market share, and better overall company success can result from effective brand management (Kasemsap, 2018).

Brand management in the literature refers to corporate brand management (Balmer, Burghausen, 2015; Chang et al., 2015; Cooper, Merrilees, et al., 2015; Paek et al., 2020; Schultz, Hatch, 2003) and product brand management (Kim et al., 2011; Rajagopal, Sanchez, 2004; Sevel et al., 2018). In addition, different approaches were analyzed; for example, the economic approach was first cited, referring to transaction theory and an economic management perspective (Heding et al., 2008). The identity approach pointed to corporate brand management in the context of corporate branding, organizational vision, mission, identity, and culture (Aaker, Joachimsthaler, 2000; Rajagopal, Sanchez, 2004). The development of brands, including corporate and product brands, resulted in another approach referring to a consumer-based approach to brand management (Keller, 1993). A further four approaches referred to personality, relationship, community, and culture perspectives (Heding et al., 2008), each time pointing to key publications relating to brand personality and archetypes (Aaker, 1997), brand consumer relationships (Fournier, 1998), brand communities (Muniz, O'Guinn, 2001), as well as brand cultures and icons (Holt, 2002). In the stakeholder approach of brand management, the corporate behavior of many stakeholder groups, including management, staff, clients, financial market participants, and others, is influenced by brand management (Maio, 2003). Subsequent approaches to brand management have pointed to approaches based on authenticity (Beverland, 2005) and heritage (Wiedmann et al., 2011).

At the same time, the antecedents and outcomes of the brand management process have been analyzed in the literature. The antecedents include, for example, brand authenticity (Beverland, 2005; Górska-Warsewicz, 2025; Moulard et al., 2016), brand history, culture (Górska-Warsewicz, 2025), brand identity (Górska-Warsewicz, 2025; Heding et al., 2008; Kapferer, 2012; Rajagopal & Sanchez, 2004), brand architecture (Aaker, Joachimsthaler, 2000), consumer loyalty (Aaker, 1996; Keller, 1993; Keller, Lehmann, 2006), and also brand heritage (Wiedmann et al., 2012, 2013). Various measures of brand performance are given as outcomes. They point to consumer measures such as loyalty, relative satisfaction, reputation, awareness (Coleman et al., 2015), customer retention, and acquisition (Herlinawati et al., 2019). Financial measures include sales, profit growth (Herlinawati et al., 2019), and financial ratios measuring return on investment and assets (Rauch et al., 2009). Business performance indicators (profitability, sales growth, market share growth, market share, and return on investment), new product performance (success rate and new product turnover) (Lee, Tsai,

2005), as well as marketing assets and brand equity (Romero, Yagüe, 2016), were also mentioned. Additionally, measures of brand performance include two groups relating to brand market performance (brand loyalty, channel support, price premium, quality, and market penetration) and to brand financial performance (market share, sales value, return on investment, gross margin, and return on assets) (Luxton et al., 2015). A's brand model, including appraisal, awareness, acquaintance, association, and allegiance metrics, is also cited in the literature (Rajagopal, 2007).

Crisis management has been widely analyzed in the literature (Boers, Henschel, 2022; Ghaderi, Paraskevas, 2022; Mokhtarifar et al., 2023; Zabłocka-Kluczka, Sałamacha, 2023; Zenker et al., 2019), referring to various levels, including brand management (Cooper, Miller, et al., 2015; Custance et al., 2012; Drewniak, Karaszewski, 2016; Greyser, 2009; Savelli, 2011). Brand crises are known as major incidents that harm brand reputation and frequently result in monetary losses as well as harm the company's reputation and future operations (Johnson et al., 2022). Lack of human-centered strategy, crisis prevention, market knowledge, leadership, management abilities, innovation, and quality assurance are some of the factors that might cause internal brand crises. These elements have the potential to compound and result in crises pertaining to values and performance (Do et al., 2019). Additionally, events involving the public and media where customers discuss their experiences are frequently examples of external causes. Reputational harm may result from these occurrences, which may impact a particular product or the entire product category (Černikovaitė, Černikovaitė, 2018).

The literature indicates various approaches to brand crisis management. Brands experience a variety of crises that can impact their financial performance and reputation. Restoring brand equity and minimizing harm require effective crisis management. Proactive planning (De Matteis et al., 2023; Deveney, 2018), crisis response strategies (Caulton et al., 2022; Dutta, Pullig, 2011), open communication (Doberstein, 2018; Morgan, Wilk, 2021; Ren, Yan, 2024), and post-crisis recovery (Doberstein, 2018; Srivastava, 2019) are all components of effective crisis management. Companies are more likely to preserve their reputation and come out stronger if they respond swiftly to crises, interact with their audience, and take lessons from them. Proactive planning is a pre-crisis planning strategy. Companies that take a proactive approach to crisis management prepare their reaction strategies in advance and train their crisis management staff (Deveney, 2018). At the same time, business continuity management is known to be one of the most effective processes used by companies to cope with crises to continue or resume business activities, thus contributing to strengthening organizational resilience (De Matteis et al., 2023).

Crisis response strategies include corrective action, reduction of offensiveness, denial (Caulton et al., 2022; Dutta, Pullig, 2011), and defensive and accommodative strategies (Fang et al., 2011). Corrective action as a strategy involves taking responsibility and repairing the damage, which is often effective in reducing brand dilution (Caulton et al., 2022). Moreover, reducing offensiveness refers to an approach aimed at minimizing the perceived severity of the

crisis (Dutta, Pullig, 2011). At the same time, denying the crisis can sometimes be effective, but its success depends on the nature of the crisis (Caulton et al., 2022; Dutta, Pullig, 2011). In contrast, defensive strategies perform better in defensible crises, while accommodative strategies perform better in indefensible crises (Fang et al., 2011).

In the context of communication in crises, a quick response and clear communication are needed to manage public perception and maintain trust (Doberstein, 2018). At the same time, social media management is important because of the crucial importance of monitoring and responding to social media sentiment. This is important since the public's reaction can significantly affect brand perception (Morgan, Wilk, 2021; Ren, Yan, 2024). In post-crisis recovery, rebuilding trust requires brands to communicate honestly and consistently (Srivastava, 2019). Additionally, companies can enhance their future crisis management tactics by taking lessons from past crises (Doberstein, 2018).

## 3. Methodology

The aim of the study was to determine the state of development of the topic of brand management in crisis situations with reference to the thematic areas, based on a bibliometric analysis. This is a frequently used method of analysis (Fang et al., 2022; Khalil, Gotway, Crawford, 2015; Saini et al., 2022; Songdi et al., 2021; Valenzuela-Fernandez et al., 2019) as a way to assess the current state of the area of study from a historical standpoint and forecast future development trends (Donthu et al., 2021a; Gan et al., 2022).

Five stages were used in the bibliometric analysis (Zupic, Čater, 2015). Research topics and the study's design were developed in the first stage, identified as design. In the second stage, defined as a compilation, bibliometric data in the form of 624 publications were obtained from the Scopus database and 572 publications from the Web of Science database. The search was conducted as of 27 December 2024. Databases were searched using the following search paths for Scopus (TITLE-ABS-KEY (brand AND management) AND TITLE-ABS-KEY (crisis)) and for Web of Science (brand (Topic) and (management (Topic) and crisis (Topic)). The papers that met the inclusion requirements for this analysis had to be published between 1985 and 2024, have relevance to the subject of brand management in crises, and be indexed in the Scopus or Web of Science databases. Only articles about brand crisis management—such as those about reputation, product damage, and crisis communication—were included. Publications from a range of industries, including food safety, healthcare, and tourism, were included if they addressed crisis brand management. Relevance to the particular research issue served as the basis for the exclusion criteria. Publications that did not offer substantial insights into the subject area or that did not concentrate on brand management during crises were not included. Studies published in languages other than English and those not included in

the databases above were also disregarded. In particular, brand, crisis, and management were highlighted by the keywords like "brand management", "crisis communication", "reputation management", "consumer behavior", and "sustainability".

The data analysis at the third step included science mapping and performance analysis. Citation- and publication-related measures, such as the total number of publications and citations and the average number of publications and citations per year, were employed (Donthu et al., 2021b). The thematic areas in publications indexed in Web of Science and Scopus databases were examined using the bibliometric analysis. In the fourth stage, referred to as visualization, charts showing the quantity of items and clusters were part of the bibliometric counting method of science mapping. An examination of co-occurrence was found using mapping techniques. A minimum of two keyword co-occurrences were covered by a counting approach. To prepare bibliometric counting and co-occurrence analysis, VOSviewer (Nees Jan van Eck and Ludo Waltman, Leiden University, version 1.6.20) was utilized. This software is frequently used for bibliometric mapping and analysis (van Eck, Waltman, 2010). Clusters were presented for the entire period under study, starting from the first publication indexed in the Scopus and Web of Science databases and divided into three periods. The following division was used: until 2008, 2009-2019, and 2020-2024. The financial crisis and the first year of the COVID-19 pandemic were considered breakthrough dates. The aim of such division was to identify the subject of brand management in the context of crisis situations. The final step of the bibliometric study, known as interpretation, involves summarizing the responses to the research questions.

## 4. Results

### 1.1.Number of publications and citations related to brand management in crises

The number of publications on crisis brand management in the Scopus database at the end of 2024 was 624 (Figure 1), with an average value of 15.6 publications per year. The first two publications appeared in 1985 in Social Marketing Forum. By 2000, 22 publications had been published; in subsequent periods, the number of publications was as follows: 77 publications in 2001-2010, 275 in 2011-2020, and 250 in 2021-2024. The number of citations was 7446, with an average value of 186.15 citations per year. Just under 400 (395) publications were cited, giving an h-index of 44. The number of citations exceeded 100 in 2011, 500 in 2020, and 1000 in 2023. The highest number of citations was recorded in 2024, accounting for 20.9% of all citations. On the other hand, 61.6% of all citations were identified in 2021-2024. The number of publications and citations showed an increasing trend, as presented by the trend line with $R^2$ values of 0.9572 and 0.9812, respectively.

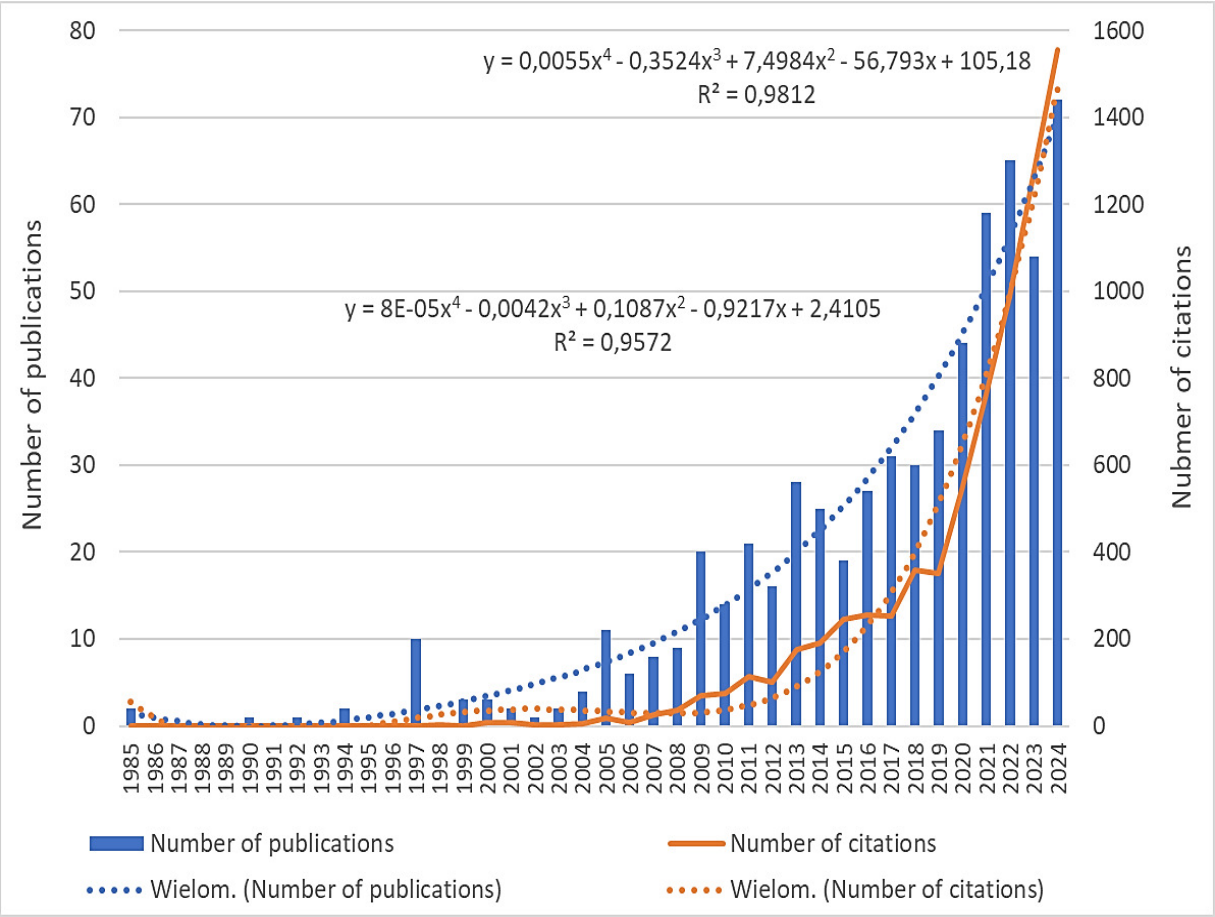



**Figure 1.** Number of publications and citations related to brand management in crises between 1985 and 2024 (Scopus database).

Source: Scopus data with trend line, as of 27.12.2024.

The number of publications on brand management in crises in the Web of Science database at the end of 2024 was 572 (Figure 2), with an average value of 19.03 publications per year. The first publication appeared in 1995 in Veterinary Clinics of North America – Small Animal Practice. By 2000, 4 publications had been published; in subsequent periods, the number of publications was as follows: 59 publications in 2001-2010, 282 in 2011-2020, and 226 in 2021-2024. The number of citations was 8,503, with an average value of 283.43 citations per year and an h-index of 44. The number of citations exceeded 100 in 2013, 500 in 2019, and 1,000 in 2021. The highest number of citations was recorded in 2023, accounting for 16.6% of all citations. In contrast, the number of citations in 2021-2024 accounted for 62.1% of all citations. The number of publications and citations showed an increasing trend, as shown by the trend line with $R^2$ values of 0.914 and 0.9721, respectively.

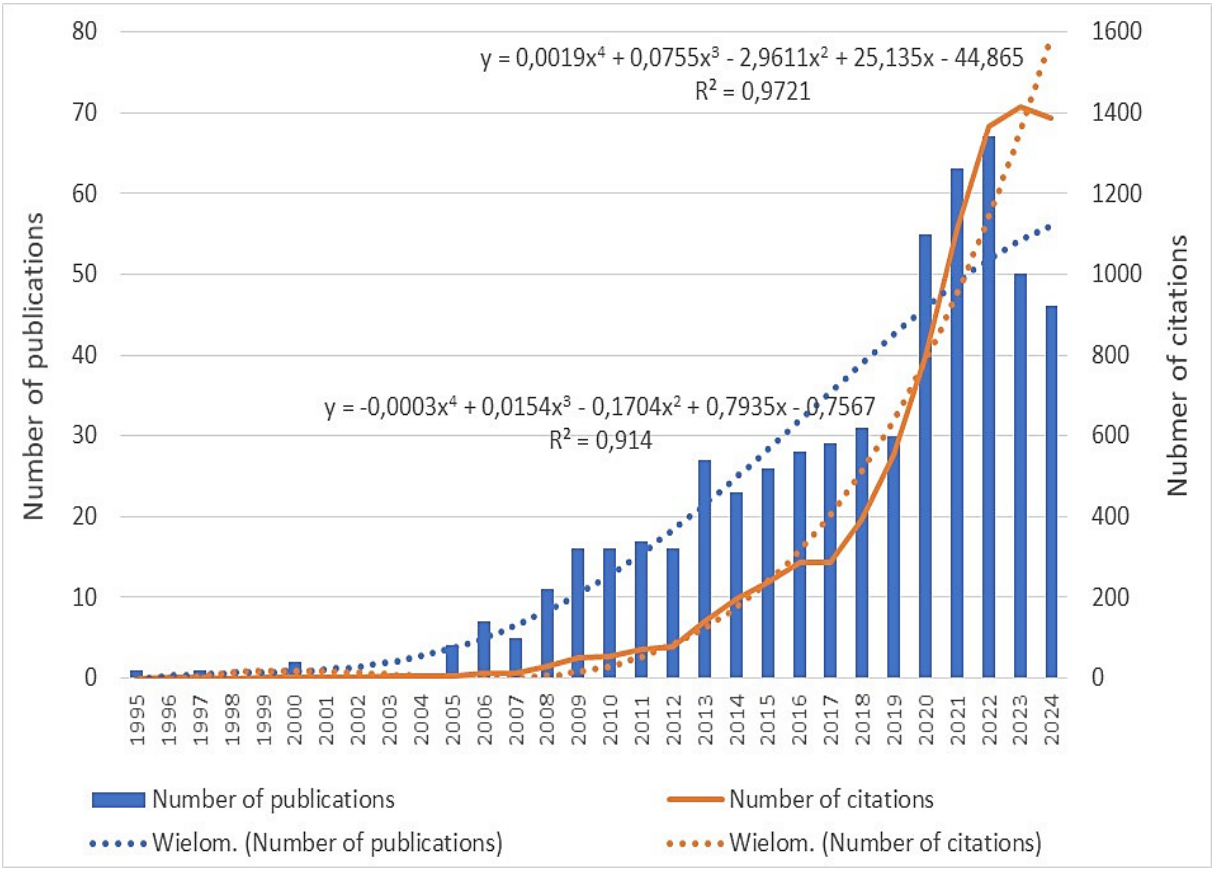



**Figure 2.** Number of publications and citations related to brand management in crises between 1985 and 2024 (Web of Science database).

Source: Web of Science data with trend line, as of 27.12.2024.

In the Scopus database, the study with the highest number of citations (295) was the article *The impact of a product-harm crisis on marketing effectiveness* published in Marketing Science in 2007 (Van Heerde et al., 2007) (Table 1). The article analyzed product crises using the example of the Australian market and Kraft peanut butter. It was pointed out that there is a quadruple threat in the event of a product crisis relating to loss of core sales, reduced effectiveness of marketing instruments, increased cross-sensitivity to the marketing-mix activities of competing companies, and the impact of marketing-mix instruments on sales of competing brands. This article ranked second in terms of the number of citations in the Web of Science database. On the other hand, the publication with the highest number of citations (595) was the article *Impact of product-harm crises on brand equity: The moderating role of consumer expectations* published in the Journal of Marketing Research in 2000 (Dawar, Pillutla, 2000). The aim of the study was to determine the impact of companies' responses to crises on customer-based brand equity. It was shown that consumers interpret company reactions based on their prior expectations of the company. Furthermore, the interaction of expectations and company reactions influences brand equity after a crisis. Different company responses (i.e., explicit support, ambiguous responses, and explicit concealment) and their impact on brand equity were identified.

**Table 1.**
*Most cited publications on brand management in crises*

| No. | | Title | Authors | Journal | Year | Number of citations | |
|---|---|---|---|---|---|---|---|
| Scopus | WoS | | | | | Scopus | WoS |
| 1. | 2 | The impact of a product-harm crisis on marketing effectiveness | Van Heerde, H., Helsen, K., Dekimpe, M.G. | Marketing Science, 26(2), pp. 230-245. | 2007 | 295 | 267 |
| 2. | 4 | An online discursive inquiry into the social dynamics of multi-stakeholder brand meaning co-creation | Vallaster, C., Wallpach, S. | Journal of Business Research, 66(9), pp. 1505-1515. | 2013 | 230 | 178 |
| 3. | | Reputation and its risks | Eccles, R.G., Newquist, S.C., Schatz, R. | Harvard Business Review, 85(2), pp. 104-114. | 2007 | 185 | |
| | 1 | Impact of product-harm crises on brand equity: The moderating role of consumer expectations | Dawar, N., Pillutla, M.M. | Journal of Marketing Research, 37(2), pp. 215-226. | 2000 | | 595 |
| 4. | 5. | Negative spillover in brand portfolios: Exploring the antecedents of asymmetric effects | Lei, J., Dawar, N., Lemmink, J. | Journal of Marketing, 72(3), pp. 111-123. | 2008 | 184 | 169 |
| 5. | | From new deal institutions to capital markets: Commercial consumer risk scores and the making of subprime mortgage finance | Poon, M. | Accounting, Organizations and Society, 34(5), pp. 654-674. | 2009 | 171 | |
| | 3. | Online damage control: The effects of proactive versus reactive webcare interventions in consumer-generated and brand-generated platforms | Van Noort, G., Willemsen, L.M. | Journal of Interactive Marketing, 26(3), pp. 131-140. | 2012 | 398 | 264 |
| | 4 | An online discursive inquiry into the social dynamics of multi-stakeholder brand meaning co-creation | Vallaster, C., Wallpach, S. | Journal of Business Research, 66(9), pp. 1505-1515. | 2013 | | 178 |

Source: Scopus and Web of Science data, as of 27.12.2024

Of the five publications with the highest number of citations, three were repeated in both databases. In addition to the article described above, two articles had the highest number of citations in both databases*: An online discursive inquiry into the social dynamics of multi-stakeholder brand meaning co-creation* published in the Journal of Business Research, and *Negative spillover in brand portfolios: Exploring the antecedents of asymmetric effects*

published in the Journal of Marketing. The aim of the first article was to identify the process of co-creation of brand meaning by multiple stakeholders in a virtual environment using social media. The crisis of the UK brand Gate Gourmet was taken as an example. The article argues that brand meaning arises from the simultaneous interactions between interdependent stakeholders in a network (referred to as a multi-log) (Vallaster, von Wallpach, 2013). The second article examines inter-brand linkages in brand portfolios in the context of marketing effectiveness and brand equity diffusion. It was pointed out that the creation of inter-brand linkages can expose brands to negative spillover effects. Based on two experiments, it was shown that the magnitude of the spillover effect between brands is a function not only of the strength of brand associations but also of their direction. In this context, the directional strength of associations depended on the number and importance of associations (Lei, Lemmink, 2008).

### 1.2. Thematic areas of keyword co-occurrence of publications related to brand management in crises indexed in the Scopus database

All publications related to brand management in crises and indexed in the Scopus database possessed 2,249 keywords. An analysis of the co-occurrence of keywords in 624 publications on brand management in crises in publications indexed in the Scopus database between 1985 and 2024 identified 17 clusters with varying themes (Figure 3). The first cluster, *Crisis management and communication in the digital age,* focused on the challenges of crisis management in the digital age, where the internet, social media, and mobile technologies play a key role. The impact of social media and the speed at which information is shared have made it necessary for brands to respond to crises in real time. Modern communication techniques were also necessary for enhanced transparency, information availability, and immediate contact with the customer. In the second cluster, *Strategic management and industrial development in a global economy*, the effects of a shifting global economy on brand management, industrial development, and strategic management were examined. In crises, companies had to adjust flexibly to new market conditions. Considering this, brand management is increasingly being incorporated into growth strategies in dynamic, international marketplaces. Consumer behavior's influence on brand management tactics was examined in the papers included in Cluster No. 3, *Brand management, consumer behavior, and social responsibility*. Companies had to pay attention to corporate ethics and social responsibility during the crises and modify their operations to meet shifting consumer expectations. Social values and sustainability were part of well-managed branding in this context, especially in times of crisis.

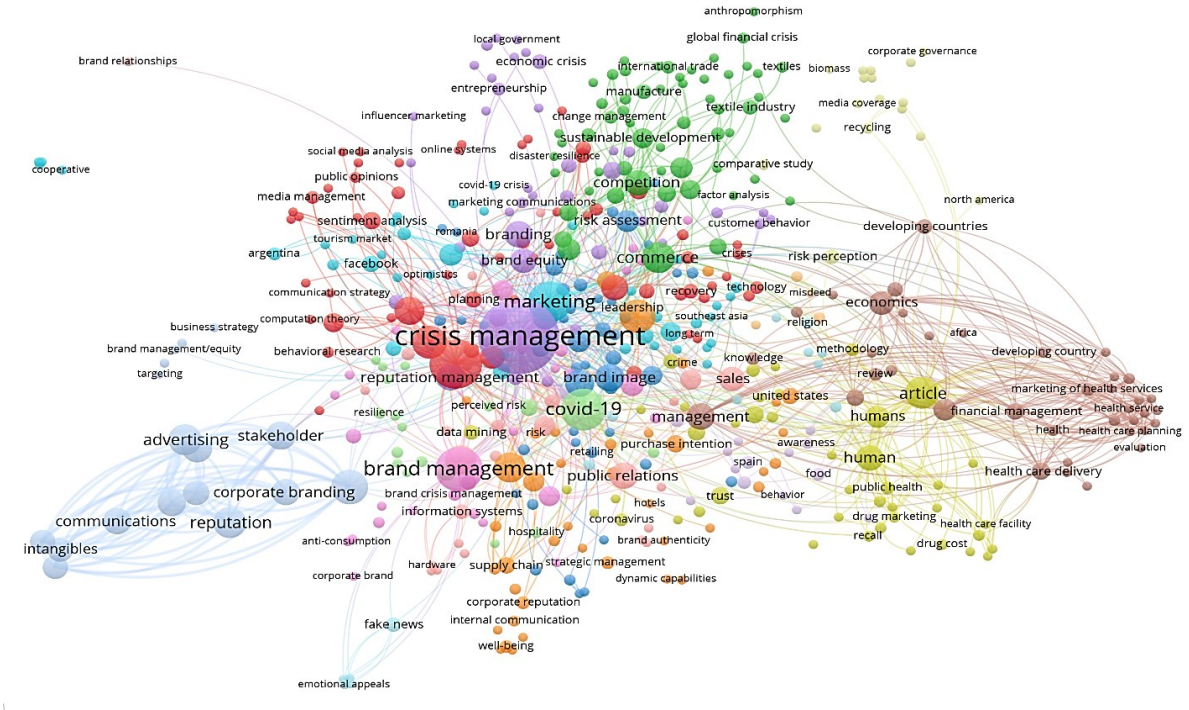



**Figure 3.** Bibliometric mapping of keyword co-occurrence in publications related to brand management in crises indexed in Scopus in the total period.

Source: VOSviewer based on Scopus data, as of 27.12.2024.

Topics in Cluster No. 4, *Public health, food safety, and data analytics in the context of crises,* referred to brand management in the context of public health and food safety, especially during health crises such as a pandemic. The use of data analytics enabled accurate decisions to be made regarding risk management and brand image protection. In this context, companies had to respond to health crises with full awareness of the impact they have on the perceived quality of their products. The research in Cluster No. 5, *Brand management and marketing communications in the context of crisis and digital transformation,* focused on the impact of digital transformation on brand management and marketing communications in crises. It was underlined that modern crises have required companies to respond quickly. At the same time, effectively online and digital communication tools have become essential in maintaining relationships with consumers. Crises accelerated the digitalization of processes, and brands had to skillfully combine traditional and new forms of communication to maintain their reputation.

The publications in Cluster No. 6, *Branding, globalization, and tourism development in the context of developing economies,* explored how globalization affects the development of the tourism industry in developing countries, particularly in the context of crises that may affect the economic and tourism transition in these regions. Challenges related to economic, political, or health crises influenced the perceived tourism value of a region and how a brand is managed in the context of international tourism. The themes of the publication in Cluster No. 7, *Risk, reputation, and commitment management in the context of crises and strategic communication,* focused on risk, reputation, and commitment management during crises. Strategic communication appeared to be key to maintaining a positive brand image, while risk and

reputation management in times of crisis became a cornerstone of crisis management. Companies needed to be prepared for different scenarios to not only minimize losses but also to build long-term engagement with their stakeholders. The articles in Cluster No. 8, *Management and marketing of health services in developing countries,* examined the difficulties in marketing and managing health services in developing countries, especially in the event of epidemics or other health emergencies. In the health sector, responsible communication and efficient marketing techniques that may foster trust and address medical emergencies were essential for good brand management. Cluster No. 9 on brand and crisis management methods in evolving marketplaces addressed how to modify brand management tactics considering the shifting market conditions and crisis situations. Companies needed to modify their brand strategies to new circumstances and react flexibly to crises because of shifting market conditions.

Customer relationship management and crisis communication management were the main issues of the publications in Cluster No. 10. Companies had to be cautious to keep their customers loyal, particularly during crises when it was essential to communicate with customers in a timely and suitable manner to reduce the harm to their brand's reputation. The difficulties of managing a brand in the face of societal diversity and pandemics were examined in the publications in Cluster No. 11, *Brand management in the context of pandemics and diversity.* The challenges of social and cultural diversity in the face of global crises such as pandemics have proved important, modifying their marketing and communication strategies to reflect the changing reality. Cluster No. 12, *Brand and communication management in business strategy*, focused on how important these elements were to overall corporate strategy, particularly during crises. It has been demonstrated that sustaining the integrity of business operations and promptly repairing reputations during a crisis depend on effective communication and brand management.

Cluster No. 13, *Investment in sustainable development, recycling, and waste management,* discussed recycling, waste management, and sustainability investments, all of which can aid in a brand's recovery from environmental crises. In this regard, it was noted that companies can enhance their brands and win over customers by making investments in sustainability and environmental responsibility. How the food sector, and specifically branding tactics, had to adapt to shifts in consumer behavior during a pandemic was examined in the papers in Cluster No. 14, *Branding strategies and consumer behavior in the context of the food market and pandemics.* The changing goals and demands of consumers during this period required companies to be flexible and modify their marketing strategies. Emotional and ethical methods were important in crisis management, according to Cluster No. 15, *Crisis management, emotional approach, and ethics in communication*. To communicate effectively during a crisis, it was necessary to maintain ethical communication standards while properly addressing the needs and feelings of stakeholders. Cluster No. 16, *Business ethics, image crises, and scandal management,* covered these topics, particularly when it comes to scandals. A brand reputation

could be harmed by such crises; thus, careful crises management that considers moral considerations and openness of action is essential. Brand relations management in the context of crises was the focus of Cluster No. 17, *Managing brand relations in the context of crises.* Maintaining brand value in the view of consumers and limiting the negative effects of crises now depends on maintaining customer loyalty, transparency in operations, and responding appropriately to crises.

Cluster analysis was also carried out over three time periods (Table 2). In the first period, i.e., 1985-2008, 65 publications with 399 keywords were identified. Four clusters were extracted describing key aspects of organizational management, public health, brands, and communication in the face of contemporary global challenges. It was examined how companies, governmental organizations, and communities react to situations that are always changing, such as health, economic, and ecological crises. The role of innovation, effective communication, and risk management strategies in building the resilience and competitiveness of organizations was highlighted. Special attention was given to the management and development of trade in emerging countries. At the public health level, the importance of proper management of medical services and public education was emphasized for improving well-being and effectively combating pandemics. In the context of brands and reputation, the importance of image management, building customer trust, and using modern tools such as digital communications in the face of global competitiveness and social concerns was emphasized. It was noted that modern management is inclusive and requires cooperation in many areas to achieve sustainability and organizational resilience.

In the second period (2009-2019), 264 publications with 1381 keywords were included. Analysis of co-occurrence of keywords identified 11 clusters. These clusters' articles focused on the difficulties and tactics of managing in a rapidly evolving global corporate, technological, social, and industrial context. Several aspects of risk management, crisis response, and building organizational resilience are examined considering global values, dynamic supply chains, and sustainability. With an emphasis on social media and artificial intelligence, which are transforming communication tactics and customer interactions, the importance of brands, reputation, and ethical marketing in the digital age was emphasized. Studies were conducted on consumer behavior and the use of innovation in particular industries. Furthermore, it became clear that sustainability, competitiveness, and change management were important in both local and international marketplaces. In this regard, the publication's themes emphasized the convergence of brand management tactics, innovation, social responsibility, and competitiveness in a global environment where technology, changing consumer tastes, and escalating environmental issues are radically changing the way companies and sectors operate.

**Table 2.**
*Cluster comparison of keyword co-occurrence of publications related to brand management in crises indexed in the Scopus database by analyzed periods*

| Period | Publi-cations | Key-words | Clusters | Cluster specifications |
|---|---|---|---|---|
| Total period 1985-2024 | 624 | 2249 | 17 | 1. crisis management and communication in the digital age<br>2. strategic management and industrial development in a global economy<br>3. brand management, consumer behavior, and social responsibility<br>4. public health, food safety, and data analytics in the context of crises<br>5. brand management and marketing communications in the context of crisis and digital transformation<br>6. branding, globalization, and tourism development in the context of developing economies<br>7. risk, reputation, and commitment management in the context of crises and strategic communication<br>8. management and marketing of health services in developing countries<br>9. brand and crisis management strategies in changing markets<br>10. customer relationship and crisis communication management<br>11. brand management in the context of pandemics and diversity<br>12. brand and communication management in business strategy<br>13. waste management, recycling, and investment in sustainable development<br>14. branding strategies and consumer behavior in the context of food markets and pandemics<br>15. crisis management, emotional approach, and ethics in communication<br>16. business ethics, image crises, and scandal management<br>17. managing brand relations in the context of crises |
| First period: 1985-2008 | 65 | 399 | 4 | 1. managing brand, risk, communication, and product development in the context of global challenges<br>2. public health and health service management<br>3. organizational governance, innovation, and trade in the context of developing countries<br>4. brand management, corporate communications, and reputation building |
| Second period: 2009-2019 | 264 | 1381 | 11 | 1. risk management, business continuity, and crisis response in an organizational context<br>2. brand, crisis, and reputation management in the age of artificial intelligence and social media<br>3. managing change and competitiveness in global value chains<br>4. advertising strategies and innovation in industrial sectors<br>5. brand management, consumer behavior, and ethical marketing in the digital era<br>6. crisis management, brand reputation, and corporate social responsibility in the advertising and food industry<br>7. crisis response, innovation, and sustainability in industries<br>8. brand management and consumer behavior in emerging markets<br>9. economic and social impacts of sustainable development in global and regional markets<br>10. brand management and organizational performance in the airline industry<br>11. the impact of modern developments in transport, quality control, and marketing on the economy |

Cont. table 2.

| | | | | |
|---|---|---|---|---|
| Third period: 2020-2024 | 285 | 1416 | 12 | 1. crisis management, consumer attitudes, and corporate strategies in the context of sustainability<br>2. consumer behavior, healthcare, and economic challenges in the pandemic<br>3. sustainable development, competitiveness, and crisis management<br>4. brand development, e-commerce, and sustainability in pandemic times<br>5. brand, crisis, and reputation management in the context of business ethics and entrepreneurship<br>6. risk management, sustainability, and innovation in the tourism industry<br>7. innovation, strategic management, and marketing in pandemic<br>8. brand trust, crisis, and reputation in pandemic times<br>9. brand reputation management, and crisis communication in social media<br>10. brand management and digital marketing<br>11. brand management, ethics, and consumer psychology<br>12. airline industry management, tourism, and marketing |

Source: Scopus data, as of 27.12.2024.

In the last period (2020-2024), there were 285 publications with 1416 keywords, which identified 12 clusters. Considering global issues including pandemics, climate change, and technological advances, the cluster topics explored the complex interactions between crisis management, sustainability, brand strategies, and innovation. Its main areas of study were corporate strategies, consumer behavior, and the growing significance of business ethics. Particularly in the era of social media, where the quick dissemination of information affects how the public views organizations, issues like reputation management, fostering brand trust, and crisis communication were crucial. Another key element was the integration of innovation and sustainable practices into sectors that are undergoing significant transformations due to global crises. The clusters additionally considered the significance of consumer psychology, strategic management, and digital marketing in fostering and preserving competitiveness in global marketplaces. In industries that are vital to the global economy, like healthcare, aviation, and tourism, they concentrated on creating value for stakeholders through sustainability, ethical business practices, and efficient management. To achieve sustainable growth and organizational resilience in the face of ongoing change and global difficulties, recent cluster themes have highlighted the necessity of combining innovative, socially responsible, and brand management strategies.

### 1.3. Thematic areas of keyword co-occurrence of publications related to brand management in crises indexed in the Web of Science database

All publications related to brand management in crises and indexed in the Web of Science database carried 2,647 keywords. An analysis of the keyword co-occurrence in 572 publications on brand management in crises identified 16 clusters with varying themes (Figure 4).

Topics related to crises, brand management, and consumer behavior in the face of uncertainty were covered in publications in Cluster No. 1, *The dynamics of consumer behavior, brand management, and responses to crises in the context of contemporary challenges.* Studies

were conducted on topics such as consumer behavior, product safety, brand anthropomorphizing, anti-consumption, brand bonding, and brand crisis management. They also looked at coping mechanisms and interaction between customers and the brand in crises.

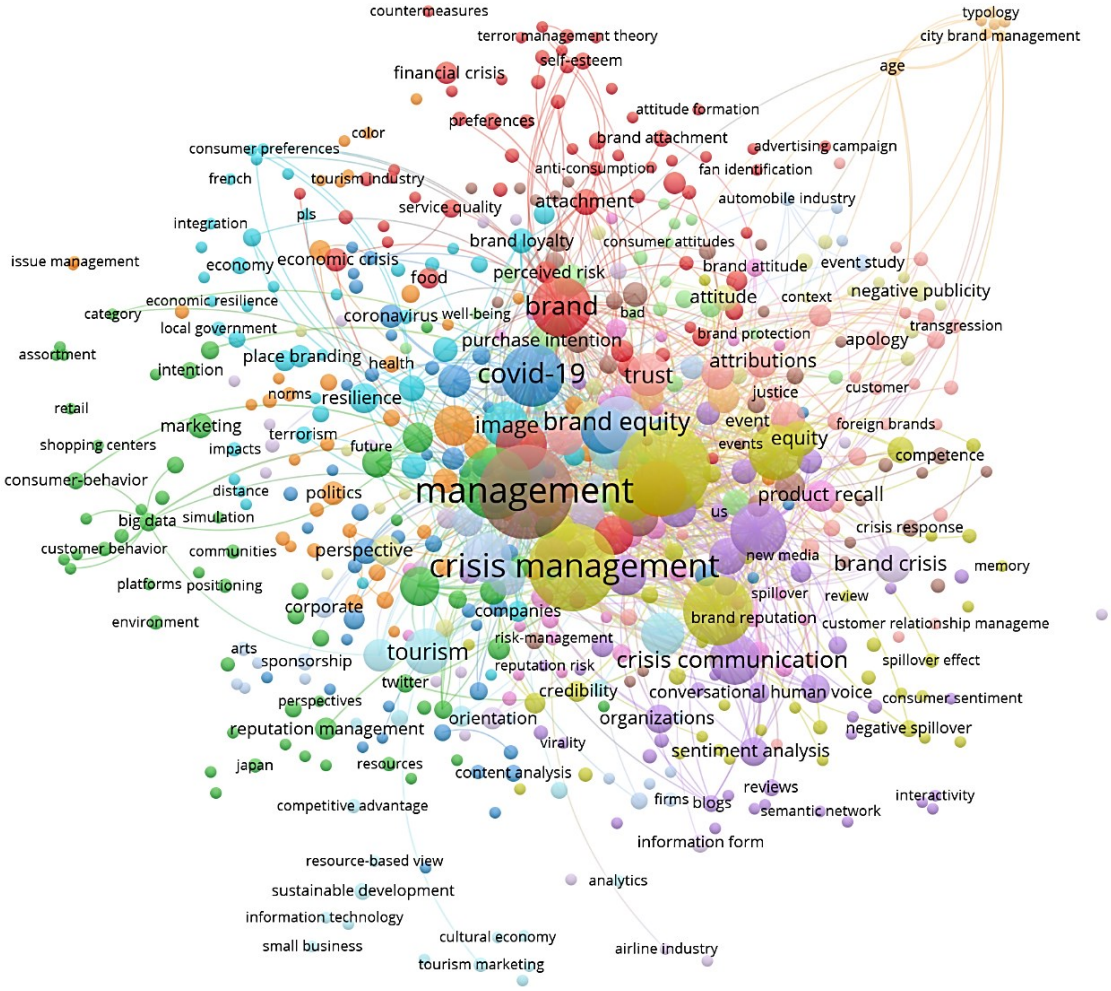



**Figure 4.** Bibliometric mapping of keyword co-occurrence in publications related to brand management in crises indexed in Web of Science in the total period.

Source: VOSviewer based on Web of Science data, as of 27.12.2024.

The application of contemporary technology in marketing, risk management, and strategic decision-making were the subjects covered in Cluster No. 2, *Managing communication, technology, and innovation in times of global change*. Additionally covered were issues including digital platforms, data analytics, crisis management, e-commerce, big data, and risk perception. The potential and difficulties generated by digital transformation in companies were also highlighted. Brand image, customer loyalty, and corporate social responsibility are among the publication subjects in Cluster No. 3, *Sustainable development, innovation, and corporate social responsibility in the global context.* Pandemics, sustainability, sustainable tourism, resource management, and knowledge management featured among the subjects covered. It also explored how ethical principles and social responsibility affected how people perceive brands.

Subjects of publications in Cluster No. 4, *Brand-consumer relations and reputation management in the digital age*, centered on methods for establishing a brand through social media, crisis communication, and consumer interactions. Publications covered subjects such as relationship marketing, crisis management, brand image management, love/hate relationships with brands, and the effect of social media on brand perception. Strategies to improve the relationship between the brand and its customers were also examined. Aspects of crisis communication, business reputation, and online engagement were covered in the studies of Cluster No. 5, *Crisis communication and opinion analysis in the social media*. Publications explored such topics as social media, sentiment analysis, semantic networks, situational theory of crisis communication, and electronic word-of-mouth. Furthermore, an analysis was conducted on how companies handle crises and maintain their online reputation. Consumer preferences, local branding, and quality perceptions were the main issues in studies in Cluster No. 6, *Brand image, service quality, and consumer perceptions in global markets.* Topics covered included social responsibility, consumer behavior, location branding, and product quality. It also looked at how local characteristics affect consumer loyalty and brand perceptions.

Marketing strategies and their connections to cultural values and brand perception were examined in Cluster No. 7, *Creativity, sustainability, and values in strategic marketing.* National branding, internal communication, sustainability, and planned customer behavior were among the subjects covered. Analysis was also done on social norms and how they affect communication tactics. The emotional aspect of crisis management and trust-building were the main issues of Cluster No. 8, *Crisis management and social responsibility in an organizational context.* Subjects covered included consumer attitudes, internal crisis communication, signaling theories, empathy, emotions, and resource management ideas. It was investigated how emotions and empathy affected crisis response tactics. Competition management, product quality, and marketing were among the subjects covered in Cluster No. 9, *Product, sales, and communication management as market challenges*. Furthermore, topics like competition, social responsibility, product crisis management, and brand reputation were covered. It focuses on how companies develop their position and deal with market forces.

Consumer responses to crises and ways to minimize them were the main topics of Cluster No. 10, *Consumer responses to crises and strategies for rebuilding brand reputation*. Among the topics discussed were consumer reactions, brand forgiveness, product crises, and psychological contract breaks. Furthermore, methods for restoring trust and enhancing reputation were investigated. Concerns of national culture, ethics, and globalization were covered in Cluster No. 11, *Globalization, ethics, and quality in marketing and brand management*. Greenwashing, legitimacy, education, and product safety were among the subjects covered. Companies' management methods and ethical attitudes were examined in relation to both local and global concerns. Brand value, philanthropy, and industry effectiveness were examined in publications in Cluster No. 12, *The impact of sponsorship and philanthropy*

*on corporate image in a changing market environment*. Public-private partnerships, sponsorship, brand equity, and how the capital markets react to business decisions were among the subjects covered. Analysis was conducted on how to combine social responsibility and corporate efficiency.

Sports and media celebrities' image management was one of the topics covered in Cluster No. 13, *The use of celebrity and sport images in brand building in crises*. Among the subjects covered were unfavorable publicity, internal branding, sports marketing, and image alignment. The cluster investigated how sports and celebrities affect the efficacy of advertising initiatives. Building resilience in the face of crises was the main topic of Cluster No. 14, *Crisis management and brand strategy in the transport and hospitality industries.* Social media, strategic choices, crisis management, and forward-looking analysis were among the subjects discussed. It examined whether organizations could adapt and survive in a changing business environment. Innovation, the tourism sector, and sustainability were the main subjects of the publication in Cluster No. 15, *Sustainability strategies and reputation management in tourism and small business.* Stakeholder management, small business development, destination branding, and competitive advantage were among the subjects covered. It was investigated how sustainable strategies affected competitiveness. Public communication, media, and government digital strategies were the topics of publication in Cluster No. 16, *Brand management of cities and public communication in the digital age*. Among the subjects covered were typologies, e-government, city brand management, and strategic communication. It explored the use of technology by public administration to enhance their reputation.

The cluster analysis was conducted over three time periods. In the first period, i.e., 1995-2008, 30 publications with 131 keywords were identified (Table 3). Three clusters with an emphasis on product safety, market image, and strategic brand management were found. Methods of creating, maintaining, and protecting brand value were examined, as well as instruments for forming ties with customers and business partners. Product safety and risk management were discussed as being crucial to preserving customer trust and brand reputation during crises. Corporate image and advertising were viewed as communication instruments that aided in the development of brands. Their responsibilities included building recognition, establishing an emotional connection with customers, and differentiating the company from its competitors. It also examined the market linkages in which the brand mediates consumer interactions, generating value for the company and its customers. It was noted that brand equity has a significant role in determining customer sentiments, loyalty, and the success of marketing initiatives.

**Table 3.**
*Cluster comparison of keyword co-occurrence of publications related to brand management in crises indexed in the Web of Science database by analyzed periods*

| Period | Publi-cations | Key-words | Clus-ters | Cluster specifications |
|---|---|---|---|---|
| Total period 1995-2024 | 572 | 2647 | 16 | 1. the dynamics of consumer behavior, brand management, and responses to crises in the context of contemporary challenges.<br>2. managing communication, technology, and innovation in times of global change.<br>3. sustainable development, innovation, and corporate social responsibility in the global context.<br>4. brand-consumer relations and reputation management in the digital age.<br>5. crisis communication and opinion analysis in social media.<br>6. brand image, service quality, and consumer perceptions in global markets.<br>7. creativity, sustainability, and values in strategic marketing.<br>8. crisis management and social responsibility in an organizational context.<br>9. product, sales, and communication management as market challenges.<br>10. consumer responses to crises and strategies for rebuilding brand reputation.<br>11. globalization, ethics, and quality in marketing and brand management.<br>12. the impact of sponsorship and philanthropy on corporate image in a changing market environment.<br>13. the use of celebrity and sport images in brand building in crises.<br>14. crisis management and brand strategy in the transport and hospitality industries.<br>15. sustainability strategies and reputation management in tourism and small business.<br>16. brand management of cities and public communication in the digital age. |
| First period: 1995-2008 | 30 | 131 | 3 | 5. managing brand equity, and product safety in the context of market image.<br>6. advertising and corporate image as branding tools.<br>7. mediating role and brand value in market relationship analysis. |
| Second period: 2009-2019 | 230 | 1126 | 13 | 1. communication, reputation, and crisis management.<br>2. brand loyalty, trust, and marketing.<br>3. consumer behavior and market trends.<br>4. public policy, image, and reputation.<br>5. social responsibility, sustainability, and brand equity.<br>6. crisis response strategies and brand management.<br>7. advertising effectiveness and risk management.<br>8. branding, strategy, and sustainability in companies.<br>9. sentiment analysis, trust, and social responsibility.<br>10. brand image, crisis, and social responsibility.<br>11. consumer preferences and challenges in the financial market.<br>12. crisis management, strategy, and brand management.<br>13. crisis and issue management in the context of reputational equity. |

Cont. table 3.

| | | | | |
|---|---|---|---|---|
| Third period: 2020-2024 | 311 | 1810 | 15 | 1. consumer behavior, psychology, and crisis response.<br>2. corporate strategy and branding in the context of competitive advantage.<br>3. consumer engagement, crisis communication, and reputation management.<br>4. corporate social responsibility, ethics, and crisis management.<br>5. consumer behavior in the era of digital and content marketing.<br>6. market strategies, customer satisfaction, and product quality.<br>7. corporate governance, image, and communication.<br>8. innovation, risk management, and digital transformation.<br>9. brand loyalty, consumer perception, and marketing communication.<br>10. corporate governance, performance, and strategic management.<br>11. health communication, crisis management, and public relations.<br>12. crisis and risk management in the context of strategic recovery.<br>13. consumer behavior, machine learning, and data analytics.<br>14. public communication, governance, and digital media.<br>15. small business, technology, and service management. |

Source: Web of Science data, as of 27.12.2024.

In the second period (2009-2019), 230 publications with 1,126 keywords were included. Thirteen clusters covering a wide range of issues related to brand management, reputation, crises, and communication strategy in the context of various business and social elements were identified based on a co-occurrence analysis of keywords. It looked at how businesses handle their brand and reputation when faced with issues including social responsibility, shifting consumer preferences, and crises. For organizations looking to keep a favorable image during challenging times, crisis management was mentioned in relation to organizational reputation, crisis response, crisis communication, and response techniques. Aspects of marketing like brand trust, customer loyalty, and the success of advertising campaigns were also looked at. Sustainability, corporate social responsibility, and the effects of these initiatives on reputation and brand value were also highlighted. Key components of marketing strategy include concerns about customer behavior, market trends, and the effects of social media, technology, and innovation. In a review of modern marketing strategies, image and reputation threat management emerged as a key element, as has the increasing importance of technological innovation, social media, and new communication channels.

In the most recent period (2020-2024), 311 publications with 1810 keywords were included, identifying 15 clusters. In the context of modern technology and management, these clusters provide a range of concerns related to marketing tactics, corporate communications, crisis management, consumer behavior, and innovation. Cluster subjects covered consumer behavior, preferences, loyalty, and crisis management, among other psychological aspects of consuming. In addition, topics including branding, communication tactics, reputation management, and corporate social responsibility were discussed as they related to establishing and maintaining competitive advantage and brand management. Customer satisfaction, product quality management, marketing efficacy, and the application of new technology for data analysis were the main points of analysis. Innovation, risk management, and digital transformation have been shown to have a significant influence in helping companies better

handle the difficulties of the contemporary market. To create a sustainable and favorable perception of companies in the view of stakeholders and customers, special emphasis was placed on crisis management techniques, social responsibility, communication, and customer interaction.

## 8. Discussion of results and implications

The study aimed to determine the state of development of the topic of brand management in crisis situations with reference to the thematic areas, based on a bibliometric analysis. Three research questions have been formulated, and a discussion of the results follows according to these questions.

The first research question relates to the state of the development of brand management in crisis situations, presented in terms of the number of publications and citations. The first publication on this topic indexed in Scopus appeared in 1985 in Social Marketing Forum, while the first document indexed in Web of Science was published in 1995 in Veterinary Clinics of North America – Small Animal Practice. Since then, there have been 624 publications indexed in the Scopus database with 7446 citations. In the period 2021-2024, 49% of all studies were published, and the number of citations in this period was 61.6% of all citations. Considering publications indexed in the Web of Science database, 572 studies were published with a total of 8503 citations. In the last period, 39.6% of all studies were published, and the number of citations accounted for 62.1% of all citations.

Answering the second question, clusters reflecting the keyword co-occurrence in publications indexed in Scopus and Web of Science databases addressed approaches to contemporary challenges in brand, communication, and crisis management, considering sustainability, social responsibility, and innovation in a global context. Key areas covered several aspects, including crisis management and communication, brand and consumer relationship management, as well as social responsibility and business ethics. Seventeen clusters illustrating the keyword co-occurrence in publications indexed in the Scopus database and 16 clusters based on the Web of Science database were identified. The topics of the clusters included the crisis management strategies in various industries, taking into account the role of technology, social media, and emotions in communication. In addition, the dynamics of brand-customer relations, management of brand image and reputation, and rebuilding relationships after crises were explored. Sustainability, pro-social activities (e.g., philanthropy, sponsorship), and ethics in business strategies were taken into account. In the area of globalization, the challenges of developing economies and diversity in approaches to brand management were presented. The role of technology and innovation in communication, branding, and relationship management in times of global change and in relation to specific economic sectors was pointed

out. The topics presented in the clusters identified based on the keyword co-occurrence in publications indexed in both databases focused on crisis management and brand strategies in the context of contemporary challenges but differed in their emphasis on specific sectors, subject areas, and approaches to ethics and social responsibility. Clusters of keyword co-occurrence in publications indexed in the Scopus database referred more to specific industries, while those from the Web of Science approached marketing and management challenges in a global context.

To answer question three, the keyword co-occurrence in publications indexed in the Scopus and Web of Science databases was presented as clusters for three periods: (1) up to 2008, (2) 2009-2019, and (3) 2020-2024. In all three periods, clusters formed based on the keyword co-occurrence in publications focused on brand, reputation, and communications management, although in different contexts. Risk and crisis management were analyzed, with different emphases on global development, pandemics, and technology. Sustainability was examined in the first period in the context of global challenges, in the second period – in relation to innovation and industrial sustainability, and in the third period – in the context of pandemics and tourism, including consumer and business perspectives. The analysis of innovation covered the entire period studied in different contexts: in relation to organizational management in the first period and in the context of value chains, industrial sectors, and responses to crises in the second and third periods.

Cluster themes reflecting the keyword co-occurrence in publications up to 2008 referred to general aspects in the context of risk management, communication, public health, and innovation in developing countries. For example, it was pointed out that a good corporate reputation is a reservoir of goodwill that protects companies from market declines in times of uncertainty and economic turbulence (Jones et al., 2000). Appropriate reputation management (Margaritis, 2000), crisis management (Davies, 2005; Tucker, Melewar, 2005), and product-harm crisis issues (Van Heerde et al., 2007) have been studied.

At the same time, a comparative analysis of the co-occurrence clusters of keywords in publications on brand management in crisis indexed in Scopus and Web of Science databases during the first period analyzed reveals significant differences in topic coverage, research depth, and disciplinary orientation. The main differences are shown by comparing keyword co-occurrence clusters from publications on brand management in crises that were indexed in the Scopus and Web of Science databases during the first analysis period. Despite the fact that both datasets cover comparable periods (Scopus: 1985-2008; Web of Science: 1995-2008), their clustering results show different viewpoints on the concept and analysis of brand management in the early crisis-related literature.

During this period, Web of Science clusters indicate a more conventional and limited approach to branding. Management of brand equity and product safety as instruments of market image maintenance, advertising and corporate image as strategic branding levers, and the mediating function of brand value in the analysis of market relations are key areas of

focus. Taken as a whole, these clusters demonstrate a marketing-centric perspective, in which brand management is viewed mainly as a tool for maintaining competitive positioning and consumer perception. Crises are hidden circumstances that impact brand strength and reputation rather than being major subjects in themselves. The method is largely static and focuses on traditional concepts such as value perception, company image, and promotional communication.

Clusters developed from the Scopus database, on the other hand, suggest a more complex, multidisciplinary, and dynamic understanding of crisis brand management. In the face of global difficulties, one notable cluster links brand management to risk, communication, and product development, demonstrating an early understanding of the connection between market dynamics and the more general environmental unpredictability. Public health and health service management were introduced in another cluster, indicating a connection between branding and social infrastructure that is conspicuously lacking in the Web of Science clusters. Other clusters concentrate on brand management as a component of a larger corporate communication and reputation-building strategy, as well as organizational management, innovation, and international trade in the context of developing countries.

Between 2009 and 2019, the themes of the keyword co-occurrence clusters indicated a concretization of the issues studied in relation to specific industries and the use of new technologies. Corporate brand reputation and brand crisis management (Greyser, 2009), the role of brand equity in product-harm crisis (Rea et al., 2014), brand management in economic crisis (Drewniak, Karaszewski, 2016), and brand crisis communication (Wang, 2016) were analyzed. Brand management has also been studied in the context of luxury brands (Savelli, 2011), automotive brands (Heller, Darling, 2011, 2012), powdered milk for children (Custance et al., 2012), and food brands (Assiouras et al., 2013). Reference was also made to individual brand crises, indicating that emotional attachment to the brand provided the basis for rebuilding trust in the brand after a crisis by increasing perceptions of brand authenticity among consumers. This, in turn, provided the basis for reinstating the intent to purchase (Roy et al., 2018).

There are differences in the approach to the topics of brand management, with a focus on risk management, crisis response, sustainability, and corporate social responsibility, according to a comparison of clusters from the two databases (Scopus and Web of Science) for publications on crisis brand management from 2009 to 2019.

The second period's Scopus database has eleven clusters with a broad topic focus that includes crisis response in an organizational setting, risk management, and business continuity. In the era of social media and artificial intelligence, there is also a lot of focus on the relationship between brand, crisis, and reputation management. Other clusters concentrate on advertising strategies and innovation in industrial sectors, managing transformation and competition in global value chains, brand management, consumer behavior, and ethical marketing in the digital age. In the context of corporate social responsibility, crisis response and brand reputation management are also clearly prioritized, especially in the food and advertising sectors.

Other clusters cover topics including industry sustainability, the impact of modern advances on transportation, and airline brand management and organizational performance. Additionally, emerging markets and their impact on brand management are discussed.

The Web of Science database, on the other hand, contains 13 clusters that are thematically focused on marketing, brand loyalty, trust, and reputation, as well as communication and crisis management. Along with public policy, image, and reputation management in crisis situations, consumer behavior and market developments are also major topics. In addition to crisis response plans and brand management, other key topics include social responsibility, sustainability, and brand equity. Along with branding, strategy, and sustainability, there is also a focus on risk management and advertising effectiveness. Notably, there are clusters that concentrate on social responsibility, trust, and sentiment analysis. In addition, strategy, brand management, and crisis management are discussed, with an emphasis on crisis and issue management in relation to reputational equity.

In this context, a more comprehensive approach to brand management during crises is provided by the Scopus database, which incorporates not only communication elements but also changes in global value chains, technical progress and their impact on various industries, and the unique difficulties faced by emerging markets. Additionally, Scopus integrates sustainability with brand management and consumer behavior, with a greater emphasis on the business and social environment. However, Web of Science offers a more diverse set of clusters, emphasizing public policy, corporate social responsibility, consumer loyalty, and reputation management in relation to brand management. A more theoretical and structural approach to brand management is indicated by Web of Science's greater emphasis on sentiment and trust analysis in crisis situations as well as the connection between sustainability and brand.

In contrast, from 2020 to 2024, the cluster themes focused most on pandemics, sustainability, and business ethics in the context of global challenges. The issues of the pandemic, its impact on the economy, marketing, and sustainability were analyzed in detail. Various aspects of artificial intelligence for brand management in crisis situations were explored. Topics included research, analytics, and intelligence in crises (LaVail et al., 2024), effective crisis communication (Chiames, Smulyan, 2024), and rebranding as a crisis response (Meintjes, Botha, 2024). The importance of online brand communities in product-harm crises is demonstrated when members engage in interactions with others in online brand communities, seeking and reviewing information, creating meaning, and forming opinions (Casey et al., 2024). In the context of Ukrainian brands and communications conducted on Instagram during the Ukraine-Russia war, the importance of public and digital diplomacy was demonstrated, alongside the more specific concepts of nation branding, diplomacy, and reputation security (Ventura, 2024). The issue of COVID-19 in the context of brand management was analyzed in various aspects, including managing tourism crises (Varghese et al., 2022), crises in luxury fashion segments (Karaosman et al., 2023), the impact of marketing signals on the activities of

foreign subsidiaries (Georgopoulos et al., 2024), and university opinion leaders in global crises (Guo, Feng, 2024).

Regarding crisis brand management, the comparison of the co-occurrence clusters between the Scopus and Web of Science databases for the third period (2020-2024) shows a difference in thematic focus and research orientation. There are 12 clusters in the Scopus database for the 2020-2024 period, with a focus on corporate strategies, consumer behavior, and crisis management, particularly in relation to sustainability. Important topics include consumer behavior and the difficulties caused by healthcare and economic disruptions, especially during pandemics. With references to sustainability, competitiveness, and crisis management, as well as the convergence of brand development, e-commerce, and sustainability during a pandemic, sustainability often appears in several clusters. The management of reputation, crises, and brand in relation to entrepreneurship and corporate ethics are the subject of another notable cluster. In the tourism sector, risk management, innovation, and sustainability are emphasized. Brand trust, crises, and reputation management are also covered, especially in light of social media and pandemics. Discussions on consumer psychology, brand management ethics, digital marketing, and airline industry management are among the other clusters.

The Web of Science database, on the other hand, offers 15 clusters with a wider range of topics. Consumer behavior and crisis response are strongly emphasized, alongside psychological elements and the impact of crises on consumer sentiments. In addition to customer involvement, crisis communication, and reputation management, corporate strategy and branding are also studied in relation to competitive advantage. A recurring theme, which echoes issues identified in Scopus but places greater emphasis on broader ethical implications, is corporate social responsibility, ethics, and crisis management. Furthermore, the Web of Science explores the application of advanced technologies in crisis management and brand strategy, highlighting the significance of digital transformation, machine learning, and data analytics. Alongside smaller but equally important clusters, such as the use of technology in small businesses and service management, other clusters focus on market strategies, customer satisfaction, corporate governance, innovation, and public communication.

Over time, the two databases differ primarily in the diversity of their content as well as in the technological and strategic focus of their clusters. Scopus offers a more targeted approach to pandemic-related issues, digital marketing, and sustainability, especially in sectors such as travel and aviation. It also examines brand management in relation to ethics and entrepreneurship, highlighting them as essential elements of long-term crisis resilience. In contrast, the Web of Science provides a more comprehensive perspective, with clusters spanning digital transformation, machine learning, and data analytics, suggesting a more advanced technological approach to crisis and brand management. Moreover, the Web of Science is more detailed in its consumer-focused strategies, placing greater emphasis on marketing approaches, customer loyalty, and customer satisfaction in connection with branding.

Regarding brand management during crises, the clusters studied over time in the Scopus and Web of Science databases offer important insights into the types of crises that have been researched. Throughout the entire time from 1985 to 2024, several types of crises are identified. Considering technological change, one of the main crisis types relates to crisis management and communication in the digital era, highlighting the growing significance of digital tools in crisis response. The focus lies on how brands handle crises in the digital environment, especially in light of the influence of social media on public perceptions of crisis management.

Global economic and organizational crises are another form of crisis observed across the analyzed periods. Several clusters focus on issues such as business continuity, economic downturns, and crisis management strategies. These crises often involve disruptions such as financial recessions or internal organizational challenges, as brands attempt to navigate uncertain economic conditions. Public health and safety crises have also attracted considerable attention, particularly in sectors like healthcare and food safety. Crisis communication and brand reputation frameworks are employed to address incidents related to health, such as product contamination or medical errors. These types of crises were especially prominent in earlier years and experienced a resurgence during the pandemic.

Reputation crises and brand image issues are continuously discussed across all periods, with a particular focus on how companies manage public relations and maintain consumer trust in the face of events such as product recalls, corporate scandals, or other incidents that damage brand reputation. Over time, especially in the second and third periods, the issues of sustainability and social responsibility gained importance. These crises underscore the role of ethical dilemmas, weak corporate governance, and environmental challenges in shaping societal expectations regarding responsibility and sustainability.

In the most recent time, health crises and pandemics—especially the COVID-19 pandemic—have received significant attention. These crises encompass global health emergencies, changes in consumer behavior, and the profound impact of health-related issues on businesses, particularly in the healthcare, e-commerce, and tourism sectors. Brands have had to manage not only the immediate crisis response but also the long-term consequences of the pandemic for consumer trust and brand reputation.

The relevance of different types of crises shifted across the three periods. During the first period (1985-2008), the primary focus was on reputation crises related to corporate image management, brand risk, and product safety. These crises were often more traditional in nature, requiring brands to protect their image in situations such as product recalls or health-related issues.

The second period (2009-2019) reflected the increasing influence of new technologies, with a shift toward crises driven by digital and social media. In the era of social media, digital communication, and artificial intelligence, maintaining brand reputation required adaptation. Brands also began to face growing social and environmental challenges, as well as economic

crises affecting sectors such as food and aviation. Ethical marketing and corporate social responsibility became increasingly prominent.

During the third period (2020-2024), pandemic-related crises intensified, with particular attention paid to health communication, healthcare system challenges, and the impact of the COVID-19 pandemic on global trade. The clusters from this period reflect how businesses managed pandemic-related challenges, with a focus on consumer behavior, sustainability, crisis communication, and brand trust in the digital era. Innovation and digital transformation emerged as key themes as brands adopted new technologies and marketing strategies to address the crisis.

In conclusion, the nature of crises studied in the context of brand management has evolved significantly over time. The scope has expanded—from traditional reputation crises to more complex issues involving digital transformation, sustainability, and global health emergencies—mirroring broader societal and technological changes. Each period reveals the challenges and opportunities brands have encountered while responding to crises, with new themes emerging as global circumstances have shifted.

Considering current global issues, the thematic clusters identified in the Scopus and Web of Science databases reflect the growing complexity of brand management and crisis communication research. These findings reveal several theoretical and practical ramifications that are crucial to both academic research and organizational strategy decision-making. First, the results highlight the need for an integrated approach to crisis communication and brand management. Studies (Scopus: clusters No. 5, 9, 10, and 17; Web of Science: clusters No. 1, 10, and 14) show that crisis communication is becoming an increasingly important factor in brand management. In practice, this requires creation of comprehensive response plans that not only protect corporate reputation but also strengthen stakeholder interactions in uncertain times.

Second, the clusters (Scopus: clusters No. 1 and 7; Web of Science: clusters No. 2, 5, and 16) highlight the growing importance of social media and digital transformation in crisis management. These technologies enable real-time monitoring and rapid response, prompting companies to enhance their digital communication capabilities and make crisis management more adaptive. Another key conclusion concerns the importance of ethics, social responsibility, and trust as fundamental pillars of brand communication strategies. Several clusters highlight the significance of incorporating ethical behavior and corporate social responsibility into branding initiatives, particularly during periods of reputational risk (Scopus: clusters No. 3, 14, and 16; Web of Science: clusters No. 3, 8, and 11). This implies that companies must increase transparency and align marketing strategies with principles that appeal to socially conscious customers.

Another important subject that comes up is sector-specific methods to crisis management. According to research on sectors including healthcare, tourism, and transportation (Scopus: clusters No. 4, 6, and 8; Web of Science: clusters No. 14 and 15), crisis response plans must be

tailored to the unique dynamics of each sector. This has practical implications for developing policies and crisis response scenarios specific to individual industries.

Furthermore, another significant implication is the changing character of brand-consumer connections in the face of uncertainty and globalization (Scopus: clusters No. 11 and 12; Web of Science: clusters No. 1, 4, and 6). To stay relevant and loyal during times of crisis, companies need to provide not only functional value but also emotional and symbolic meaning. Additionally emphasized as crucial reactions to market shocks are creativity and innovation (Web of Science: clusters No. 2, 7, and 9). For companies operating in unstable environments, the ability to innovate in product offerings, marketing tactics, and technology implementation is considered crucial.

Finally, reputation is recognized as a strategic asset, especially in times of crises (Scopus: clusters No. 7 and 16; Web of Science: clusters No. 4, 10, and 12). The research indicates that building and maintaining a strong reputation requires a long-term strategy supported by authentic communication, CSR programs, and open brand conduct.

## 9. Conclusions, limitations, and future research

Brand management in crises is an important decision-making and management issue. Aspects related to brand reputation, brand awareness, product quality, marketing, social media, marketing communication, branding, and sustainable development indicate the need for a holistic approach to brand management in crisis situations. Bibliometric analysis has proven the importance of this area in the scientific literature, showing a quantitative increase in the number of publications and citations. Above all, however, this study shows research areas related to brand management in crises, identifying thematic clusters throughout the period under study, divided into three research periods limited by the financial crisis and the outbreak of the pandemic.

Despite these advantages, the study has its limitations. Firstly, brand management in crises was analyzed in relation to different crises and brands, but the breakdown between brand and crisis types was not analyzed. Secondly, keyword mapping was presented, and clusters were listed for the three periods. However, changes in these issues across geographical regions were not analyzed.

As directions for future research, it is worth pointing out the different types of crises and strategies for dealing with them to maintain and strengthen brand image and reputation. It is also worth highlighting different brands, including corporate brands and product brands. Another direction of research should be the issue of social media marketing, real-time marketing, content marketing, and influencer marketing. The impact of crises on brand equity

and brand value should also be analyzed across different areas, including digital brands, luxury brands, retail brands, university brands, and others.

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# CREATING A UNIVERSITY MANAGEMENT MODEL USING LEAN MANAGEMENT INSTRUMENTS

Marcin JAKUBIEC

University of Bielsko-Biala; mjakubiec@ubb.edu.pl, ORCID: 0000-0003-1874-1272

**Purpose:** The aim of the article is to analyze the impact of the Lean Management concept and its instruments on the modules of the university management model, taking into account the expectations and real impact of the concept.
**Design/methodology/approach**: The article proposes 16 modules of the university management model and analyses the impact of the Lean Management concept on university management. The analysis is based on the example of University of Bielsko-Biala.
**Findings:** The case study allowed us to assess the validity of the proposed university management model modules, as well as to verify the expected and real impact of Lean Management and improvement instruments on these modules. This was another step to increase the awareness of the customs management regarding the use of Lean Management concepts to improve processes and services.
**Research limitations/implications**: The limitations of the article concern the proposed university management model and its modules. The autonomy of each university causes certain obstacles in creating universal solutions. Therefore, for the purposes of the article, modules were adopted that constitute the basic functions implemented in the university.
**Practical implications:** The case study revealed that the expected impact of Lean Management and its instruments on the university management model modules is higher than the actual impact. This may indicate the need for a broader use of Lean instruments to improve processes and services at the university. This may also be the subject of further scientific research.
**Originality/value:** The added value of the article is the case analysis, which shows the importance of the Lean Management concept and its instruments in the management and improvement of university.
**Keywords:** university, management model, Lean Management.
**Category of the paper:** Case study.

## 1. Introduction

The concept of Lean Management has been known and used in the economy for several decades. The above conclusion cannot be applied to aspects of university management. One can notice the use of selected elements of the Lean improvement concept or instruments,

but there is no comprehensive use of the concept in the management and improvement of universities. This is confirmed by scientific research conducted for several years by researchers representing such research centers as: Jagiellonian University in Krakow, Gdansk University of Technology and University of Bielsko-Biala. Therefore, there is a need for further scientific research in this area to deepen the area of knowledge about the possibilities of using the subject concept and Lean improvement instruments in university management.

It should be noted that interest in the subject of the improvement concept, including Lean Management as a research area within higher education and university management, increased with the emergence of the New Public Management concept. The improvement of the quality of management in the broadly understood public sector was to occur through the absorption of market mechanisms and management methods, techniques and tools used on a large scale in the private sector (Kożuch, 2013; Emiliani, 2015; Balzer, 2010; Yorkstone, 2016).

This article addresses the issue of the impact of the Lean Management concept and its improvement instruments on the university management model. The issue of the model was treated with a great deal of awareness that this is a conventional issue in the case of universities. Each university is autonomous and has its own individual management model. However, it is possible to propose modules, which are elements of the model, occurring at universities and referring to the basic functions performed by universities. The article presents a fragment of a broader study that addressed the above issue. The empirical part presents the case of the author's alma mater - the University of Bielsko-Biala.

## 2. Lean Management and its relations with university management model

Managing a public academic university is possible using the Lean Management concept. The basis of this concept is sensitivity to changes in the environment and introducing changes, optimally using all available resources, eliminating waste by simplifying processes and analyzing effects on an organizational scale (Liker, Meier, 2011, pp. 27-28; Puvanasvaran, Megat, Tang, Muhamad, Hamouda, 2009, pp. 930-943).

Lean Management constitutes a management concept that has been successfully implemented by companies and organizations around the world. In Poland, an increasing number of organizations can boast successful implementations of this concept. The Lean Management concept originates from the Lean Thinking philosophy, implemented into the terminology of economics and management by J.P. Womack, D.T. Jones and D. Roos, scientists representing the Massachusetts Institute of Technology (Womack, Jones, Roos, 1990; Womack, Jones, 1996).

The concept of Lean Management is evolving, which results in the emergence of new terms and applications. There are varieties of Lean Management within organizations that refer to specific functional areas, e.g.: Lean Leadership, Lean Innovation, Lean Teams, Lean Product and Process Development. Variations of Lean Management are also emerging within industries, e.g.: Lean Public Services, Lean Education and Lean Universities (Torbjørn, Powell, 2016, pp. V-VIII).

Implementing the ideas and principles of Lean Management at a university means changing the philosophy and organizational culture. Long-term changes occur along the entire stream of activity, not just individual tasks. University employees create value, implement processes, use modern management methods and tools. Therefore, it is necessary to start by creating an appropriate culture and environment in which employees demonstrate commitment, think creatively and perform work that matters. The use of Lean Management requires maintaining consistency with the mission, vision and strategy of the university. A common problem that appears when implementing the principles of the Lean Management concept is the inability to look at the university as a system and the employees' understanding of their place in it and the impact on its functioning (Carvalho, 2020).

The fundamental features of the Lean Management concept are the pursuit of improving broadly understood quality, minimizing costs and shortening the time of process implementation as a result of systematic elimination of waste within the framework of management based on a flat organizational structure. Lean Management means management focused on processes. Properly implemented in the university, the principles of process management can be a factor helping to adapt the Lean Management concept. Process management, focused on achieving the synergy effect to achieve the university's goals, has become the basis for "lean management" for comprehensive improvement of the management system. The key intention of process management and the Lean Management concept based on it is the elimination of rigid functional structures at the university. In place of this ineffective and inefficient model, the Lean Management concept introduces a flattened and horizontal organizational structure that is focused on processes and knowledge accumulation, while simultaneously decomposing the strategic goals of the university into the goals of processes and individual positions, along the value chain. Process management in the Lean Management concept concerns not only operational processes, but also auxiliary processes without which the proper functioning of the university would not be possible (Wiśniewska, Grudowski, 2014, pp. 34-38).

Implementing Lean Management at a university means implementing five fundamental principles:

1. Identifying the value stream.
2. Eliminating waste (Muda).
3. Ensuring the flow of activities in processes.
4. Controlling processes through a pull system.
5. Continuous pursuit of process perfection.

The implementation of Lean Management principles at the university can proceed according to the following stages (Krdžalicia, Brguljab, Duraković, 2020, p. 570):

1. Learning the assumptions of the Lean Management concept. The initial action starting the implementation of the LM concept should be to familiarize management staff and employees with the basic assumptions and goals of the concept, as well as the benefits of its application.
2. Assessment of the existing state and identification of opportunities. It is necessary to assess all the positives and negatives and development opportunities related to Lean Management (service, process) at a given moment, taking into account organizational, technical, economic and social aspects.
3. Analysis and modification of the existing state. This means determining deviations in the scope of efficiency parameters and determining the level of expected effects. At this stage, Lean Management instruments such as Kaizen, Value Stream Mapping, 5S and others can be included.
4. Design and implementation of a new service or process. Establishing a team, developing a plan and implementation.
5. Continuous improvement. Implemented by all employees at all organizational levels at the university.

The implementation of the Lean Management concept at a university leads to the identification and elimination of all activities that do not create value for the customer in the process of continuous improvement of processes and services. A university implementing the Lean Management principles adapts better to current market conditions through fundamental transformations of the management and functioning spheres. Lean Management attaches great importance to the human factor, changes the way of thinking and acting as well as the mentality of the management staff and other employees (Thomas, Antony, Francis, Fisher, 2015, pp. 982-996; Sunder, 2016, pp. 159-178; Kadarova, Demecko, 2016, pp. 11-16).

Materialization of the concept principles requires the use of various and appropriate Lean instruments (methods, techniques or tools) in given conditions. The table 1 presents the characteristics of selected Lean instruments, which were also included in the study presented later in the article.

**Table 1.**
*Selected Lean instruments*

| Selected Lean instruments | Description |
|---|---|
| Failure Mode and Effect Analysis | The FMEA method concerns the analysis of potential types and effects of defects. A characteristic parameter is the risk indicator, which is the product of three components: the probability of occurrence of a defect, its detectability and the significance of the defect. The FMEA method constitutes a cause-effect analysis. It can be applied to a product or a process. The FMEA analysis can be carried out in three stages: preparation, subject analysis and supervision of preventive actions.<br>An example of FMEA application in a university may be the modification or launch of a new course of study. |

Cont. table 1.

| | |
|---|---|
| Quality Function Deployment | The main goal of this method is to translate the needs and expectations of customers into the characteristics of the service. Information about needs and expectations is collected using surveys, interviews, reports prepared by external organizations, etc. Linking the information obtained and linking it with actual expectations, and then creating the right service is difficult. The QFD method is to support these activities. The process of implementation using the QFD method can be reduced to the stages: planning (defining the area of activity), collecting requirements (based on quantitative methods, e.g., surveys) and analyzing the collected material in terms of improving a given service. An important tool used in the method is the "House of Quality". This is a matrix of relations in relation to: customer requirements, parameters characterizing the service of the university being studied and services of competing universities.<br>The QFD method, similarly to the FMEA method, can be used to modify the course of study in order to determine the optimal subject grid. |
| Reengineering | The reengineering method refers to process management. It means a quick and thorough reconstruction (redesign) of the process in order to improve the effectiveness in achieving its goal and process indicators, also from the point of view of value for the customer. When doing this, it should be remembered that a given process is related to other processes and affects elements of the organizational structure of the university. Reengineering is a revolutionary approach to management, starting the organization and implementation of the process from scratch. Whether the actions taken within the framework of reengineering will be effective depends largely on the university management, understanding the university strategy, the structure of the implemented processes, etc. The aim of reengineering is to improve the analyzed process, reduce unnecessary activities, increase flexibility, efficiency of the process implementation and improve customer service. Reengineering can be used to analyze and change any process in the university. Its use should be dictated by the need for a quick change in the implementation of a given process. |
| Audit | It is a systematic, independent and documented process of obtaining objective evidence and its objective evaluation in order to determine the degree of fulfillment of audit criteria. The general classification of audits distinguishes internal audit, i.e., first-party audit, conducted by the organization itself. External audits are also distinguished, which are divided into second-party audits, i.e., audits conducted by parties interested in the organization, e.g., clients, and third-party audits, which are conducted by independent auditing organizations, such as certification bodies or government agencies. In the case of a university that does not have an implemented and certified quality management system, the audit process takes place, among others, as part of the management control system. It is used to review this system and improve it in all organizational units of the university. |
| Block diagram | A flowchart is one of the basic tools for quality management and improvement. It is most often used for graphical presentation of the course of a process, i.e., its individual stages. Graphical presentation of a process facilitates its analysis and allows for its improvement in relation to individual stages. A flowchart can also illustrate the flow of information and responsibility. Using a flowchart, you can present, for example, the stages of the recruitment process, which will undoubtedly make it easier for candidates to understand it or the circulation of documents related to a business trip. A flowchart can be found at a university in documents such as: procedures, instructions, orders or resolutions. |
| Checklist | A checklist is a simple tool used to assess the degree of implementation of a given undertaking or project. It consists of a series of questions related to the project or its environment. Such a list is prepared at the project planning stage and in the final control phase. From the university's point of view, the checklist is used when submitting scientific projects, including the analysis of the risks associated with the implementation of the project. |
| 5Why | Solving a problem or irregularities is possible after determining the causes of their occurrence. This is important from the point of view of implementing preventive actions, not only corrective ones. Determining the causes is related to the use of specific solutions. One of them is the Ishikawa chart mentioned above. Another is the 5Why tool. Its essence is to ask the question why several times (usually five times) in order to determine the source of the problem. The 5Why analysis covers two aspects: why the problem occurred and why it could not be detected. Teamwork is recommended within this tool, and the tool itself is a useful support in solving everyday problems. The 5Why tool is widely used at universities. It can be used to analyze, for example, the reasons for losing a document or providing incorrect information in the process. |

Cont. table 1.

| | |
|---|---|
| Corrective actions | They are defined as actions taken to eliminate the cause of non-compliance and prevent its recurrence. Corrective actions are taken after a problem or irregularity has occurred. Their aim is to eliminate them or minimize the effects of their occurrence. If a problem occurs at the university in the form of an incorrectly completed document in internal circulation, the corrective action will be to correct it. |
| Preventive actions | They are defined as actions taken to eliminate the cause of a potential non-compliance and prevent its occurrence. Preventive actions, which are preventive in nature, are taken to prevent a given problem or irregularity from occurring. For example, a checklist can be used when submitting documentation in external scientific competitions, so that it is complete and no document or signature is omitted. |

Source: Jakubiec, 2017; Jakubiec, 2021, pp. 111-115; Abdus Samad, Thiyagarajan, 2015, pp. 618-629; Aguirre, Pérez-Domínguez, Luviano-Cruz, Noriega, Gómez, Callejas-Cuervo, 2020, pp. 2-3; Klochkov, Gazizulina, Ostapenko, 2020, p. 2; Lock, 2002, pp. 356-357; ISO 9000:2015-10, p. 34; Höfer, Naeve, 2017, pp. 63-80; Slack, Chambers, Johnston, 2007.

The above catalogue of Lean instruments, as mentioned, is open and flexible. Each entity using the Lean Management concept can individually shape those Lean instruments that are useful at a given moment.

Moving on to the university management model, it is necessary to indicate a wide range of scientific publications in the field of higher education, management and quality improvement at the university, which was taken into account when defining the components of the model (modules) (Wawak, 2012a, 2012b, 2019b; Leja, 2013; Wiśniewska, Grudowski, 2019; Grudowski, Wiśniewska, 2019, pp. 49-61; Grudowski, 2020; Karpov, 2017, pp. 58-76; Teichler, 2016; Altbach, 2002; Tight, 2012; Meek, Teichler, Kearney, 2009; Barblan 2011, pp. 550-574; Scott 2008; Teixeira 2013, pp. 1-121; Clark, 2004; Lim, 2020; Barnett, Fulford, 2020).

Among the modules accepted for analysis:

1. Acts of internal and external law.
2. Single-person university bodies.
3. Collegiate bodies of universities.
4. Teams of employees.
5. Ensuring the quality of education.
6. Teaching process.
7. Scientific and research process.
8. Commercialization of research activities.
9. Human capital management.
10. Knowledge and intellectual property management.
11. Material capital management.
12. Financial management.
13. Investments.
14. Internal and external communication.
15. Risk and uncertainty management.
16. Improving processes and tasks.

The modules are flexible, so that the university can respond appropriately to changes in its environment. There are interactions between the university environment and the university. They result from legal regulations established by the government administration, influencing the shape and functioning of the university, from the market demand for educational and research services, which are determined by candidates for studies and organizations and enterprises from the business sphere and cooperating with universities.

In the characteristics of the model, it should be clearly emphasized that its components are of a conventional and debatable nature. Its adoption resulted from the implementation of the research process and verification of the impact and dependencies between Lean Management and the model modules. As emphasized in the introduction, each university has its own individual management model and it is on it that the use of the assumptions of the Lean Management concept and the practical application of its instruments actually depends.

## 3. The impact of Lean Management on the university management model – case study of University of Bielsko-Biala

The empirical part of this article refers to a selected fragment of scientific research that was conducted on the subject matter (the Lean Management concept and its functioning within the university) in the years 2021-2023 on the example of public academic universities in Poland. It was decided to present the case of University of Bielsko-Biala in the context of the impact of Lean Management and its instruments on the modules of the university management model. During the case study, the objectivity of the research was maintained. The Rector, together with other people from the university management selected to conduct the study, had the freedom to assess the importance of the model modules, as well as the impact of the Lean Management concept on these modules. The issue of the model was presented in the earlier part of the article. The Lean Management concept, described earlier as a set of improvement activities, can be implemented in practice by many improvement instruments. The full research included a number of Lean-specific instruments, which for organizational purposes are indicated below: Total Quality Management, quality management system according to ISO 9001, management through processes, standardization, Value Stream Mapping (graphical analysis and process improvement), Kaizen – continuous improvement, PDCA (continuous improvement cycle – Plan – Do – Check – Act), 5S (workplace improvement), FMEA method (identification of irregularities in the process and service - Failure Mode and Effect Analysis), QFD method (service improvement – Quality Function Deployment), benchmarking (comparison to patterns), reengineering (process redesign), audit, brainstorm, block diagram, Ishikawa chart (descriptive analysis of the causes of abnormalities), Pareto chart (quantitative analysis of the causes of irregularities), control charts, checklist, program chart of the decision process

(methodology of conduct in the event of irregularities), 5Why (searching for the causes of the problem), SWOT analysis, knowledge management, intellectual capital management, training system, employee suggestion system, motivational system, corrective actions, preventive actions.

The discussion about the belonging of the above-mentioned instruments to Lean seems justified and let this article also be a contribution to this discussion. It is worth remembering, however, that each scientific study is characterized by a certain subjectivity presented by the researcher. It is also necessary to emphasize the clear differences between the knowledge of instruments by university managers and the number of instruments actually used.

The main research objective was adopted as an analysis of the impact of the Lean Management concept and its instruments on the modules of the university management model. Further assumptions of the research present table 2.

**Table 2.**
*Assumptions of the research*

| Items | Description |
|---|---|
| Research goal | Analysis of the impact of the Lean Management concept and its instruments on the modules of the university management model |
| Research method | Case study |
| The interviewees | The Rector and other managers of University of Bielsko-Biala |
| Date of realization | Period 2021-2023 |

Source: personal elaboration.

The table 3 shows the assessment by the university managers of the importance of the proposed modules of the university management model and the possible (desirable, preferred) and real (resulting from the current state of affairs) impact of Lean Management and Lean instruments on these modules. The assessment of the importance of the modules and the impact of Lean Management on these modules was made on a Likert scale from 1 to 5, where 1 indicates the lowest rating and 5 the highest rating. Out of 16 assessed modules, only one received an importance assessment of 5.0 (it was the module scientific and research process), the remaining 15 modules were important at the level of 4.0. The average value of the assessment of the importance of the modules was 4.06. The distinction of the module concerning the scientific and research process testifies to the general significance of scientific research conducted by universities. Scientific research builds the position of the university on the market, making it an attractive entity for cooperation with the economy. Public academic universities, among which the analyzed University of Bielsko-Biala is located, are universities that create trends in scientific research and determine their innovativeness.

**Table 3.**
*Interactions between model modules and Lean Management*

| Model modules | Validity of modules | Possible impact | Real impact |
|---|---|---|---|
| Acts of internal and external law | 4 | 3 | 1 |
| Single-person university bodies | 4 | 3 | 1 |
| Collegiate bodies of universities | 4 | 3 | 1 |
| Teams of employees | 4 | 4 | 3 |
| Ensuring the quality of education | 4 | 4 | 3 |
| Teaching process | 4 | 4 | 3 |
| Scientific and research process | 5 | 4 | 3 |
| Commercialization of research activities | 4 | 3 | 3 |
| Human capital management | 4 | 4 | 2 |
| Knowledge and intellectual property management | 4 | 4 | 2 |
| Material capital management | 4 | 4 | 2 |
| Financial management | 4 | 4 | 2 |
| Investments | 4 | 4 | 2 |
| Internal and external communication | 4 | 4 | 2 |
| Risk and uncertainty management | 4 | 4 | 3 |
| Improving processes and tasks | 4 | 5 | 3 |
| | 4,06 | 3,81 | 2,25 |

Source: personal elaboration.

The analysis of the possible and real impact of Lean Management and Lean instruments on the model modules clearly shows that the possible, and in fact desired impact is greater than the real one. The average impact values are as follows: possible impact 3,81 and real impact 2,25. In terms of the possible impact of Lean Management on the modules of the university management model, the highest assessment was given to the impact on the module improving processes and tasks. Among the impact assessments at level 4 were the modules: teams of employees, ensuring the quality of education, teaching process, scientific and research process, human capital management, knowledge and intellectual property management, material capital management, financial management, investments, internal and external communication and risk and uncertainty management. The lowest possible impact of Lean on the modules of the model concerns: acts of internal and external law, single-person university bodies, collegiate bodies of universities and commercialization of research activities.

The analysis of the real impact of Lean concepts and instruments on the modules of the university management model was rated from 1 to 3. The modules with the lowest ratings included: acts of internal and external law, single-person university bodies and collegiate bodies of universities. A rating of 2 was assigned to the modules: human capital management, knowledge and intellectual property management, material capital management, financial management, investments and internal and external communication. A rating of 3 was assigned to the modules: teams of employees, ensuring the quality of education, teaching process, scientific and research process, commercialization of research activities, risk and uncertainty management and improving processes and tasks.

The possibilities of further and broader use of Lean Management assumptions and its instruments at the universities studied depend on the awareness and need for broadly understood improvement of the university management system, processes and services. It is important to continuously verify emerging problems and barriers in university management that create waste, identify waste itself and make attempts at improvement in response to the above, using specific Lean Management instruments. It is also necessary to strive for greater implementation of Lean Management culture elements resulting from such assumptions as the process approach or appreciation of the role of human capital.

## 4. Summary

This article aims to show the usefulness of Lean Management concept in university management, referring to the conventional management model. The specificity of each university, included in the article, does not allow for a rigid adoption of a management model, but for proposing acceptable modules that can create this model as elements. The empirical part of the article shows the essence of the impact of the assumptions of the instruments for improving the concept on the model modules, indicating that the desired impact is greater than the real one. This indicates the need for further and broader education of university managers in the context of the possibility of using Lean Management at universities. The following can be indicated:

1. It is recommended that university managers be more involved in identifying barriers and waste in university management systems. This is the basis for launching improvement activities, as well as for a broader use of improvement instruments.
2. Lean Management instruments (e.g., brainstorming, Ishikawa chart, 5Why, etc.) can be used to solve everyday problems, and additionally engage employees in university matters, which builds their attachment to the workplace.
3. It is recommended that university managers strive more strongly to debureaucratize the functioning of universities. This is possible, among other things, by identifying the aforementioned waste at the source of its occurrence.
4. It is also recommended that more training for university management staff is provided in the scope of modern management and improvement concepts and systems, taking into account different levels of education, as well as the represented scientific disciplines. This will allow many people to raise awareness of the existence and possibilities of using concepts such as Lean Management.

The range of improvement guidelines, as well as improvement instruments, allows for their selection in accordance with the specificity of the university and the aspect of improvement. Selected examples of the implementation of Lean instruments at the university are included in

Table 1. The key to the successful application of Lean Management at the university is the involvement of management and employees in improvement and the conviction that implementing innovative solutions is right. The following can be indicated as prospects for the development of the undertaken subject matter and subsequent scientific works:

1. Development of case studies taking into account foreign universities, which will broaden the author's cognitive and empirical horizons, shaping further scientific research and scientific publications.
2. Expanding the study of the analysis of the management model of a public academic university and the modules that make up the model with an analysis of the impact of the university's environment (including: Polish and European law, government and local government administration, local and regional stakeholders, local and regional community, candidates for studies) on the analyzed modules and the functioning of the university.

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# ATTRIBUTES OF THE COMMERCIAL OFFER OF THE PETROL STATION NETWORK ADDRESSED TO HOUSEHOLDS IN THE PODKARPACKIE VOIVODESHIP

Zdzisław JEDYNAK

Rzeszow University of Technology; zjedynak@prz.edu.pl, ORCID: 0000-0001-7994-6306

**Purpose:** The main objective of the article is to present the results of research aimed at indicating the attributes of the commercial offer of the petrol station network addressed to households residing in the Podkarpackie Province. The essence of the research problem comes down to providing an answer to the question regarding the fundamental factors characterizing the commercial offer of the petrol station network addressed to individual customers. Detailed questions refer to indicating the entity structure of the retail market of petrol station network in the studied region. In addition, its geographical, subject and process structure. The structure of the article consists of the following parts, i.e. determining the current state of knowledge in the scope of the discussed issues, describing the research method, presenting the measurement results and their interpretation, and presenting the final conclusions. The research method used is a critical review of the subject literature and quantitative methods.
**Design/methodology/approach**: The research procedure will run through the following stages: 1) determining the current state of knowledge in the scope of the discussed issues; 2) description of the research method; 3) measurement and interpretation of the obtained results; 5) final conclusions. The applied research method is a critical review of the subject literature and quantitative methods. For the purposes of the conducted research, the following criteria were indicated for the characteristics of the commercial offer of the petrol station network, i.e. economic-financial, organizational-technical and safety.
**Findings:** It should be emphasized that the research results presented in the article are preliminary in nature. They constitute one of the stages of scientific research, i.e. *Attributes and determinants of the commercial offer of the petrol station network aimed at households in the Podkarpackie Province*. The aim of this research is to indicate the scope and form of cooperation between the retail supplier of liquid fuels and individual customers whose place of residence is the Podkarpackie Province. It is implemented by: determining the attributes of the commercial offer of the petrol station network addressed to households in the Podkarpackie Voivodeship, indicating the determinants of the choice of the transport fuel supplier by households residing in the Podkarpackie Voivodeship, and determining to what extent the commercial offer of the petrol station network addressed to individual customers in the Podkarpackie Voivodeship reflects the actual needs of the market.
**Originality/value:** This publication is practical. The adopted main topic and goal of the research is a response to the identified needs reported by individual clients in relation to the current state of knowledge, achievements and experience of the researcher. Actions taken to

achieve progress in scientific knowledge in the discipline of management science and quality in the area of trade systems, their organization and management.
**Keywords:** supplier, liquid fuels, road transport, customers.
**Category of the paper:** Research paper.

## 1. Introduction

Its main objective the article will be to present the results of research aimed at indicating the attributes of the commercial offer of the petrol station network aimed at households in the Podkarpackie Province. Structure of its implementation will be carried out through: 1) determining the current state of knowledge in the scope of the discussed issues; 2) description of the research method; 3) measurement and interpretation of the obtained results; 5) final conclusions. The applied research method is a critical review of the subject literature and quantitative methods. For the purposes of the conducted research, the following criteria were indicated for the characteristics of the commercial offer of the petrol station network, i.e. economic-financial, organizational-technical and safety.

The research results presented in the article are preliminary in nature. They constitute one of the stages of the research topic, i.e. *Attributes and determinants of the commercial offer of the petrol station network aimed at households in the Podkarpackie Province*. The aim of this research is to indicate the scope and form of cooperation between the retail supplier of liquid fuels and individual customers whose place of residence is the Podkarpackie Province. It is to be implemented through: 1) determining the attributes of the commercial offer of the petrol station network addressed to households in the Podkarpackie Voivodeship; 2) indicating the determinants of the choice of the transport fuel supplier by households residing in the Podkarpackie Voivodeship; 3) determining to what extent the commercial offer of the petrol station network addressed to individual customers in the Podkarpackie Voivodeship reflects the actual needs of the market.

The adopted main topic and objective of the research is a response to the identified needs reported by individual clients in relation to the current state of knowledge, achievements and experience of the researcher.

In Poland, in recent years, there has been an increase in the share of transport fuel purchase costs in the structure of household expenditure. This was related to the persistently high prices of petroleum fuels. In the Podkarpackie province, the average number of people in a household was 2.98 in 2021 (2.55 in the country). This region has a low standard of living for its residents. In 2021, GDP there was 3.8% of the national level. GDP per person amounted to 69.4% of the national level. The Podkarpackie Province was characterized by one of the lowest average gross wages per person in the country (87.3% compared to the average in Poland). Disposable income per person in a household reached 82.6% of the national level. Average monthly expenses per

person were at 76.4%. In the structure of household expenses, 9.4% was transport (9.4% in the country), while expenses incurred for the use of a flat or house and the purchase of energy carriers were 17.4% (18.9%) (Statistics, 2022). In 2023, the number of passenger cars in the analysed province was at the level of 1.3 million, which was 655 cars per 1000 inhabitants (723 in the country) (Statistics, 2024a).

The retail market for liquid fuels in the Podkarpackie province was strongly competitive from domestic and foreign companies. In the past period, the petrol station market was changing towards a shopping and service centre model. At the stations, one could not only refuel a vehicle, but also do basic shopping, relax during the journey, use financial services, eat a meal or perform simple maintenance and repair activities (Polish, 2024).

The conducted analysis of the subject literature indicates a lack of comprehensive and detailed studies relating to the structure of the surveyed enterprises and the characteristics of the processes implemented there. The literature review was conducted based on electronic databases, i.e. Scholar.Google.com, Scopus.com, Academica.edu.pl and in the traditional form - library resources. It should be emphasized that the available scientific works most often present determinants shaping the demand for services offered by petrol stations (Zielińska, 2018; Domasiewicz et al., 2023; Zawadzki, 2015) or a study of mobility at petrol stations (Norman, 2006). They present forms of fuel station management (Zawadzki et al., 2017) and issues of spatial distribution and location conditions (Roj-Rojewski et al., 2018; Aslani et al., 2011; Tuzmen et al., 2011; Zhu et al., 2024). In addition, the literature presents trends and expectations in the field of fuel distribution or the direction of transformation in road transport in the use of alternative power sources (Kamiński et al., 2021; Bayram et al., 2022; Domasiewicz et al., 2023). Many available scientific works emphasize the adverse impact of the operation of petrol stations on the area in which they are located, human health and their long-term consequences (e.g. Terrés et al., 2010; Maksoud et al., 2019; Adedeji et al., 2022).

On the other hand, research on the commercial offer of the petrol station network was conducted by the author of this publication and the final results are presented in the article: *Attributes of the Commercial Offer of the Petrol Station Network Addressed to Micro and Small Road Transport Enterprises in the Podkarpackie Voivodship* (Jedynak, 2023a). Their aim was to indicate the attributes of the commercial offer of the petrol station network to the extent necessary to support the decision-making process aimed at selecting the appropriate supplier of transport fuels for the needs of micro and small road transport enterprises based in the Podkarpackie Voivodship. Based on the research conducted, it was found that the commercial offer of the petrol station network addressed to micro and small road transport enterprises goes far beyond the sale of fuels. It includes facilities for the recipient supporting their process of purchasing and using transport fuels, which aims to add additional value by integrating dispersed activities carried out as part of the transport process service. The essential attributes include: personalization of the offer, limited access to the terms of cooperation, wide scope of the offer, availability of the offer, integration of the transport process, personalization of tasks,

speed of establishing cooperation, dispersion of points and extra-regional significance (Jedynak, 2023a).

## 2. Theoretical basis

One of the intermediate links in the distribution process is retail trade. According to Armstrong J.G., Kotler Ph., this concept means all activities related to the sale of goods and services directly to final consumers for their own, non-business use (Armstrong et al., 2012). Retail trade is conducted in various forms, i.e. retail stores, sales via the Internet and mail, catalog sales, telemarketing and other means of direct contact. Assuming the criterion of the width and depth of the assortment, the following entities in retail trade are commonly indicated, i.e. specialist stores, department stores, supermarkets, convenience stores, hypermarkets, category killers, retail service providers (Jedynak, 2017). Taking into account the way it is organized in the literature on the subject, we distinguish, among others, company retail chains, voluntary retail chains, cooperatives, franchise organizations. On the other hand, due to the scope of service provided, the following groups are indicated, i.e. self-service stores and full-service stores (Armstrong et al., 2012).

In the literature, the sales process in retail trade is divided into three phases, i.e. pre-transaction, transaction, post-transaction (Christopher, 1996). The pre-transaction phase is preparatory (conceptual and organizational). It consists of collecting and transmitting market information, organizing promotions (both products and the enterprise), preparing commercial offers, establishing commercial contacts or conducting negotiations. A commercial offer means a proposal made by the seller to sell material goods and/or services aimed at concluding a binding purchase and sale agreement (Jedynak, 2023a). According to the Civil Code, a commercial offer is a method of concluding a contract consisting in presenting the terms by the offeror and acceptance by the offeree (Act, 1964). In its content, it contains the terms and methods of carrying out the commercial transaction accepted by the seller. The offer may be presented in various forms and scope. It may be subject to commercial negotiation. It may be submitted both orally and in writing in paper or electronic form. It may be addressed to both an individual person and a larger group. It may be generally available or limited (Jedynak, 2023a). In the literature, the basic attributes of a commercial offer are most often indicated as: fit, availability, transparency and timeliness (Levy et al., 2023).

Among the fuels used in road transport, petroleum products are of primary importance. According to data from the Central Statistical Office, in 2023, in the Podkarpackie Province, the structure of fuel consumption in road transport was dominated by motor gasoline with a result of 46.8% (nationally 53.6%) and diesel oil – 36.8% (32.4%). The share of LPG amounted to 16.0% (13.4%). On the other hand, electric passenger cars and hybrid cars

accounted for 0.12% (0.20%) and 0.18% (0.24%) (Statistics, 2024b). According to the President of the Energy Regulatory Office, retail trade in motor gasoline and LPG intended for spark-ignition engines in the past period was conducted at petrol stations. The sale of diesel oil to end customers was carried out using petrol stations, company stations and through deliveries to container petrol stations belonging to recipients, as well as outside the petrol stations themselves (Energy, 2024).

Petrol stations play an important role in motorization. Zielińska E. defines a petrol station as the technical background of motorization (Zielińska, 2018). Norman notes that many activities performed at petrol stations also take place in street traffic, and thus petrol stations reflect the changes and needs noted in motorization (Norman, 2006). Petrol stations primarily enable the distribution of various types of fuels, without which neither the owner of new or used vehicles would be able to use their own cars, in accordance with their individual transport needs (Zielińska, 2018). They can be publicly available or with limited access (Roj-Rojewski et al., 2018). In her scientific work on mobility at petrol stations, Norman emphasizes that they are a place of transition between the stationary and mobile state (Norman, 2006).

Kamiński A, Jakubiec J., Pusz A. note that currently, fuel station facilities are architectural objects with a complex structure, development and equipment (Kamiński et al., 2021). According to the Regulation of the Minister of Economy of November 21, 2005, a liquid fuel station is a construction object that may include: a building, underground storage tanks for liquid fuels, underground or above-ground tanks for liquefied gas, liquid fuel and liquefied gas meters, technological installations, including devices for storing and loading liquid fuels and liquefied gas, water and sewage and power installations, driveways and roofs, and other service facilities and auxiliary rooms (Regulation, 2005). The structure of the fuel station area will include commercial and service facilities and technical facilities. Within the commercial and service part of a petrol station, three basic zones should be identified, i.e. refueling, vehicle service and passenger service (Zielińska, 2018).

There are many criteria used to describe petrol stations. When adopting the criterion of the stability of the location of infrastructure facilities, portable (container) and permanent (stationary) stations should be indicated (Roj-Rojewski et al., 2018). Due to the breadth and depth of the commercial offer, we distinguish petrol stations, i.e. housing estate, basic and motorway (Roj-Rojewski et al., 2018; Zielińska, 2018). The division of petrol stations in the literature on the subject also takes into account the business organization model, on this basis we distinguish dependent and independent networks, independent operators and store stations (Polish, 2024). When adopting this criterion, Zawadzki T., Suszyńska K. indicates five possible forms of running a petrol station, i.e. running an independent petrol station operating under its own brand, running an association petrol station operating under a common brand, running a franchise petrol station, renting a petrol station facility to a fuel concern and running a petrol station as an agent (Zawadzki et al., 2017). The Polish Organisation of Petroleum Industry and Trade in the available studies in the division of steel fuels takes into account the criterion of

capital origin and entity (Polish, 2024). The Central Statistical Office also uses the geographical criterion in its studies (Statistics, 2024a). It should be added that an important criterion for the characteristics of petrol stations should also be the scope of specialisation of entities providing services, the location of petrol stations in relation to existing infrastructure or its availability (Jedynak, 2023b).

In the Podkarpackie Province, there was strong competition on the retail market for transport fuels from both domestic and foreign companies. Fuel stations operated as dependent or independent chains and as independent operators or stations located at stores (Polish, 2024). The Central Statistical Office reports that in 2021 the total number of fuel stations in the Podkarpackie Province was 448 (5.5% share in the country) (Statistics, 2022). According to the Polish Organization of Petroleum Industry and Trade, in 2023 domestic companies had a 24.4% market share, foreign companies 25.6%, independent chains 18.5%, other independent operators 29.0%, and stores 2.5%. In their entity structure, the highest share was held by PKN Orlen SA 24.4%, BP Polska Sp. z o.o. 7.3%, Shell Polska Sp. 5.8, Anwim S.A. (Moya) 5.7%, Circle K Polska Sp. z o.o. 5.2%, and Mol Polska Sp. z o.o. 5.0% (Polish, 2024).

The basic activity of each petrol station is the sale of transport fuels (Roj-Rojewski et al., 2018). However, currently these entities do not focus their activity only in this area. The Polish Organisation of Petroleum Industry and Trade notes that the petrol station market is changing towards a shopping and service centre model. This meant that at petrol stations you can not only refuel your vehicle, but also do basic shopping, relax during the journey, use financial services, eat a meal or perform simple service and repair activities (Polish, 2024). According to the Polish Organisation of Petroleum Industry and Trade, a significant factor in the observed changes are large road investments, changes in the location of stations, takeovers by both domestic companies and independent chains. Moreover, an important factor of change is the introduced ban on Sunday trading (Polish, 2024). Similarly, Zawadzki T., Suszyńska K. notices that the commercial offer of petrol stations addressed to customers is being expanded to include more and more services that were previously reserved for other commercial entities, such as sending and receiving courier parcels, selling motor insurance or renting cars (Zawadzki et al., 2017). Norman D. emphasizes that at petrol stations we are dealing with a very diverse group of people, taking into account the criteria of age, gender, profession, education, financial status, etc. (Norman, 2006).

It is commonly emphasized in the literature that the range of products and services offered by a petrol station depends mainly on its location, and thus its purpose (Zielińska, 2018; Aslani et al., 2011; Tuzmen et al., 2011). Additionally, the range of the offer depends on the package of products and services available to a given operator. Local competition also has a significant impact (Jedynak, 2022). Domasiewicz M., Anuszkiewicz A. note that the advantage of petrol stations over other commercial facilities is their 24-hour availability, good location and thus access or access on days when other commercial entities are closed due to applicable regulations (Domasiewicz et al., 2023). Based on research, Zawadzki indicates three key factors that Polish

drivers pay special attention to when choosing a petrol station: convenient location, fuel price and the station's affiliation to a given chain - understood in the context of the quality of the fuel sold (Zawadzki, 2015). However, Roj-Rojewski S., Kotarska E. notes that the functioning of petrol stations is influenced by many factors, the most important of which are the offered fuel prices (Roj-Rojewski et al., 2018).

Domasiewicz M., Anuszkiewicz A. note that currently, buying fuel is accompanied by buying food and drinks, using toilets, servicing vehicles or simply resting. Based on the conducted research, they state that customers of stations are not guided by the offer of buying fuel itself, but also by the gastronomic offer. Domasiewicz M., Anuszkiewicz A. in their scientific work indicate that every customer who fills up with fuel uses additional options. They point out that petrol stations must expand their group of customers not only among drivers, but also among fellow passengers who satisfy their consumer needs at petrol stations. Domasiewicz M., Anuszkiewicz A. note that with constant attempts to increase the attractiveness of the offer of petrol stations, the sales of fuel itself are decreasing (Domasiewicz et al., 2023). Zawadzki T., Suszyńska K. state that it is the relatively low margin per liter of fuel sold that is the source of dynamic changes in the offer of petrol stations, both in terms of the range of goods and services offered. Therefore, in terms of personnel management, the emphasis is placed on enforcing the obligation of active sales (cross-selling) in relation to each customer, and store promotions at petrol stations are shaped in the same way as in the case of other types of commercial entities (Zawadzki et al., 2017).

## 3. Methodology

The stages of the research procedure include: 1) indicating the research topic, its purpose, scope and method; 2) determining and defining the evaluation criteria; 3) selecting a sample for research; 4) measurement; 5) interpretation of the obtained results; 6) final conclusions; 7) dissemination of research results.

Research topic: Attributes of the commercial offer of the petrol station network addressed to households in the Podkarpackie Voivodeship.

Its main objective will be to identify the structure of the fuel station network in the Podkarpackie Province and to indicate the attributes of their commercial offer to the extent necessary to support the decision-making process aimed at selecting the appropriate supplier of transport fuels by households residing in the Podkarpackie Province. The essence of the research problem will be to provide an answer to the question regarding the fundamental factors characterizing the commercial offer addressed to individual customers of petrol stations located in the Podkarpackie Province. Detailed questions will refer to the indication of the entity structure of the retail market of fuel station networks in the Podkarpackie Voivodeship.

In addition, its geographical, subject and process structure. Therefore, the subject of the research is the retail market of transport fuels in the studied region, and the entity is the fuel station networks operating there. The area of research is the attributes of the commercial offer of fuel station networks addressed to households whose place of residence is the Podkarpackie Voivodeship.

In terms of the state of knowledge, taking into account the researcher's achievements and experience, the following research hypothesis was formulated, i.e. the price of fuel at the pump is not a fundamental attribute of the commercial offer addressed to households in the Podkarpackie Voivodeship. The commercial offer goes far beyond the sale of fuels. It contains numerous conveniences for recipients, and thus supports (facilitates) their purchasing process. The size of the benefits obtained is primarily related to the purchasing activity of customers and is associated with loyalty programs.

The research method used is quantitative research. The research technique is a direct interview. The research tool is an interview form. Data will be measured from publicly available sources (electronic databases and cooperation regulations) and through an indirect (telephone) and direct interview with a representative of a given petrol station chain. The geographical scope of the research is the Podkarpackie Province. Purposeful sample selection, according to the criterion of the number of stations and their geographical distribution. It was assumed that the measurement would be carried out in November 2024. Analytical tool is MS Exel. The research will maintain data confidentiality and reliability of its collection.

For the purposes of the research, three areas of the characteristics of the petrol station network were identified, i.e. economic-financial, organizational-technical and safety. The adopted areas were defined using measures. A total of 76 variables describing the commercial offer. The measurement form is included in Table 1-3.

**Table 1.**
*Petrol station network evaluation parameters – Economic and Financial Area*

| SYMBOL | TESTED PARAMETER Economic and Financial Area | | UNIT OF MEASURE | | NOTES |
|---|---|---|---|---|---|
| A.1.1 | average unit price of fuel at selected petrol stations | - Motor Gasoline (Standard) | PLN/dm$^3$ | | |
| A.1.2 | | - Motor Gasoline (Premium) | PLN/dm$^3$ | | |
| A.1.3 | | - Diesel Oil (Standard) | PLN/dm$^3$ | | |
| A.1.4 | | - Diesel Oil (Premium) | PLN/dm$^3$ | | |
| A.1.5 | | - LPG | PLN/dm$^3$ | | |
| A.2.1 | value/quantity discounts for individual customers (fuel offer) | - permanent | yes | no | |
| A.2.2 | | - occasional/seasonal | yes | no | |
| A.3.1 | value/quantity discounts for individual customers (non-fuel offer) | - permanent | yes | no | |
| A.3.2 | | - occasional/seasonal | yes | no | |
| A.3.3. | value/quantity discounts on fuel purchases under the Large Family Card program | | yes | no | |

Source: own study.

**Table 2.**
*Petrol station network evaluation parameters – Organizational and Technical Area*

| SYMBOL | TESTED PARAMETER<br>Organizational and Technical Area | | UNIT OF MEASURE | | NOTES |
|---|---|---|---|---|---|
| B.1.1 | form of concluding a cooperation agreement | - directly from the operator (at the petrol station) | yes | no | |
| B.1.2 | | - remote | yes | no | |
| B.2.1 | duration of the cooperation agreement | - definite | yes | no | |
| B.2.2 | | - indefinite | yes | no | |
| B.3 | loyalty program | | yes | no | |
| B.4 | gift cards | | yes | no | |
| B.5 | mobile application | | yes | no | |
| B.6 | internet platform | | yes | no | |
| B.7.1 | access to the loyalty program | - aplikacja mobilna | yes | no | |
| B.7.2 | | - internet platform | yes | no | |
| B.8.1 | loyalty program | - loyalty points | yes | no | |
| B.8.2 | | - dedicated purchase offers for fuels | yes | no | |
| B.8.3 | | - dedicated shopping offers for non-fuel products | yes | no | |
| B.9 | possibility of linking a loyalty card with a fuel card | | yes | no | |
| B.10.1 | mobile application and its functionality | - electronic loyalty card | yes | no | |
| B.10.2 | | - access to transactions | yes | no | |
| B.10.3 | | - access to e-invoice | yes | no | |
| B.10.4 | | - quick payment at the distributor | yes | no | |
| B.10.5 | | - road and parking fees | yes | no | |
| B.10.6 | | - navigation and maps | yes | no | |
| B.10.7 | | - map location of petrol stations | yes | no | |
| B.10.8 | | - internet shop | yes | no | |
| B.10.9 | | - electronic loyalty catalogues | yes | no | |
| B.10.10 | | - discount offers (coupons) | yes | no | |
| B.10.11 | | - others, i.e. …… | – | | |
| B.11.1 | internet platform and its functionality | - access to transactions | yes | no | |
| B.11.2 | | - access to e-invoice | yes | no | |
| B.11.3 | | - navigation and maps | yes | no | |
| B.11.4 | | - map location of petrol stations | yes | no | |
| B.11.5 | | - internet shop | yes | no | |
| B.11.6 | | - electronic loyalty catalogues | yes | no | |
| B.11.7 | | - discount offers (coupons) | yes | no | |
| B.11.8 | | - others, i.e. …… | – | | |
| B.12.1 | additional services | - shop | yes | no | |
| B.12.2 | | - parking | yes | no | |
| B.12.3 | | - food service | yes | no | |
| B.12.4 | | - hotel services | yes | no | |
| B.12.5 | | - car repair | yes | no | |
| B.12.6 | | - car wash | yes | no | |
| B.12.7 | | - parcel | yes | no | |
| B.12.8 | | - direct service at the distributor | yes | no | |
| B.12.9 | | - mobile cashiers | yes | no | |
| B.12.10 | | - self-service checkouts | yes | no | |
| B.12.11 | | - double-sided refueling (information for customers at the dispenser) | yes | no | |
| B.12.12 | | - stacje ładowania pojazdów elektrycznych | yes | no | |
| B.12.13 | | - others, i.e. …… | – | | |
| B.13 | number of petrol stations located in the service area | | pcs. | | |

Cont. table 2.

| | | | | | |
|---|---|---|---|---|---|
| B.14 | Geographical index/Demographic index | | $km^2$/pcs. tys. person/ pcs | | |
| B.15 | access to infrastructure | | h/day | | |
| B.16.1 | main location | - city | yes | no | |
| B.16.2 | | - motorway and expressway | yes | no | |
| B.16.3 | | - national roads | yes | no | |
| B.16.4 | | - other road categories | yes | no | |
| B.17 | geographical scope of the commercial offer | | – | | |

Source: own study.

**Table 3.**
*Petrol station network assessment parameters – Safety Area*

| SYMBOL | TESTED PARAMETER Safety Area | | UNIT OF MEASURE | | NOTES |
|---|---|---|---|---|---|
| C.1.1 | fuel type/types | - Motor Gasoline (Standard) | yes | no | |
| C.1.2 | | - Motor Gasoline (Premium) | yes | no | |
| C.1.3 | | - Diesel Oil (Standard) | yes | no | |
| C.1.4 | | - Diesel Oil (Premium) | yes | no | |
| C.1.5 | | - LPG | yes | no | |
| C.1.6 | | - Electricity | yes | no | |
| C.2 | qualitative assessment of the operator (according to information from the President of the Office of Competition and Consumer Protection) | | – | | |
| C.3 | the length of the supplier's existence on the market | | – | | |
| C.4 | enterprise size | | – | | |
| C.5 | specialization in the scope of the service provided | | – | | |
| C.6 | supplier's position on the market | | – | | |
| C.7 | consumer opinion about the supplier (Rzeszów city) | | – | | |

Source: own study.

## 4. Empirical Results and Discussion

Based on the analysis of the number and geographical structure of the petrol station network in the Podkarpackie Voivodeship, the following enterprises were indicated for research: PKN Orlen SA (Orlen), BP Europa SE European Company Branch in Poland (BP), Shell Polska Sp. z o.o. (Shell), Circle K Polska Sp. z o.o. (Circle K), Mol Polska Sp. z o.o. (Mol), Anwim SA (Moya station network), Slovnaft Polska SA (Slovnaft Partner), Watkem Sp. z o.o. (Watkem) (BP, 2024; Circel K, 2024; Mol, 2024; Moya, 2024; Orlen, 2024; Shell, 2024; Slovnaft, 2024; Watkem, 2024). The above enterprises included both dependent and independent networks (i.e. Moya, Slovnaft, Watkem). In the case of other enterprises operating in the studied region, due to the limited number of petrol stations, it was assumed that they were of a secondary (local) nature. The research only took into account the commercial offer dedicated to individual customers. The measurement was made in November 2024.

The measurement results in the Economic and Financial Area are presented in Table 4.

**Table 4.**
*Measurement results in the Economic and Financial Area*

| PARAMETR | MEASURE | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Orlen** | **BP** | **Shell** | **Circle K** | **Mol** | **Moya** | **Slovnaft** | **Watkem** |
| **A.1.1** | 6,30 | no data | 6,23 | 6,17 | 6,23 | 6,18 | 6,28 | 6,19 |
| **A.1.2** | 6,51 | no data | 6,76 | 6,52 | 7,08 | 6,99 | no fuel | 6,97 |
| **A.1.3** | 6,25 | no data | 6,29 | 6,23 | 6,28 | 6,23 | 6,23 | 6,24 |
| **A.1.4** | 7,05 | no data | 6,81/7,75 | 6,59 | 6,48 | 6,79 | no fuel | no fuel |
| **A.1.5** | 3,29 | no data | 3,29 | 3,21 | 3,29 | 3,20 | 3,27 | 3,25 |
| **A.2.1** | yes | yes | yes | yes | yes | yes | no | yes |
| **A.2.2** | yes | yes | yes | yes | yes | yes | no | no |
| **A.3.1** | no | no | no | no | no | yes | no | no |
| **A.3.2** | yes | yes | yes | yes | yes | yes | no | no |
| **A.3.3** | yes | | yes | yes | yes | yes | no | yes |

Source: own study.

The measurement of the prices of individual fuels was carried out at selected stations located within a radius of approximately 10 km in the provincial city of Rzeszow. Four of these stations, i.e. Orlen, Moya, Slovnaft, Watkem, were located at Sikorskiego Street (the main street leading towards Warsaw Insurgents' Avenue and Rejtana Street). In the case of Circle K on Rejtana Street. BP and Shell stations were located on Warsaw Insurgents' Avenue. Meanwhile, a petrol station operating under the Mol brand is located on Peasant Battalion Avenue (extension of Warsaw Insurgents' Avenue). The measurement was carried out in the morning hours from Monday to Friday, November 18-22, 2024. On November 19-22, 2024, the BP petrol station was closed due to renovation work. The location of the indicated petrol stations is shown in Figure 1.

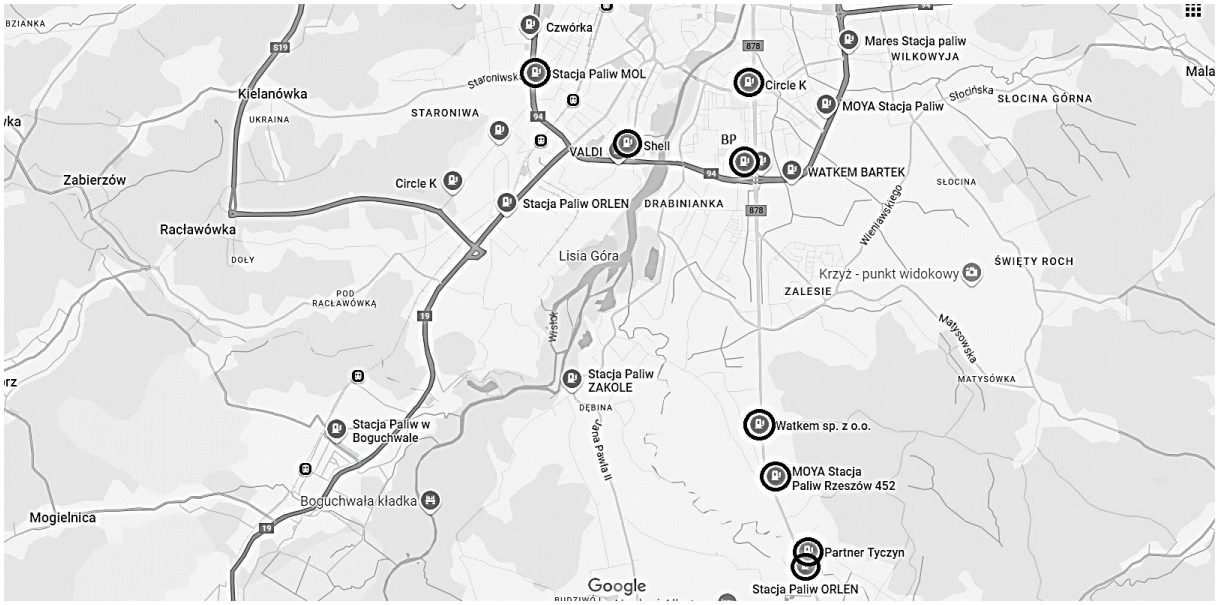



**Figure 1.** Petrol stations selected for research in the city of Rzeszow.

Source: own study.

In the analysed period, fuel prices posted at the dispensers of individual operators showed deviations. In the case of standard fuels, the difference between the highest and lowest level for Motor Gasoline was 0,13 PLN, for Diesel Oil 0,06 PLN, and LPG 9 PLN. In the case of premium fuels for Motor Gasoline this indicator was 0,57 PLN and for Diesel Oil 0,96 PLN. The lowest prices were recorded at two stations, i.e. Circle K and the independent chain Moya. It should be emphasized that the Circle K petrol station is located in the central part of the city, where numerous shopping centers are located. The Moya petrol station is located at the southern entrance to the city of Rzeszow. Where within a radius of approximately 1 km there are petrol stations operating under the Orlen, Watkem and Slovnaft brands.

The commercial offer of the majority of the examined fuel station chains included value and quantity discounts for individual customers. They were mainly time-limited. They concerned fuel and non-fuel offers (shop, catering, services). Their level was primarily related to the purchasing activity of customers and was linked to loyalty programs. In addition, the Large Family Card was recognized at most of the stations. Which translated into benefits mainly in the form of permanent discounts granted for the purchase of transport fuels.

The measurement results in the Organizational and Technical Area are presented in Table 5.

**Table 5.**
*Measurement results in the Organizational and Technical Area*

| PARA-METR | MEASURE | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Orlen** | **BP** | **Shell** | **Circle K** | **Mol** | **Moya** | **Slovnaft** | **Watkem** |
| **B.1.1** | no | no | no | no | no | no | no | no |
| **B.1.2** | yes | yes | yes | yes | yes | yes | no | no |
| **B.2.1** | no | no | no | no | no | no | no | no |
| **B.2.2** | yes | yes | yes | yes | yes | yes | no | no |
| **B.3** | yes, Orlen Vitay | yes, PayBack, BP Super Card | yes, Shell Club Smart | yes, Circle K Extra | yes, Mol Move | yes, Super Moya | no | no |
| **B.4** | yes | yes | yes | yes | no date | yes | no | no |
| **B.5** | yes, Orlen Vitay | yes, BP me, PayBack | yes, Shell Club Smart | yes, Circle K | yes, Mol Move | yes, Super Moya | no | no |
| **B.6** | yes | no | yes | yes | yes | yes | no | no |
| **B.7.1** | yes | yes | yes | yes | yes | yes | no | no |
| **B.7.2** | yes | no | yes | yes | no date | yes | no | no |
| **B.8.1** | yes | yes | yes | yes | yes | yes | no | no |
| **B.8.2** | yes | yes | yes | yes | yes | yes | no | no |
| **B.8.3** | yes | yes | yes | yes | yes | yes | no | no |
| **B.9** | yes | no | no | no | no | no | no | no |
| **B.10.1** | yes | yes | yes | yes | yes | yes | no | no |
| **B.10.2** | yes | no | yes | yes | no | yes | no | no |
| **B.10.3** | yes | no | yes | no | no | no | no | no |
| **B.10.4** | yes | no | yes | yes | no | yes | no | no |
| **B.10.5** | yes | no | no | no | no | no | no | no |
| **B.10.6** | yes | no | no | no | no | no | no | no |
| **B.10.7** | yes | yes | yes | yes | yes | yes | no | no |
| **B.10.8** | yes | no | no | no | no | no | no | no |
| **B.10.9** | yes | no | no | no | no | no | no | no |
| **B.10.10** | yes | yes | yes | yes | yes | yes | no | no |
| **B.10.11** | no | partner shop in PayBack | no | no | no | no | no | no |

Cont. table 5.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.11.1** | yes | no | no | yes | no | no data | no | no |
| **B.11.2** | no | no | no | no | no | no data | no | no |
| **B.11.3** | no | no | no | no | yes, only through the website | no data | no | no |
| **B.11.4** | yes | no | yes | yes | yes | no data | no | no |
| **B.11.5** | yes | no | no | no | no | no data | no | no |
| **B.11.6** | yes | no | yes, limited assort-ment | no | yes, only through the website | no data | no | no |
| **B.11.7** | yes | no | yes | yes | yes, only through the website | no data | no | no |
| **B.11.8** | no | no | no | no | no | no data | no | no |
| **B.12.1** | yes | yes | yes | yes | yes | yes | no | yes |
| **B.12.2** | yes | yes | yes | yes | yes | yes | no | yes |
| **B.12.3** | yes, Orlen Stop.Cafe | yes, Wild Bean Caffe | yes, Shell Caffe | yes | yes, Fresh Corner, SUBWAY | yes, Coffe Moya | no | yes |
| **B.12.4** | no | no | no | no | no | no | no | no |
| **B.12.5** | no | no | no | no | no | yes, on selected stations | no | no |
| **B.12.6** | yes | yes | yes | yes | yes | yes | no | no |
| **B.12.7** | yes | no | no | no | no | yes, on selected stations | no | no |
| **B.12.8** | yes | no | no | no | no | no | no | no |
| **B.12.9** | yes | no | yes | no | no | yes | no | no |
| **B.12.10** | yes, on selected stations | yes, on selected stations | no | no | no | no | no | no |
| **B.12.11** | yes | no | no | no | no | no | no | no |
| **B.12.12** | yes, on the selected ones, i.e. 4496, 1280, 4224 | no | no | no | no | yes, on the selected ones, i.e. 387, 452, 317 | no | no |
| **B.12.13** | Orlen Foundation | catering services on request | no | catering services on request | e-motorway ticket | automatic stations, i.e. 457, 340 | no | no |
| **B.13*** | 83 | 23 | 15 | 25 | 5 (including 3 stations with the Lotos logo) | 30 | 9 | 11 |
| **B.14** | 215,0 /25,1 | 775,9 /90,7 | 1189,7 /139,1 | 713,8 /83,4 | 3569,2 /417,2 | 594,8 /69,5 | 1982,9 /231,8 | 1622,3 /189,6 |
| **B.15** | 24h | 24h | 24h | 24h | 24h | 11/30 | 1/9 | 8/11 |
| **B.16.1** | yes | yes | yes | yes | yes | yes | no | yes |
| **B.16.2** | yes | yes | yes | no | no | no | no | no |
| **B.16.3** | yes | yes | yes | yes | no | yes | no | no |
| **B.16.4** | no | no | no | yes | no | yes | yes | no |
| **B.17** | dispersion | dispersion | dispersion | dispersion | dispersion | dispersion | dispersion | concen-tration |

* as of December 2, 2024.

Source: own study.

In the case of petrol stations, the main way of establishing permanent cooperation with individual customers was remotely. Agreements were concluded for an indefinite period.

The commercial offer mainly included a loyalty program or a mobile application. In addition, selected ones offered gift cards and an internet platform (e-bok). A complete lack of the above facilities was noted in the case of two independent operators (Slovnaft, Watkem).

Access to the loyalty program was provided mainly through a mobile application. For selected operators, also through an online platform. The loyalty program offer, depending on the number of points collected, included preferential purchase offers for fuels and other products and services available at the gas station. Only one operator (Orlen) noted the possibility of linking a loyalty card to a fuel card.

The mobile application mainly offered access to a loyalty card, discount coupons or petrol station locations. Some operators also provided access to the history of fuel and non-fuel transactions. Documents confirming payment (e-invoice) were less frequently available. Quick payment at the fuel dispenser was also becoming more common. The domestic operator operating under the Orlen brand offered, among other things, an electronic loyalty catalogue, an online shop and navigation.

In the case of the internet platform, the operators most often offered discount coupons or a map of the location of petrol stations. Some of them had a preview of the transaction history. In the case of Orlen petrol stations, an electronic loyalty catalogue or an extensive online store also appeared. In the case of Moya stations, there was a problem with access (logging in) to the internet platform.

In addition to fuel sales, the stations also offered other services. Commonly, a shop, catering, car wash or a public car park. Depending on the purpose of the station and its location, the stations were equipped with infrastructure to service trucks and buses. Additionally, selected domestic enterprises had postal services (own or external). Hotel services were provided primarily by independent operators. In addition, the Moya station's offer included a car repair shop. In the case of Watkem, vehicle inspection stations. In other cases, operators offered 24-hour roadside assistance by providing a hotline. The service of payment at the fuel pump or, in the case of Orlen fuel stations, direct service at the pump has also become popular. Most of the entities surveyed lacked information about the possibility of double-sided refuelling at the fuel pump.

The total number of fuel stations surveyed in the Podkarpackie Voivodeship was 201. The geographical indicator was 88.8 km2/pcs, and the demographic indicator was 10.23 thousand people/pcs. Their structure was dominated by stations operating under the Orlen brand. Their share in the total number of entities surveyed was 41.3%. A high share was also recorded by the Moya chain with a result of 14.9%, Shell 12.4% and BP 11.4%. The location of fuel stations of individual operators in the Podkarpackie Voivodeship was most often dispersed. They were mainly located in cities. In the case of networks of dependent stations, their points were most often located on motorways, expressways and national roads. The dependent networks of fuel stations were available to customers 24 hours a day. In the case of other enterprises, their opening hours were limited in time.

The measurement results in the Security Area are presented in Table 6.

**Table 6.**
*Measurement results in the Security Area*

| PARAMETR | MEASURE | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Orlen** | **BP** | **Shell** | **Circle K** | **Mol** | **Moya** | **Slovnaft** | **Watkem** |
| **C.1.1** | yes (95 efecta) | yes (Euro Super 95) | Yes, FuelSave 95) | yes (95 miles) | yes (Evo 95) | yes | yes (Super 95) | yes |
| **C.1.2** | yes (98 verva) | yes (98 Ulitmate) | yes (V-Power 95) | yes (98 miles PLUS) | yes (Evo 98) | no | tak (BA 98) | no |
| **C.1.3** | yes (Diesel efecta) | yes (BP Diesel) | yes (FuelSave Diesel) | yes (miles Diesel) | yes (Evo ON) | yes | yes | yes |
| **C.1.4** | yes (Diesel verva) | yes (ON Ulitmate) | yes (V-Power Diesel, V-Power Racing) | yes (miles Plus Diesel) | yes (Evo ON Plus) | yes (ON Moya Power) | yes (Drive) | no |
| **C.1.5** | yes | yes | yes | yes | yes | yes | yes | yes |
| **C.1.6** | yes (stations: 4496, 1280, 4224) | no | no | no | no | yes (stations: 387, 317, 452) | no data | no |
| **C.2** | not found | not found | not found | not found | not found | not found | not found | not found |
| **C.3** | above 5 | above 5 | above 5 | above 5 | above 5 | above 5 | above 5 | above 5 |
| **C.4** | large | large | large | large | large | large | large | medium-sized |
| **C.5** | specialized | specialized | specialized | specialized | specialized | specialized | specialized | specialized |
| **C.6** | primery | primery | primery | primery | primery | primery | secondary | secondary |
| **C.7*** | 4,2 (652 opinions) | 4,3 (436 opinions) | 3,9 (167 opinions) | 4,3 (1373 opinions) | 4,4 (408 opinions) | 4,5 (133 opinions) | 4,8 (25 opinions) | 4,4 (142 opinions) |

* as of December 2, 2024.

Source: own study.

The commercial offer of the dependent network fuel stations included standard and premium fuels. In the case of independent operators, the situation was different. Access to electricity distributors at network fuel stations in the Podkarpackie Voivodeship was very limited (only at selected Orlen and Moya stations). In the remaining enterprises, the most common was a map of the locations of electric chargers located in the Podkarpackie Voivodeship. In the analysed period, according to the information of the President of the Office of Competition and Consumer Protection, no deviations from the applicable standards regarding fuel quality were found at the examined fuel stations (Regulation, 2015).

The petrol network fuel station belonged to large and experienced enterprises. They were entities associated with domestic and foreign capital. Their activities were specialized. The geographical scope of the commercial offer varied from global, through continental and national, to regional. The position on the market due to the potential they had and the location of individual points was of primary importance. In the case of Watkem stations, due to the

number of points in the country, the geographical scope or concentration of the station location were of secondary importance.

According to the assessment of users of petrol stations, the average rating was above 4.3 (on a scale of 5.0-2.0). The ratings were determined based on anonymous customer opinions posted on Google.pl. They concerned petrol stations located in the city of Rzeszow, where fuel prices were measured.

## 5. Conclusions

The implementation of the topic and objective of the research allowed to identify the following attributes of the commercial offer of the flue station network addressed to households in the Podkarpackie Voivodeship, i.e.:

- Wide range of commercial offer. Petrol stations have transformed into commercial and service centres. In addition to the possibility of refuelling, there is a limited sale of fresh, food and industrial goods and catering services are provided. In addition, services related to the maintenance of the vehicle fleet, i.e. parking, car wash or repairs. The leader on the domestic retail market in terms of the breadth of the commercial offer was Orlen and Moya.
- Significant retail price deviation at the fuel pump. In the surveyed operators, despite their close location, a different level of retail prices of individual transport fuels was noted. A large difference in value occurred in the case of premium fuels.
- An extensive and varied discount offer. The commercial offer included value and quantity discounts for individual customers. They were usually time-limited. They concerned both fuel sales and other products offered by petrol stations, as well as services provided. Their level was primarily related to the purchasing activity of customers and was linked to loyalty programs. It reduced the value of purchased goods and services.
- Personalization of the commercial offer. The commercial offer of the fuel station chain addressed to individual customers is a package consisting of available goods and services provided as well as the terms and conditions of handling purchase-sale transactions.
- Speed of establishing cooperation. An remote form is made available and accepted in order to establish permanent cooperation with an individual client.
- Access to the terms of cooperation. Basic information is clearly available on the websites of individual operators. It mainly concerns the method of establishing permanent cooperation, the location of the station, the services provided or the applicable discounts. Additionally, a hotline or a real-time internet conversation is available.

- The preferred form of cooperation is remote. Cooperation with the majority of operators is based on a mobile application. Its functionality allows for the sales process to be increasingly supported.
- Permanent cooperation preferred. Implemented through a shared loyalty program or facilitations in the process of handling purchase-sale transactions.
- Scattering of points of sale. In most cases, the location of fuel stations is characterized by dispersion throughout the Podkarpackie Voivodeship. They are located mainly in large and medium-sized towns and on main communication routes. On the other hand, small towns or roads of secondary importance are dominated by local independent operators.
- The importance of enterprises beyond the regional level. The geographical scope of the commercial offer of the petrol station network goes beyond the surveyed province. Most often, the offer is of a continental nature. It is related to the use of own or partner stations.
- Availability of the offer. The vast majority of network petrol stations provide their services 24/7.

In summary, the implementation of the research topic and objective allowed to indicate the attributes of the commercial offer of the fuel station network addressed to households in the Podkarpackie Voivodeship. The adopted research hypothesis was confirmed. In the article, the actions taken to achieve progress in scientific knowledge led to the expansion of knowledge in the discipline of management and quality science in the area of commercial systems, their organization and management.

During the research procedure, no significant limitations in access to data were noted. Basic information was made available in a clear manner on the websites of individual operators. Most often, it concerned the method of establishing permanent cooperation, the location of the station, the services provided or the applicable discounts. The scope of available data varied, which required supplementation by conducting an indirect interview, i.e. by phone or directly at the petrol station. Most operators have provided a hotline or real-time internet conversation. There have also been no significant limitations in access to the mobile application or the internet platform. Only in the case of one operator, despite access to the mobile application, there was no possibility to log in to the internet portal. On November 19-22, 2024, the BP petrol station was out of service due to renovation work. This limited the measurement of retail prices at this station.

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# ENTREPRENEURIAL ORIENTATION IN THE NEW ECONOMIC REALITY

Agata KIELESIŃSKA

The Management Faculty, Czestochowa University of Technology; k.olejniczak-szuster@pcz.pl,
ORCID: 0000-0001-9974-7961

**Purpose:** In the face of dynamic market changes, economic uncertainty, and increasing competition, businesses must demonstrate the ability to adapt and respond swiftly to evolving conditions. Entrepreneurial orientation—encompassing innovation, risk-taking, and the pursuit of new market opportunities—serves as a key factor supporting small and medium-sized enterprises (SMEs) in achieving sustainable success. This study aims to identify how entrepreneurial orientation influences companies' ability to adapt, manage risk, and seize emerging opportunities within a rapidly changing economic environment. The analysis offers valuable insights into strategies that can foster business growth in the context of the new market reality.

**Design/methodology/approach**: The study was conducted on a sample of 53 SMEs using survey questionnaires designed to assess four variables: entrepreneurial orientation, adaptability, resilience to market uncertainty, and the ability to seize new market opportunities. The data were analyzed statistically, including the calculation of means, standard deviations, and examination of relationships between variables.

**Findings:** The results indicate a high level of entrepreneurial orientation (mean = 3.85) among the surveyed firms, reflecting their readiness to innovate, take risks, and explore new opportunities. Adaptability scored an average of 4.05, suggesting that these firms are flexible in responding to changing market conditions. Resilience to market uncertainty had a mean of 3.88, indicating a moderate capacity to manage risk. The ability to seize new market opportunities received the highest average score (4.17), demonstrating strong competitiveness among the participating firms.

**Originality/value**: This study contributes significantly to the understanding of the role entrepreneurial orientation plays in enhancing the adaptability and opportunity exploitation capabilities of SMEs amid dynamic economic shifts. The findings offer valuable guidance for practitioners and policymakers seeking to support SME development in uncertain market conditions and provide practical recommendations for improving strategic management in these firms.

**Keywords:** entrepreneurship, entrepreneurial orientation, dimensions of entrepreneurial orientation.

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

## 1. Introduction

Today's business environment is undergoing a profound transformation, shaped by the rapid advancement of technology, the unpredictability of global crises (such as the COVID-19 pandemic, the war in Ukraine, and disruptions to supply chains), and growing pressures related to environmental and social responsibility. These factors are contributing to the emergence of a so-called "new economic reality," characterized by increasing complexity, volatility, and discontinuity in market processes (García-Valenzuela et al., 2023; Bui et al., 2021; Taneja et al., 2024). In this new reality, companies are required not only to be adaptive but also to adopt a proactive approach to change management, demonstrate innovativeness, and show a willingness to take risks (Xia et al., 2024). A key concept supporting these capabilities is entrepreneurial orientation, understood as an internal driver of organizational change (Volkmann et al., 2010; Covin, Lumpkin, 2011). This construct encompasses key dimensions such as innovativeness, proactiveness, and risk-taking (Rauch et al., 2009). Organizations with a strong entrepreneurial orientation are more inclined to explore new market opportunities, experiment with novel business models, and implement innovative solutions—making them more resilient to external disruptions and environmental shifts (Wales, 2016; Kraus et al., 2012). Prior studies have shown that entrepreneurial orientation can positively influence financial performance, digital transformation capability, and long-term competitiveness (Anderson et al., 2015; Lechner, Gudmundsson, 2014; Kreiser et al., 2013).

Despite the growing interest in the topic of entrepreneurial orientation, the literature still lacks in-depth analyses regarding its role in the functioning of the SME sector under the conditions of a dynamically changing economic reality. Previous studies often overlook the impact of new challenges—such as digitalization, market uncertainty, and environmental volatility—on entrepreneurship in small and medium-sized enterprises. The identified gap highlights the need to examine how entrepreneurial orientation influences SMEs' ability to adapt and build a competitive advantage. Therefore, the aim of this article is to analyze the significance of entrepreneurial orientation in the context of contemporary economic conditions.

## 2. Theoretical Background

In the literature, the construct of entrepreneurial orientation is extensively discussed in relation to strategy formulation and strategic decision-making processes within organizations. Entrepreneurial orientation not only shapes the mindset and attitudes of entrepreneurs but also serves as a foundation for the development of long-term business strategies that enable organizations to thrive in dynamically changing market environments (Dyduch, 2008;

Gębczynska, 2017). Entrepreneurs and managers operating within the framework of entrepreneurial orientation are guided by core values such as innovativeness, risk-taking, and proactiveness (Miller, 1983). These values underpin the strategic direction of the organization (Kim, Park, 2022; Baker, Sinkula, 2009) and are reflected in the key decisions made by managers (Wiklund, Shepherd, 2003; Kraus et al., 2024) (Table 1).

**Table 1.**
*Characteristics and Strategic Directions of Entrepreneurial Orientation Values*

| Dimension | Key Characteristics | Strategic Direction |
|---|---|---|
| **Innovativeness** | The organization's ability to generate new ideas, products, processes, or technologies; creation of new products or services; foundation for organizational growth; implementation of modern technologies; continuous search for new solutions; ability to adapt quickly to the market. | Competitive advantage |
| **Risk-taking** | Acceptance of uncertainty in the long-term perspective; ability to calculate risk; pursuit of unconventional opportunities; responsible risk assessment. | Responsible management |
| **Proactiveness** | Acting in advance, before problems arise; initiating change; leveraging market trends and forecasts; high flexibility. | Maintaining competitiveness |

Source: Own elaboration based on Morgan, Strong, 2003; Wiklund, Shepherd, 2005; Covin, Wales, 2019; Mason et al., 2015; Eniola, 2020; Gabriel, Kobani, 2022.

This approach is considered classical and remains dominant in the literature—particularly in quantitative studies—where entrepreneurial orientation is often treated as a unidimensional construct or as an integrated indicator of a company's entrepreneurial posture (Górska-Warsewicz, 2024). Entrepreneurial orientation should be understood both at the organizational level, where it functions as a strategic and managerial tool, and at the individual level, reflecting employees' attitudes and behaviors (Lichtarski, 2014). Individuals with a strong entrepreneurial orientation exhibit initiative and take action to improve processes without requiring detailed instructions (Kaczmarek, 2019). They are willing to take calculated risks, enabling the implementation of innovative solutions and the ability to step outside their comfort zones (Lichtarski, 2014). Such employees solve problems quickly and treat challenges as opportunities, which significantly enhances organizational efficiency (Karpacz, 2019). According to Okręglicka (2021), they are also open to change and actively engage in innovation processes, thereby increasing their competencies and adaptability in a dynamic market. Their pursuit of high performance and quality at work further contributes to improved organizational outcomes. At the organizational level, entrepreneurial orientation functions as a mechanism that enables firms to differentiate themselves from competitors through entry into new markets, investment in innovation, and strategic flexibility (Nogalski, Karpacz, 2011; Zbierowski, 2012; Genc et al., 2018; Fadda, 2018). Lumpkin and Dess (1996) argue that entrepreneurial orientation is a multidimensional construct, incorporating elements such as autonomy and competitive aggressiveness. Autonomy refers to the freedom to pursue innovative initiatives, while competitive aggressiveness represents a firm's determination to outperform rivals and pursue market leadership. These dimensions enhance a firm's capacity

for non-standard responses and rapid adaptation to environmental change. According to Cho and Lee (2018), companies with high entrepreneurial orientation continually seek to identify and exploit new opportunities, enabling the creation of innovative solutions and the generation of added value. Such organizations are characterized by a proactive mindset, allowing them to capture emerging market trends before they are widely recognized by competitors (Zahra et al., 2006). Firms that are innovation-oriented demonstrate a readiness to embrace risk, which forms the foundation for building and sustaining competitive advantage (Kreiser et al., 2002). Through active participation in shaping their markets, these companies are positioned to become industry leaders, thereby securing a lasting and robust market presence.

In light of these considerations, entrepreneurial orientation emerges as a crucial component of an organization's development strategy, directly influencing its ability to remain competitive in a volatile and uncertain environment (Lumpkin, Dess, 1996).

## 3. Research Methodology, Research Subject and Research Sample

To achieve the main objective of the article, the following research hypotheses were formulated:

*H1: Entrepreneurial orientation has a positive impact on the ability of enterprises to adapt to new challenges and changing economic conditions.*

*H2: Companies that exhibit a strong entrepreneurial orientation are more resilient and better equipped to cope with market uncertainty in the new economic environment.*

*H3: Entrepreneurial orientation positively influences a company's ability to identify and exploit new market opportunities in a rapidly changing economic context.*

To empirically verify these hypotheses, a quantitative research approach was adopted, involving a survey conducted among owners and managers of 53 small and medium-sized enterprises (SMEs). The largest group in the sample consisted of small enterprises (47.2%), which reflects the prevailing structure of the Polish SME sector. Medium-sized enterprises accounted for 30.2%, while microenterprises made up 22.6% of the sample. In terms of industry representation, service-oriented companies had the largest share (34%), in line with current economic trends in Poland. Manufacturing companies accounted for 26.4%, while trade-related enterprises represented 20.8%. The remaining 18.8% comprised businesses from sectors such as transportation, logistics, education, and healthcare. With regard to legal form, limited liability companies were predominant, representing 71.7% of the sample (38 out of 53 companies). This high percentage suggests that entrepreneurs may seek to limit personal liability, which could be relevant in assessing their willingness to take risks—a core component of entrepreneurial orientation. Sole proprietorships accounted for 18.9% (10 firms), while partnerships comprised 9.4% (5 firms). More than 84% of the surveyed companies have been operating for over six years, with nearly half (45.3%) active for more than a decade.

A significant portion (49%) operates nationwide, which may suggest greater experience in competing in complex markets and a heightened need for innovation and proactivity. Companies operating locally made up 28% of the sample, while 23% were engaged in international operations—often through exports—a factor that may be relevant for analyzing their ability to identify new market opportunities.

The survey included three independent variables and three dependent variables, as summarized in Table 2.

**Table 2.**
*Characteristics of Independent and Dependent Variables*

| Variable Type | Variable Name | Description | Specific Indicators |
|---|---|---|---|
| **Independent Variable** | Entrepreneurial Orientation | The degree to which a company demonstrates innovativeness, proactivity, and risk-taking behavior | Innovativeness, proactivity, risk-taking, initiative |
| **Dependent Variable** | Adaptation to Economic Change | The company's ability to flexibly adjust to changing environmental conditions | Strategic flexibility, responsiveness, readiness for change |
| **Dependent Variable** | Resilience to Market Uncertainty | The company's ability to manage unpredictability and maintain operational stability | Risk management, liquidity maintenance, forecasting ability |
| **Dependent Variable** | Identification of New Market Opportunities | The ability to recognize and capitalize on emerging niches and trends | Opportunity recognition, trend utilization, implementation of innovative products/services |

Source: own research.

Each variable was measured using a set of specific indicators, evaluated by respondents on a five-point Likert scale (ranging from 1 – "strongly disagree" to 5 – "strongly agree"). The applied indicators were consistent with the theoretical framework presented in the literature and were developed based on a review of previous studies on entrepreneurial orientation in the context of strategic management in SMEs.

## 4. Presentation of research results

The conducted study first allowed for the assessment of the individual variables (Table 3).

**Table 3.**
*Assessment of Variables According to the Surveyed Companies*

| Variable | Mean (M) | Interpretation |
|---|---|---|
| Entrepreneurial Orientation | 3.85 | Companies demonstrate a high level of entrepreneurial orientation, though there is some variation in innovation and proactivity. |
| Adaptability | 4.05 | Most companies have high adaptability, though differences exist in flexibility and responses to changes. |
| Resilience to Market Uncertainty | 3.88 | Companies exhibit moderate resilience to market uncertainty, with some variation in risk management practices. |
| Ability to Seize New Market Opportunities | 4.17 | Most companies are able to effectively identify and exploit new opportunities, which provides them with a competitive advantage. |

Source: own research.

The results indicate that the average value of entrepreneurial orientation is 3.85, reflecting a relatively high willingness among companies to take risks, innovate, and pursue new market opportunities. However, there is some variability in the level of this orientation across the surveyed firms. The adaptability of the companies in the sample has a mean value of 4.05, suggesting that most companies respond flexibly to market changes, although there is variation in the speed of adaptation. Resilience to market uncertainty averaged 3.88, indicating that companies possess moderate resilience to market volatility, with notable differences in their preparedness for risk management. Conversely, the ability to seize new market opportunities had an average value of 4.17, demonstrating that these companies are effective in identifying and capitalizing on emerging market opportunities, which constitutes a significant competitive advantage.

Next, the correlations between the level of entrepreneurial orientation and three key aspects of how companies operate within a dynamically changing economic environment were examined (Table 4).

**Table 4.**
*Results Obtained in the Context of Hypotheses*

| Hypothesis | Mean | Correlation Coefficient (r) |
|---|---|---|
| H1 | 4,05 | **r = 0,62** (p < 0,01) |
| H2 | 3,88 | **r = 0,55** (p < 0,01) |
| H3 | 4,17 | **r = 0,67** (p < 0,01) |

Source: own research.

Regarding Hypothesis H1, which posits a positive effect of entrepreneurial orientation on the adaptive capacity of companies, a significant positive correlation was observed ($r = 0.62$; $p < 0.01$). This finding suggests that companies with higher levels of proactivity, innovation, and risk-taking propensity are better equipped to respond to changes and adapt to new environmental conditions. The mean score for adaptability ($M = 4.05$) further emphasizes the importance of this capability in SME management practices. For Hypothesis H2, which concerns resilience to market uncertainty, a statistically significant positive relationship was also found ($r = 0.55$; $p < 0.01$). This indicates that companies with a stronger entrepreneurial orientation are better prepared to operate under uncertainty and are more likely to take action despite having incomplete information about future conditions. While the correlation for H2 is slightly lower than for H1, it remains moderate and relevant to business practice. The strongest correlation was observed in Hypothesis H3, which assumes a positive impact of entrepreneurial orientation on the ability to identify and exploit new market opportunities ($r = 0.67$; $p < 0.01$). This result indicates that companies with a strong entrepreneurial orientation are more adept at recognizing business opportunities, responding quickly to environmental changes, and actively seeking competitive advantages through market exploration and innovation. This is further supported by the high mean score for the ability to seize new opportunities ($M = 4.17$), which was the highest among all three dependent variables.

Based on these findings, it can be concluded that all three hypotheses were confirmed by the empirical data, validating the importance of entrepreneurial orientation as a factor that enhances the resilience, flexibility, and innovativeness of SME companies in a dynamic and changing environment.

## Summary

The average value of entrepreneurial orientation, at 3.85, suggests that the surveyed SME companies exhibit a significant readiness to take risks, innovate, and seek new market opportunities. These characteristics are particularly important in the context of the new economic reality, where flexibility, the ability to innovate, and rapid responses to changing market conditions are key to survival and growth. In terms of adapting to the changing economic environment, the study's findings indicate a high ability among the surveyed companies to adjust to new challenges, with an average score of 4.05. This adaptability is critical in times of economic uncertainty, where businesses must respond flexibly to changes in their environment. The result regarding resilience to market uncertainty, with a score of 3.88, shows that the surveyed companies have a moderate ability to manage risk and market volatility, which is essential in the face of unpredictable economic crises. The findings also indicate that SME companies possess a strong ability to seize new market opportunities (with an average score of 4.17), which constitutes their competitive advantage in the new economic reality. These companies effectively identify new market opportunities and are able to capitalize on them, allowing them to remain competitive despite dynamic changes.

In conclusion, the study confirms that entrepreneurial orientation, along with the ability to adapt and seize new market opportunities, is essential for the success of SME businesses in the new economic reality. Companies that exhibit a strong entrepreneurial orientation are better prepared for the challenges of the modern market and can successfully adjust their strategies to the changing economic conditions.

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# PARADIGM OF MISSION AND VALUES IN THE ACTIVITIES OF SOCIAL ECONOMY ENTITIES: THE EXAMPLE OF RURAL WOMEN CIRCLES

Barbara KIEŁBASA

The University of Agriculture, Faculty of Agriculture and Management; barbara.kielbasa@urk.edu.pl,
ORCID: 0000-0002-3209-3729

**Purpose:** The aim of this paper is to verify the mission paradigm using the activities of social economy entities: rural women's circles. An analysis of mission perceptions and values declared by women from rural housewives' circles in the study area was carried out. Then it was verified whether there are similarities in mission components in social entities compared to entities of the economic (classical) type.
**Design/methodology/approach**: The main theme was respondents' perceptions of mission and values. This paper presents the results of the Author`s research, obtained through a questionnaire survey and the use of the field group interview method. All surveys were conducted among women active in rural women's circles. The hypothesis was developed and verified based on the deductive method. The results are presented in descriptive and tabular form. The thematic scope of the study includes issues of declaration and perception of the mission of the rural women's circles and declarations of values that guide women in their activities.
**Findings:** The research confirmed the hypothesis adopted in the article, indicating the alternative nature of the mission paradigm in social economy entities, compared to the dominant paradigm of classical economics of heterodox economics (on the example of rural women's circles). This is primarily supported by the listed mission attributes and values, which differ significantly from classical economics. In social economy entities, the mission refers primarily to intangible values, rejects individualism in the mission, and does not aim exclusively (or at all) for economic profit. As a rule, social economy entities are based on collective action and social solidarity, which is in contrast to the market economic model, focused on individual success and competition.
**Research limitations/implications**: Important limitations relate to the limited availability of data in the case of a survey of village circles. Another issue is the subjectivity of interpretation, occurring in qualitative or deductive research. The lack of standardization is also an important problem - in the case of the data presented in this article, it should be considered as case studies and not standardized data.
**Originality/value:** The article verifies popular management theories and compares classical management concepts of capitalist economy entities with social economy entities - using the example of rural women's circles. The article brings a new perspective on selected aspects of heterodox economics, referring to management's chosen tools (mission and values).
**Keywords:** mission, rural women circles, paradigm.
**Category of the paper:** Research paper.

## 1. Introduction

A paradigm, broadly described by Kuhn (2020), is an emerging concept in many fields of science, including the social sciences. Its function is to outline a theoretical framework to be used to define and explain certain socio-economic phenomena. Thanks to paradigms, it is possible to use appropriate tools for scientific analysis, to make comparisons or to observe changes in approaches to certain phenomena and describe them properly. In the management sciences, paradigms refer to certain models of behaviour and activities in different organizations and entities, described by Ansoff and Obłój (1985), Kotler et al. (2001), Porter (2006) or Drucker in his "The Practice of Management" (2005). Establishing a praxeological framework makes it possible to systematically examine and evaluate these assumptions and then make paradigm shifts. These changes are often driven by the evolution (or revolution) of social or cultural values or innovations in technologies (Sułkowski, 2012). Management sciences are praxeological sciences, as they aim to design and plan methods for effective action (Olejnik et al., 2013). One of the tools for designing and planning effective actions in economic or social organizations is the mission statement.

The mission in an organization is largely based on its values, defined as moral and ethical principles, which are adhered to by the members of an organization (employees and management) and define how they act (Lynch, 2021). It is, in a way, an overarching goal that defines the meaning of an entity's existence and defines the reason for its actions (David, 2017).

Mission is a rather broad topic and there is still no clear definition of it (Henry, 2021; Witek-Crabb, 2008). Instead, it can be described by many synonyms, such as values, goals, creed, credo, purpose, philosophy, beliefs, and principles (Henry, 2021; David, 2017, Porter, Kramer, 2011; Drucker, 2005). According to Porter and Kramer (2011) and Drucker (2005), a mission statement is a fundamental element of 'self-identification' that, in an organization (enterprise), answers the questions 'who we are', 'why we act' 'whom we serve', "how we achieve our goals". The mission, therefore, defines the identity of a given organization, while in theoretical terms, as a paradigm, it can be defined as a certain theoretical framework that defines how a given organization or entity defines its values, objectives, ways of operating, and its impact on the external environment (Sułkowski, 2012).

The concept of mission will vary depending on the economic sector. It will be of a different nature in profit-maximizing organizations than in non-profit organizations. This article analyses the concept of mission in social economy entities, i.e. those that are guided by different values than the profit-oriented entities typical of mainstream economics. Social economy entities do not exclusively aim to achieve economic profit, as they focus primarily on so-called social profit in their activities (Kalinowski, 2007). One interesting example of social economy entities is the rural women's circles. Their main activities focus on supporting local communities and rural development rather than strictly on economic gain, so their mission and values will differ from those formulated by traditional economic entities (Zybala, 2022).

## 2. Methods

The article aims to verify the mission paradigm on the example of the activities of social economy entities: rural housewives' circles. They were chosen as a case study because of their specificity and the observed growing importance in Poland. They were therefore selected for research as an interesting case study. The article focuses on finding answers to two research questions based on the chosen entities:

Q1. *What is the perception of the mission statement by the members of the rural women's circles in the study area and are there similarities in the mission statement components compared to economic-type entities?*

Q2. *What are the women's declarations of the values that guide them in carrying out their activities, which are the foundations of this type of organization?*

The research questions were proposed to be answered in the form of a hypothesis:

H1. *The components included in the mission of social economy entities of the rural women`s circles and the values on which the mission is built differs from the paradigm dominant in classical economics, resulting in the fact that it can be described as an alternative paradigm.*

The hypothesis was verified using the deductive method, starting from general theory and assumptions and testing them against specific cases. The starting point was the existing theories on the classical paradigm of mission and values, embedded in the management sciences. This was followed by verification of the basic assumptions made in the paper based on observations, interviews (qualitative research), and survey results (quantitative research).

Spatially, the research focused on the Polish Carpathian Macroregion. This macro-region is characterized by particular cultural and natural values but faces multiple problems of a socio-economic nature. Above all, there is a high fragmentation of farms, higher unemployment than in other regions (up to almost 8% in the southern districts of Małopolska and Podkarpackie) and infrastructural problems, which negatively affect the development of entrepreneurship (BDL GUS 2024, www.bdl.stat.gov.pl) The survey was conducted in an area covering 14 districts of Małopolska, 14 districts of Podkarpackie and 4 districts of Śląskie.

The thematic scope of the study includes issues concerning the perception of mission and values in entities such as rural women's circles (KGW). They are social economy entities focused on the realization of non-economic goals. KGWs in Poland have a long-standing tradition (Chmielewska, 2021; Janowski, 2023; Szymańska, 2022). Since 2018, they have been receiving financial support for their activities; hence, new KGWs have been established, and many informal groups of rural women have registered and have been operating formally since 2018. Currently, there are almost 16,000 rural women's circles registered in Poland (www.krkgw.arimr.gov.pl). In addition to this, there are still groups of informal or unregistered rural women's associations in Poland, so the total number of such women's organizations is difficult to obtain.

The research conducted was empirical in nature and was carried out in two stages: the first was a survey (quantitative) and the second was in-depth interviews (qualitative research). All surveys were carried out among registered rural women's circles from the study area, using data available on the ARMA website "National Register of Rural Housewives" Circles' (www.krkgw.arimr.gov.pl).

The survey was conducted using the CAWI survey method. The questionnaire was distributed to the presidents or representatives of women's circles from the study region via email or social media. The research sample was selected taking into account a confidence level of $\alpha = 0.95$ and assuming a maximum error of 0.03. The survey contained closed questions with a cafeteria of answers. This resulted in 389 returns from respondents. The survey elicited responses on the components of the mission statement of the respective women circles.

Qualitative research was carried out using group in-depth interviews. The research consisted of 10 face-to-face interviews with groups of members of rural women's circles. Each group represented a separate women's circle. Between 6 and 14 people participated in each interview. The interviews focused on exploring the personal experiences of the study participants, eliciting responses to open-ended questions. The interview approach was individualized to each study group, combining flexibility with openness. Each women`s circle is characterized by distinctiveness and different experiences, hence the interviews were intersubjective. During the interviews, the focus was on the women's personal feelings about the mission and values that guide them in running their village circle.

## 3. Results

As already mentioned, the research resulted in 389 questionnaires and 10 in-depth interviews, with 99% of respondents being female. The average age of respondents was 46 years (median 45 years, max 78, min 15 years). Respondents defined their involvement in KGW as experience in years. It turned out that on average women have been involved in KGWs for less than 7 years. The most frequent value was 5 years, the highest value was 52 years of work for KGWs and the lowest value was 3 months. The correlation between age and experience in KGW work was examined and found to be non-significant (0.2), so there is no effect of age on the period of activity in the circle expressed in years. Table 1 shows the respondents' declarations on the mission of their activity, expressed in specific objectives.

**Table 1.**
*Mission statement in surveyed rural women`s circles*

| Specification | Attributes of the KGW mission | | | | |
|---|---|---|---|---|---|
| | **„To act”** | **„To connect”** | **„To help”** | **„To inspire”** | **„To motivate”** |
| Number of indications | 144 | 133 | 47 | 38 | 23 |
| % of indications | 37.4 | 34.5 | 12.2 | 9.9 | 6.0 |
| The average age (in years) | 49.3 | 42.8 | 47.6 | 42.9 | 44.6 |
| Experience in KGW (the average, in years) | 6.8 | 6.2 | 8.0 | 5.8 | 7.3 |

Source: own research, survey (N = 389).

Most respondents described the mission of KGWs as being active. ‘To act’, according to almost 40% of women, best defines the mission of this type of entity. Among those who chose this answer, the largest group was mature women (average age 50). A large group of respondents (around 35%) felt that their mission is to ‘To connect’, so integration and inclusion activities are what they do. Given the number of responses, it can be concluded that these two mission attributes, i.e. ‘To act’ and ‘To connect’, are the most important for female respondents.

Table 2, on the other hand, accommodates value statements, understood as the foundations of the activities of the women`s circles, certain beliefs, and ideas that guide the members of these groups.

**Table 2.**
*Declared values in the surveyed women`s circles*

| Specification | Women's declared values of KGW | | | | | | |
|---|---|---|---|---|---|---|---|
| | **„Commitment”** | **„Friendship”** | **„Joy”** | **„Work”** | **„Affiliation”** | **„Care”** | **„Leadership”** |
| Number of indications | 322 | 269 | 251 | 133 | 100 | 49 | 13 |
| % of indications | 28.3 | 23.7 | 22.1 | 11.7 | 8.8 | 4.3 | 1.1 |
| The average age (in years) | 45.7 | 45.3 | 46.8 | 48.7 | 45.1 | 43.7 | 42 |
| Experience in KGW (the average, in years) | 6.8 | 6.7 | 6.5 | 7.8 | 6.0 | 6.0 | 4.1 |

Source: own research, survey (N = 389).

According to the surveys, most respondents favoured values such as: ‘Commitment’, “Friendship” and “Joy”. The least number of women indicated ‘leadership’ as a value they follow in their work in the village circle, with the youngest women, which may indicate future women leaders of this type of organization. Considering the women's responses, the pursuit of relational values (friendship, joy) and personal commitment is evident.

## 4. Discussion

A mission statement in an organization is a statement of purpose and values that guide an entity in its activities and can be a means of achieving competitive advantage (Porter, 2006). Classical management theory as described by e.g. David (2017) or Drucker (2005) emphasizes the importance of mission in the management of organizations. Porter (2006) in his management work outlines a strategic framework for organizations, which often starts with a clearly defined mission. The mission statement explains quite clearly not only the motives of the organization but also how the members of an organization act or are inspired to do so. The mission statement is not intended to define specific outcomes but rather serves to motivate its members, provides a general direction for action, builds a specific image, and sets the tone for the activities of a given organization (Dyduch, 2021).

In economic organizations, the purpose of the mission is to meet the needs of customers/consumers and achieve competitive advantage (Porter, 2006). In such a mission, there is also a place for product and technology (innovation). Contemporary management concepts place increasing emphasis on other resources, which Sułkowski (2012) calls symbolic, such as intellectual capital and social capital. Increasingly, the statements of market organizations also focus on people; they specify whom the organization wants to serve. They link economic activity to social benefits (Porter, Kramer, 2011; Kafel, 2011).

A mission statement in the traditional capitalist paradigm can include many components. The most common are: consumers (recipients, beneficiaries), products or services, markets, technology, philosophy, self-concept, concern for public image, concern for employees, etc. In profit-oriented organizations, the mission statement is often formulated by the company's owner, board of directors, or shareholders and is then communicated to managers at various levels and employees. In some organizations, managers and employees are directly involved in the formulation of the company's mission (Porter, 2006; David, 2017).

On the other hand, in social economy entities such as rural housewives' circles, the mission refers primarily to the needs of the organization's members and the immediate environment (neighbours, friends, family, villagers). It focuses more on social values, is created by its founders and members, and responds to the needs of the particular group, community, or locality for which it operates (Kamiński, Marcysiak, 2013). According to the research conducted in the selected rural housewives' circles, the process of concretizing the mission is informal in these organizations, but it is more participatory in nature.

As already mentioned, organizations can formulate their mission statements in different ways, depending on the specific objectives and values that the organization manifests. How objectives are concretized is described in the research by, among others, Defourny and Nyssens (2008), where they point out the distinct characteristics of these entities compared to economic profit-oriented entities, so their mission will also differ. The mission in entities such

as farmers' circles is referred to as a "social mission", a "volunteer mission" (Defourny, Nyssens, 2017), or even a social mission (Borzaga in the OECD study edited by Noya, 2009). Table 3 shows the characteristics of the most important components of the mission of economic and not-for-profit organizations, as determined by the own research (10 group interviews) and the literature review.

**Table 3.**
*Mission components in the dominant paradigm and in the alternative paradigm*

| **Specification** | **Mission components in the dominant (capitalist) paradigm:** | **Mission components in an alternative paradigm (on the example of rural women's associations):** |
|---|---|---|
| Main goal | Economic (generating and attracting additional resources) | Social (meeting the needs of the local community) |
| The method of managing | Constituted and formal | Democratic and informal |
| The goal of management | Action | Action |
| Profit characteristics | Economic (growth, profitability, revenue, turnover, etc.) | Social (relationships, friendship, helping the weaker or excluded, care, interests, etc.) |
| Values | Economic, instrumental | Relational |
| Level of mission formalization | High | Low |
| Perspective | Short-term, time-specific (deadlines, plans, strategies, policies, systems, tactics) | Long-term, strategic, time-unspecific |
| Member involvement | Superior-subordinate relationships, greater individualism | Emotional relationships and greater collectivism |

Source: developed based on 10 group interviews and literature: Drucker (2005), David (2017), Porter (2006), Kafel (2010), Dyduch (2021).

In both approaches (Table 3), mission can be thought of as taking action to achieve a goal, and therefore the pursuit of effective management (Drucker, 2005). In both the paradigm dominant in classical economics and alternative economics, activity, and action are the basis for functioning. KGW`s women see the results of their actions, they perceive their agency, and therefore one of the synonyms of mission for them is 'action'.

On the basis of the research conducted and the analysis of the literature, the research hypothesis (*H1*) indicates the alternative nature of the mission paradigm in social economy entities, such as rural women`s circles (KGWs), compared to the dominant paradigm of classical economics, was confirmed (Table 3). This hypothesis is supported by the factors presented in Table 3 and is primarily an alternative in goals: the mission of KGWs focuses mainly on intangibles such as supporting local communities, cultivating traditions, and integrating and activating residents. This differentiates it from the dominant paradigm, which prioritizes the maximization of financial benefits (profit, revenue, turnover) in profit-oriented enterprises. Another point that may indicate confirmation of the hypothesis is the apparent rejection of individualism in the mission statements of rural women`s circles.

These entities are often based on collective action and social solidarity, which is in contrast to the market economic model, which focused on individual success and competition.

Thus, in the alternative paradigm, the mission statement in entities such as rural women`s circles focuses on social benefits and long-term values, where financial profit, if present, is a means to an end rather than an end in itself. While in the classical capitalist economics model, an organization's mission statement often emphasizes its product/service, innovation, efficiency and the pursuit of maximizing financial performance as its main objective (Lynch, 2021; Ansoff, Obłój, 1985; Drucker, 2005). The mission paradigm in social economy entities such as rural women`s circles, exemplifies an alternative approach to organizational activity. It is based on social values, local commitment and collectivism, which differentiates it from the dominant paradigm focused on market efficiency and individual benefits, so important in economically profit-driven organizations.

The mission in social economy entities allows to pursue not so much economic goals - these are negligible in rural women`s circles - as social goals, which should be measured in the long term. The women of the surveyed KGWs were able to define social gain, often intuitively. They assessed the benefits of their mission as significant, primarily by creating space for social integration and activation of different social groups, offering support to lonely people, or pursuing common passions and interests. Added value, according to the respondents, is created as a result of activities for the common good and does not always have a direct and immediate translation into material values (economic gain). Fulfilling the (often informal and relational) mission of social economy entities should be seen as an investment in human resources and building social cohesion. These activities can be extremely helpful in combating negative demographic changes such as the aging of the rural population, exclusions, and loneliness (Szymańska, 2022; Hausner, 2007). It should, therefore, be emphasized that although the effects of the activities of social economy entities may be difficult to capture in the short term, they bring social and financial benefits (measurable - in the long term). Improving the quality of life of women in villages, strengthening their entrepreneurial attitudes or supporting the local economy are important results of the mission of these entities. Such entities become a place for stimulating sustainable development at the local level, both in terms of the social and environmental spheres, promoting the idea of sustainable management of resources (human, natural, cultural).

## 5. Summary

The issues presented in the article relate to the comparison of selected attributes characterizing the dominant paradigm in classical economics to selected elements of an alternative paradigm, characteristic of social economics. The article aimed to verify the

mission paradigm on the example of the activities of social economy entities: rural women`s circles. Based on the analyses performed, it should be stated that the study of this type of phenomenon requires a different objective and the application of different research methods than in the case of entities of the dominant (capitalist) economy, where verification, analysis, generalization and then programming of changes are performed. In the case of the issue analyzed in this paper, the research objective set by the Author was to analyze, understand and describe the phenomenon/problem under study. The paper focuses on seeking answers to two research questions: 'What is the perception of the mission by the members of the rural women`s circles in the studied area?' and 'What are the women's declarations of the values that guide them in conducting their activities, which are the foundations of this types of organization?' and then comparing these elements in classical (capitalist) organizations and in social economy entities.

In the dominant paradigm, the concept and understanding of an organization's mission is based on causal and recursive relationships between components of reality (resources). In contrast, the alternative approach requires the observation of multidirectional and interdisciplinary knowledge. The cognitive-methodological reflection is multifaceted in this case. In the case of social economy entities of the KGWs type, the relations between the components of reality are interdependent, but can often run as a unit. The structures of these organisms are poorly delineated or non-existent.

The missions of rural women`s circles are usually not very formal compared to large organizations. They often only exist in the consciousness (or subconsciousness) of the members of these organizations. These missions pursue various social, cultural, and developmental goals in the region where the KGW focuses its activities. Most often, the mission and values of KGWs are not communicated to a wider audience; they represent a value for a given, narrow group (KGWs members and their families) and village residents. Strictly speaking, the mission and values are relational, not instrumental. Nevertheless, they are usually strongly rooted in a given community or informal group, giving a sense of community and affiliation. Although this alternative paradigm (heterodox economics) should be considered differently from paradigms in classical economics, it finds its place in research procedures and can be subjected to scientific analysis.

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# FEMI – THERAPY FOR THE ALLEVIATION OF MENOPAUSAL SYMPTOMS – SHAPING NEW DIRECTIONS IN HEALTH TOURISM DEVELOPMENT

Monika KNEFEL[1*], Anna WRZOCHAL[2], Anna KALSKA[3], Dorota TWOREK[4]

[1] Cracow University of Economics, Faculty of Management; knefelm@uek.krakow.pl, ORCID: 0009-0003-9429-8986
[2] Akademia Wychowania Fizycznego i Sportu im. Jędrzeja Śniadeckiego w Gdańsku, Zakład Dietetyki Sportowej; annawrzochal.dietetyk@gmail.com, ORCID: 0000-0001-6284-424X
[3] Wyższa Szkoła Umiejętności Zawodowych, Wydział Pielęgniarstwa; annakalska@interia.eu, ORCID: 0009-0008-6523-3872
[4] FONTIA Sp z o.o., R&D Department; d.tworek@bristolbusko.pl, ORCID: 0009-0002-5093-9254
* Correspondence author

**Purpose:** The aim of this article is to present the concept and outcomes of completed research and development (R&D) activities, as well as the market implementation, as part of the smart specialisation strategy in the field of health tourism. The research was undertaken to define new therapeutic directions in the health resort of Busko-Zdrój, through the development of novel methods for the use of sulphur-rich medicinal waters and the introduction of innovative health tourism products to the market.
**Design/methodology/approach**: The study was conducted on a group of 100 female patients under the supervision of a Bioethics Committee, using a comparative research methodology. The research encompassed both theoretical and practical aspects within the field of innovation management.
**Findings:** The research confirmed the effectiveness of crenotherapy using medicinal water. As a result, new treatments were developed, forming the foundation of a therapy aimed at alleviating menopausal symptoms. This therapy has been given the marketing name *FEMI THERAPY*, abbreviated as *FEMI*.
**Research limitations/implications**: Limitations of the study include the sample size, the scope of conducted research, and the lack of long-term patient follow-up. Additional constraints stem from the slow pace of societal change in attitudes towards menopause, which still remains a culturally sensitive and often overlooked topic.
**Practical implications:** The outcomes of the research, particularly the development of new treatment procedures, have been implemented in practice as part of a therapeutic programme. This programme has been introduced to the market as an innovative health tourism product. The commercialisation of the research results enables the implementing entity, FONTIA Sp z o.o., to derive economic benefits by incorporating FEMI THERAPY into its permanent offer. Conducting in-house research also strengthens the company's competitive position and distinguishes its offer in the marketplace.
**Social implications:** The societal impact of the research is multidimensional. The most significant aspect is the challenge it poses to the taboo surrounding menopause in society.

Although public awareness of the issue is increasing, it remains a topic that is often avoided. Another key dimension is the response to a real societal need — the development of a dedicated therapy for alleviating menopausal symptoms. Furthermore, the advancement of health tourism through innovative therapies contributes to the creation of new jobs and enhances employees' competences not only in therapeutic skills but also in research capabilities. This, in turn, increases job satisfaction and motivation for continued professional development.
**Originality/value:** The authors aimed to explore the subject of innovation management and entrepreneurial discovery as a means of shaping new directions in the development of health tourism, recognised as a smart specialisation of the Świętokrzyskie region. The target audience of this publication includes participants in the innovation ecosystem, serving as a showcase of good practices for entrepreneurs, academia, and public administration alike.
**Keywords:** innovation management, commercialization of R&D results, health tourism, menopause.
**Category of the paper:** Research and development work involving a medical experiment and market implementation.

## 1. Introduction

The implementation of innovation policy within the framework of smart specialisations enables the co-financing of the entrepreneurial discovery process aimed at identifying new development directions in industries designated as drivers of regional growth. In the Świętokrzyskie Voivodeship, due to the endogenous potential of sulphur-rich medicinal waters, entrepreneurs operating in the health tourism sector, in collaboration with research institutions, are able to carry out research and development (R&D) projects, thereby expanding their fields of activity.

This article describes activities undertaken as part of Project No. RPSW.01.02.00-26-0020/21 entitled "Use of Crenotherapy with Sulphur-Rich Medicinal Water in Alleviating Menopausal Symptoms," implemented under the Regional Operational Programme of the Świętokrzyskie Voivodeship 2014-2020, co-financed by the European Union through the European Regional Development Fund. The project was carried out in Busko-Zdrój between June 2022 and November 2023.

The research was one of the strategic components of the beneficiary's long-term objectives, which included:

- defining new therapeutic directions in Busko-Zdrój,
- developing new methods for utilising sulphur-rich medicinal waters,
- protecting and efficiently exploiting valuable deposits of medicinal waters,
- enhancing staff knowledge and competences related to R&D implementation,
- distinguishing the facility's offer and strengthening its competitive position by improving service quality.

Moreover, social goals played a key role, particularly in breaking the taboo surrounding menopause. There was also a strong motivation to address menopausal symptoms by researching and developing a set of treatments forming a dedicated therapy. The involvement of staff in the research process contributed to increased job satisfaction and motivation for continued professional development. Additionally, it supported the creation of new jobs, thus fostering innovative growth within the health tourism sector.

## 2. Health tourism as a platform for innovative menopausal therapies

The main research area of the project focused on issues associated with the menopausal period in women and the potential for alleviating its burdensome symptoms. The study included both biological sample analyses (laboratory tests) and physical measurements related to temperature variability, conducted under the supervision of the Kielce University of Technology as part of commissioned research.

The solution was developed based on a model for creating innovative approaches in health tourism. This model involves innovation management through the identification of needs, existing solutions, and resulting problems. A detailed analysis of these identified problems enables the selection of an interdisciplinary expert team that generates creative ideas and solutions based on specialist knowledge (Knefel et al., 2024).

Primary industrial research was carried out to acquire new knowledge about the beneficial impact of crenotherapy with sulphur-rich water on menopausal symptom relief and hormonal regulation during menopause. The study group consisted of women aged 45-60 who reported experiencing at least 9 symptoms from a predefined list of clinical indicators (outlined in section 3).

The medical experiment was conducted under the supervision of the Bioethics Committee of the Collegium Medicum at Jan Kochanowski University in Kielce. It was based on a patented technology developed by the Beneficiary for masking the unpleasant taste and smell of sulphur-rich water (Invention No. P.430598: “Method for masking the salty taste and hydrogen sulphide odour of sulphur-rich medicinal water and its application in crenotherapy”).

In conventional medicine, the most common approach to managing menopause is hormone replacement therapy (HRT). Recently, various preparations based on natural compounds—used as dietary supplements—have also gained popularity. Since HRT affects both symptom intensity and hormone levels, the study sample was divided into groups using and not using HRT.

The study was conducted according to the methodology of comparative research on a total sample of 100 menopausal women in 4 groups, depending on the use of hormone replacement therapy:

- Study group using sulfide water crenotherapy - 70 women:
  a) Study sample 1 - women not using HTZ - 57 women.
  b) Study sample 2 - women using HTZ - 13 women.
- Control group using plain water crenotherapy - 30 women:
  a) Control sample 3 - women not using HTZ - 26 women.
  b) Control sample 4 - women using HTZ - 4 women.

The research group consumed a mixture of sulphur-rich medicinal water sourced from the Las Winiarski intake, combined in a 100 ml medicinal water to 200 ml fresh juice ratio. The juices comprised approximately 150 ml of vegetable and 50 ml of fruit juice, including about 10 ml of lemon juice to reduce the hydrogen sulphide aftertaste.

The control group consumed regular mineral water mixed with the same juices. Apart from this difference, all other elements of the therapy—exercises, treatments, and diet—were implemented identically. To ensure the reliability and comparability of the results, it should be noted that the participants were not given sulphur baths and were instructed to avoid them for three months during the study period.

In each group, the impact of crenotherapy (sulphur-rich vs mineral water mixes) was analysed across various measurement parameters. A series of biological tests were conducted before, during, one month after completing the therapy, and up to three months post-treatment.

Participants using HRT were defined as those taking exogenous oestrogens (either in combination with progestogens or alone) and their derivatives in doses used for hormone replacement therapy or combined oral contraceptives. Women using only progestogens were excluded from the HRT category. Assignment to research or control groups was carried out by physicians in consultation with dietitians, based on interviews and contraindications for crenotherapy.

In all groups, the effect of crenotherapy was evaluated based on both objective (measurable) and subjective (self-reported) parameters. The primary research tool was a patient diary, in which participants recorded details of their therapy, menopausal symptoms, medications, emotional wellbeing, and more.

The following parameters were analysed:

- Menopausal symptoms based on the 30-day diary (10 days in the research facility + 20 days at home).
- Bone density scans (before, after one month, and three months post-treatment).
- Laboratory blood and urine tests, including hormone levels (before, after one month, and three months post-treatment).
- Body temperature monitoring via thermographic imaging (before, after 10 days, after one month, and after three months).
- Dietary assessments of body composition and circumferences (before, after 10 days, after one month, and after three months).

Due to space constraints, this article focuses particularly on the results related to the alleviation of menopausal symptoms.

The primary aim of the industrial research was to acquire new knowledge on the impact of sulphur-rich water on menopausal symptom relief, which was confirmed by the validation of the main hypothesis:

- **H.0:** Sulphur-rich water crenotherapy contributes to the reduction of menopausal symptoms.
- **H.1 (supplementary hypothesis):** Sulphur-rich water crenotherapy regulates hormonal changes during menopause.

The main objective of the development phase was to verify the hypothesis:

- **H.2:** Body weight reduction positively correlates with the frequency of vasomotor symptoms.

The development stage combined the outcomes of the industrial research with secondary data and existing knowledge. As a result, a structured therapy for alleviating menopausal symptoms was developed and prepared for commercial implementation in the health tourism services market. This enabled the achievement of the project's defined milestones.

## 3. Menopause as a Health and Social Challenge

Menopause, also referred to as the climacteric or the perimenopausal period, is a stage in a woman's life marked by the permanent cessation of menstruation and a decline in ovarian hormonal activity. This phase typically occurs around the age of 50 (Rumianowski et al., 2012). The intensity and frequency of menopausal symptoms vary between individuals. Hormonal changes, poor diet, and an unhealthy lifestyle can lead to numerous physiological processes that may result in various ailments and conditions negatively affecting quality of life.

The age at which menopause occurs can significantly influence the risk of certain diseases. Studies have shown that late-onset menopause is associated with an increased risk of endometrial and breast cancer, while early menopause increases the risk of osteoporosis and cardiovascular diseases (Sapre, Thakur, 2014). Research also indicates that multiple factors may affect the age of onset, including parity, body weight, weight gain after the age of 20, dietary habits, intake of specific nutrients, and the use of stimulants or substances (Rumianowski et al., 2012; Piotrowska, Majchrzycki, 2013).

Menopausal symptoms are a common concern, affecting approximately 80% of women aged 45-60, with an average duration of more than seven years (Avis et al., 2015). The following symptoms were considered in the study:

- palpitations (rapid or forceful heartbeat),
- tension or nervousness,
- a feeling of pressure or tightness in the head,
- difficulty breathing,
- hot flushes,
- episodes of anxiety or panic attacks,
- irritability,
- numbness in parts of the body,
- muscle and joint pain,
- loss of interest in sexual activity,
- crying for trivial reasons or without cause,
- dizziness or fainting,
- difficulty falling asleep or insomnia,
- loss of interest in most activities,
- trouble concentrating,
- headaches,
- hyperactivity,
- fatigue or lack of energy,
- feelings of sadness or depression,
- numbness in the hands or feet,
- night sweats.

During menopause, attention to one's health becomes crucial. Studies have shown that lifestyle changes—such as improved eating habits, increased physical activity, and avoidance of stimulants—can help alleviate menopausal symptoms and reduce the risk of associated diseases (Pachocka, 2010; Iwanowicz-Palus et al., 2013; Dunneram et al., 2014). This formed the basis of the researchers' motivation to create a therapeutic programme aimed at mitigating menopausal symptoms, as part of the innovative development of health tourism.

## 4. Results of the Study on Menopausal Symptoms

For a period of 30 days, patients completed a diary (research tool) in which they recorded, among other things, the presence of menopausal symptoms on a daily basis, using a scale from 1 to 3 (where 1 indicated a mild level and 3 a severe level). The analysis followed a methodology based on comparing the intensity and frequency of each symptom over three 10-day periods.

As shown in Figure 1, symptom intensity was clearly higher in the groups not using hormone replacement therapy (HRT), which is consistent with the expected outcomes of HRT application. Moreover, in the research subgroups, the reduction in symptom severity persisted during the final 10-day period (days 21-30), while in the control subgroups, an increase in symptom intensity was observed.

The period covering days 1-10 was considered the baseline (100%). For each symptom, percentage changes were calculated in the subsequent periods, and an average was determined.

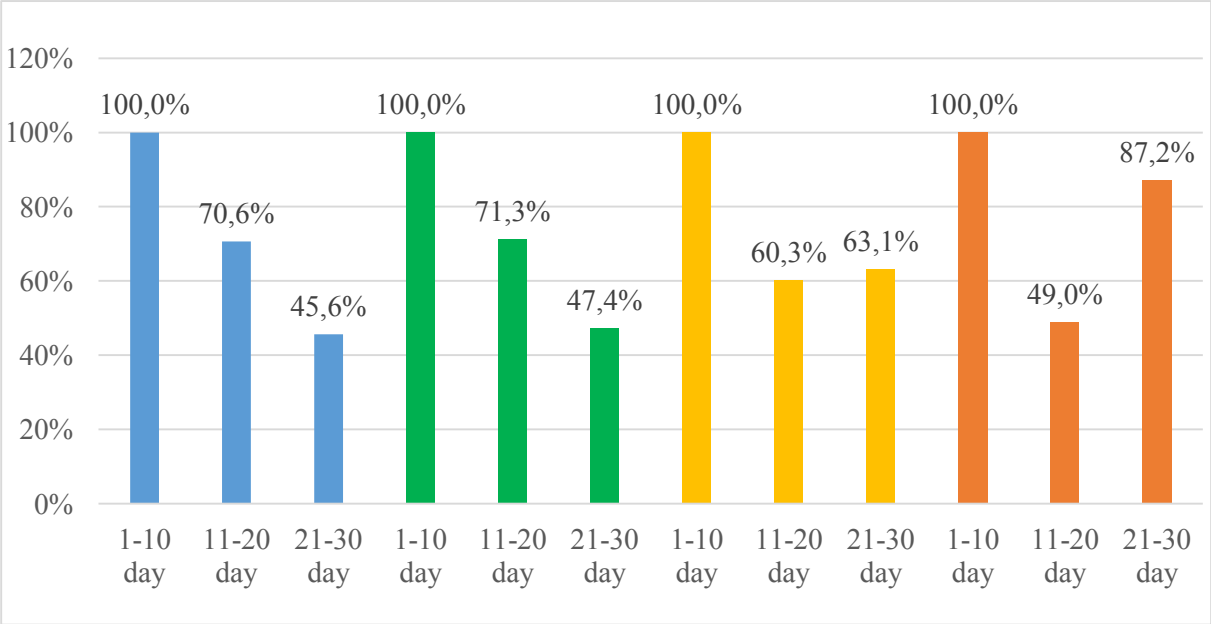



**Figure 1.** Menopausal Symptoms Over Three 10-Day Therapy Periods (Percentage-Based Analysis). Source: own elaboration.

The most frequently reported symptoms included fatigue and lack of energy, loss of interest in most activities, feelings of sadness or depression, crying for trivial reasons or without clear cause, headaches, numbness in the hands and feet, and difficulty concentrating.

Given that a review of the relevant literature indicates a link between diet, the timing of menopause onset, and the associated manifestation of menopausal symptoms (Dunneram et al., 2014), an in-depth analysis was conducted to examine symptom intensity in relation to BMI (Body Mass Index), using a comparative approach.

The BMI categories applied were as follows:

- **BMI Group A – Underweight:** below 18.5 kg/m².
- **BMI Group B – Normal weight:** 18.5–24.9 kg/m².
- **BMI Group C – Overweight:** 25–29.9 kg/m².
- **BMI Group D – Obesity:** over 30 kg/m².

The data analysis confirmed the effectiveness of HRT in reducing menopausal symptoms. At the same time, in the research subgroups (undergoing sulphur water therapy), each BMI group showed a decrease in both intensity and frequency of symptoms. In contrast, the control subgroups (receiving standard mineral water) experienced an increase in symptom severity—

particularly among women in the obese category (BMI Group D). These findings are illustrated in **Figure 2** (Note: No participants were classified as underweight; therefore, BMI Group A is not included in the chart.)

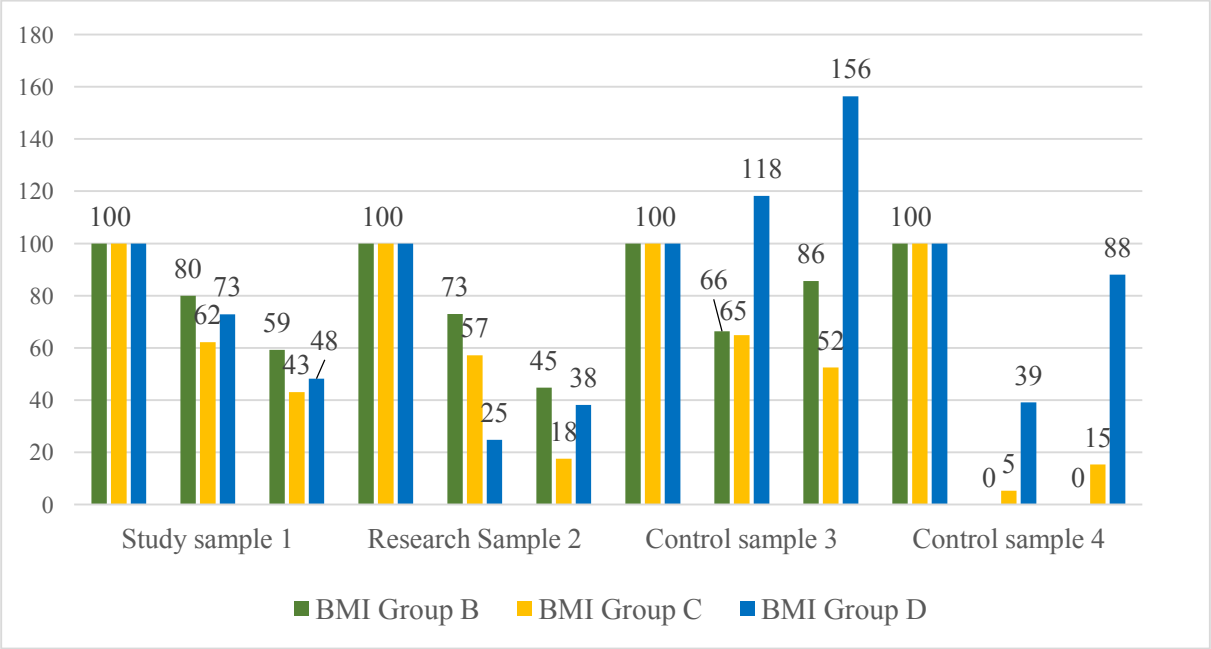



**Figure 2.** Analysis of Menopausal Symptoms Over Three 10-Day Therapy Periods by BMI Group (Percentage-Based Comparison).

Source: own elaboration.

In the research subgroups, where patients consumed sulphur-rich water, a significant reduction in menopausal symptoms was observed. Conversely, in the control subgroups—particularly among obese participants—there was a marked increase in symptoms. In the control group without HRT, symptom severity increased by as much as 56%. Furthermore, among participants not receiving HRT, the highest levels of menopausal symptoms were recorded in women with obesity. For clarity, all values presented in the charts have been rounded.

One of the most troublesome manifestations of menopause is the set of **vasomotor symptoms**, which include hot flushes, excessive sweating (especially at night), palpitations, and faintness. An analysis of vasomotor symptom occurrence by BMI group, expressed as a percentage, is presented in Figure 3.

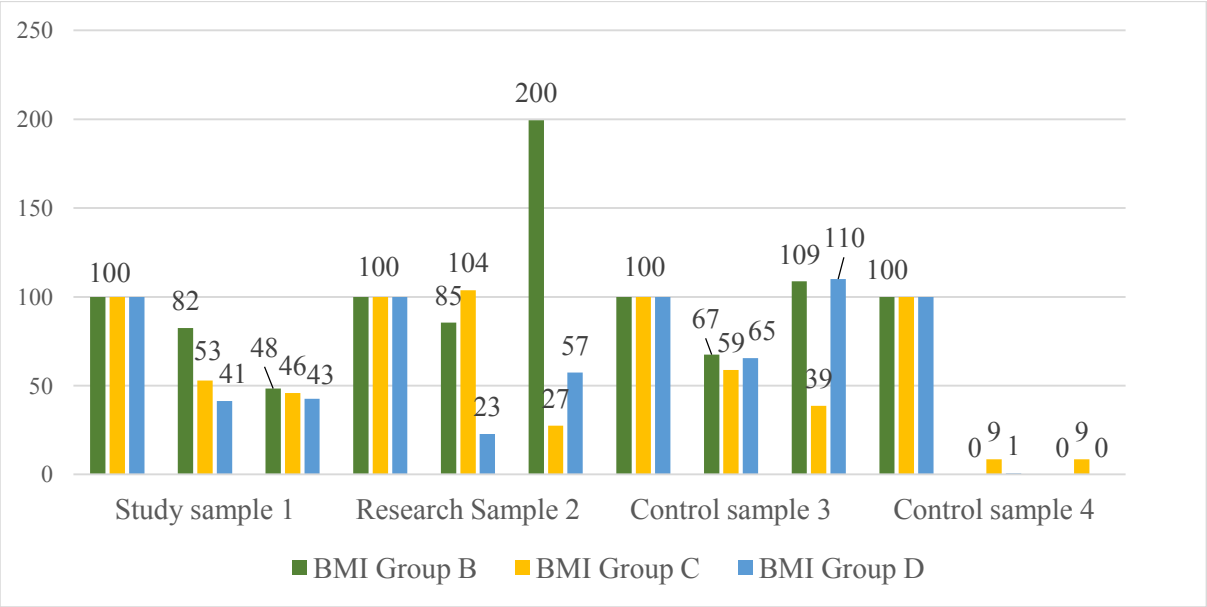



**Figure 3.** Analysis of Menopausal Vasomotor Symptoms Over Three 10-Day Therapy Periods by BMI Group (Percentage-Based Comparison).

Source: own elaboration.

The analysis of vasomotor symptoms revealed that among patients with a normal body weight (BMI Group B) and those classified as overweight (BMI Group C), symptom reduction was sustained throughout the entire study period in Research Subgroup 1. In contrast, an increase in symptoms was observed in the obesity group (BMI Group D). Most other subgroups also showed an increase in symptom intensity; however, it should be noted that the sample sizes were relatively small—particularly in Control Subgroup 4.

It is important to highlight that among patients using HRT, vasomotor symptoms were minimal. Therefore, percentage-based analysis was not applied in this context due to the incidental nature of observations in these subgroups.

To summarise the analysis of menopausal symptoms—particularly vasomotor symptoms—it can be concluded that patients in Research Subgroup 1 (receiving sulphur-rich medicinal water and not undergoing HRT) experienced the most significant symptom reduction, especially among those with a normal BMI (Group B). On the other hand, increases in vasomotor symptoms were observed primarily among obese patients (BMI Group D) and, to a lesser extent, among overweight patients (BMI Group C).

The results obtained allowed for the positive verification of the hypotheses and the achievement of the defined project milestones.

## 5. Market Implementation of the Research Results

An analysis of trends in the health tourism services market indicates a growing emphasis on holistic and comprehensive approaches to women's health, incorporating both medical and natural methods for alleviating menopausal symptoms. In recent years, numerous research projects have focused on the effectiveness of integrative medicine therapies, which combine elements of spa treatment, physical activity, dietary strategies, mindfulness, and conscious self-development, in alignment with broader demographic changes in society.

A strong emphasis was placed on **product personalisation**, including a range of specialised examinations and consultations, as well as health education for patients.

As a result of the research and development work, the following elements were developed:

- the structure of the therapeutic programme,
- an analysis of scientific literature on menopause, leading to the creation of new treatments such as:
  - pelvic floor muscle exercises,
  - breathing training based on Schultz autogenic training,
  - hormonal yoga,
  - psychosomatic training,
  - activating and relaxation sessions – including dance-based activities such as bachata,
  - sage-infused herbal baths,
  - personalised exercise sets for each type of session, led by a personal trainer,
- educational materials, instructions, and guidelines for participants on how to prepare for procedures and examinations,
- internal documentation related to participant services, including menu sets and dietary recipes with nutritional recommendations.

Another milestone in the project was the development of a **trademark** and the registration of the therapy's name with the Polish Patent Office. The application for the name *FEMI TERAPIA* was submitted under registration number **Z.563212**.




**Figure 3.** FEMI TERAPIA trademark.

Source: own elaboration.

Marketing activities were also planned, focusing on social media, influencer marketing, and endorsements from health and wellness experts. Alongside the implementation of successive stages of Technology Readiness Level (TRL) validation, a structured therapeutic stay programme was developed. This programme constitutes both a **product innovation** and a **new offering within the health tourism sector**.

## 6. Summary and conclusions

One of the phenomena accompanying population ageing is the growing number of women entering menopause, along with increasing health awareness, which supports the development of health tourism aimed at alleviating menopausal symptoms. It is worth noting that the therapy is also recommended during the perimenopausal period, as well as a **preventive measure** that promotes general wellbeing, improves bone density, and contributes to overall health.

The therapeutic programme based on **crenotherapy with sulphur-rich medicinal water**, developed through research and development activities, responds to current market trends and demand. A holistic approach to women's health during menopause contributes not only to enhancing their quality of life but also to the development of the health tourism sector.

The limitations of the study, which stemmed from formal conditions of the support programme for entrepreneurial discovery within the smart specialisation of health tourism, indicate significant potential for further research—particularly in the area of **sustainable and resource-efficient use of valuable medicinal raw materials**. Future studies should focus on the **effectiveness of individual therapeutic methods** used in health tourism, as well as their impact on women's long-term health. It is also worth noting that men experience a comparable stage in the ageing process—**andropause**—which represents another interesting and relevant area for future research.

Collaboration within an **interdisciplinary research team**—including physicians, dietitians, physiotherapists, trainers, and innovation management experts—enabled the development of effective treatments that form a comprehensive therapeutic programme. The innovative approach to collaboration within the **innovation ecosystem**, combining representatives of academia and business, not only allowed for the achievement of the intended goals, such as the positive verification of hypotheses and the completion of key milestones, but also served as a valuable source of new insights and inspiration for further collaborative research and development initiatives.

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# CAPITAL ALLOCATION IN THE REIT MARKET IN LIGHT OF THEIR CHARACTERISTICS

Krzysztof KOWALKE

University of Gdańsk, Faculty of Management; krzysztof.kowalke@ug.edu.pl, ORCID: 0000-0002-8519-0311

**Purpose:** This paper aims to evaluate the profitability of capital allocation in the U.S. REIT market, in light of selected characteristics of these entities.
**Design/methodology/approach**: Based on selected characteristics of individual REITs listed on U.S. public capital markets, hypothetical investment portfolios were constructed, and their rates of return were subsequently estimated. The characteristics analyzed included market capitalization, length of time on the market, and past performance prior to the investment period. The study covers the years 2015-2024. To verify the statistical significance of differences in REIT portfolio returns, standard t-tests were used.
**Findings:** The findings suggest that investors may benefit from allocating capital to REITs that: (1) have the highest market capitalization; (2) have been active in the market the longest; and (3) achieved the highest rates of return in the period preceding the investment. However, it is important to note that in most of the analyzed cases, the differences in returns between portfolios composed of REITs with extreme values of a given characteristic were not statistically significant.
**Research limitations/implications**: The present analyses focused on selected sectors of the U.S. REIT market and a relatively short, ten-year period. Future studies could expand the scope by including other sectors, international REIT markets, or strategies based on market ratios and fundamental metrics to verify the consistency of the findings.
**Practical implications:** The findings of this study highlight the REIT characteristics that investors should take into account when constructing investment portfolios to enhance their effectiveness
**Originality/value:** The literature review demonstrates that the relationship between investment fund characteristics and their rates of return has been extensively examined. However, there remains a noticeable gap in the research concerning the dynamically developing U.S. REIT market in recent years. Furthermore, the research aims to assess the profitability of using selected fund characteristics as a foundation for constructing an investment strategy.
**Keywords:** REIT, capital allocation, investment strategies.
**Category of the paper:** Research paper.

## 1. Introduction

Efficient capital allocation in the real estate market is a complex process that requires investors to possess extensive knowledge and expertise. Investments can be made either directly or indirectly. However, direct investments are typically characterized by low liquidity and are generally feasible only when significant capital resources are available. These limitations do not apply to indirect real estate investments, particularly those made through various forms of real estate investment funds, including Real Estate Investment Trusts (REITs). In recent years, the REIT market - especially in the United States - has experienced rapid growth. In the U.S., the market capitalization of public REITs increased from USD 330 billion in 2005 to USD 1,424 billion in 2024 (REITWatch, January 2025). These entities raise capital from both individual and institutional investors in order to invest in real estate assets. A key feature of REITs is their favorable tax status - REIT earnings are exempt from federal and state income taxes. To qualify for this status, REITs must meet several requirements, including a widely dispersed shareholder base (with at least 100 shareholders, and no more than 50% of shares held by five or fewer investors) and the obligation to distribute at least 90% of their taxable income as dividends (Gim, Jung, 2020). Although REITs operating within the same real estate segment often share similar business models, their rates of return can vary significantly. For this reason, it is so important for investors to properly select individual entities for the investment portfolio.

REITs share many characteristics with traditional investment funds. Numerous studies in the literature have examined the relationship between specific features of investment funds and the rates of return they generate (Chen et al., 2004; Babalos et al., 2012; Grinblatt, Titman, 1992). The findings of such studies are valuable, as they can serve as a foundation for developing investment strategies and improving portfolio performance. However, similar analyses are largely absent from the literature on REITs. Given the similarities between REITs and traditional funds, it can be assumed that relationships observed in the investment fund market may also apply to the REIT market. This may serve as a basis for enhancing portfolio efficiency within this market.

This paper aims to evaluate the profitability of capital allocation in the U.S. REIT market, in light of selected characteristics of these entities. The study also seeks to demonstrate how investors can apply findings on fund characteristics in the portfolio construction process, and what rates of return can be achieved through strategies based on those characteristics.

The features used to construct the investment portfolios include: market capitalization, length of market activity, and past performance prior to the investment period. For each of these characteristics, two portfolios were created, consisting of REITs representing the extreme values of the given feature. This approach made it possible to assess whether statistically and economically significant differences in performance exist between portfolios composed of REITs with high and low values of a given characteristic.

The analysis covers the years 2015-2024 and focuses on publicly traded U.S. REITs operating in three sectors: industrial, office, and retail. These represent the core sectors of commercial REITs, which in recent years - due in part to the COVID-19 pandemic - have experienced relatively high price volatility in public markets. The performance of the investment strategies was analyzed both for the combined group of REITs from all three sectors and for each sector individually.

The remainder of this paper is structured as follows: the next section provides a review of the relevant literature, followed by a description of the research methodology. The results of the analysis are then presented and discussed individually for each characteristic. Finally, the paper concludes with a summary of the main conclusions.

## 2. Literature Review

The core activities of REITs, as previously mentioned, are comparable to those of traditional investment funds. The literature in this field includes numerous studies aimed at identifying factors that influence the rates of return generated by investment funds. Among these, particular attention has been paid to the role of fund-specific characteristics and their impact on performance. The following section provides an overview of the key trends and findings in this area of research.

One of the main directions in this area of research concerns the relationship between the size of investment funds and their efficiency. A study on this phenomenon in the U.S. market was conducted by Chen et al. (2004). They demonstrated that as the size of investment funds increased, the rates of return they generated decreased. These findings were confirmed by subsequent studies conducted by Yan (2008), Ferreira et al. (2013), Pástor et al. (2020), and González et al. (2024). The causes of this phenomenon are attributed to the investment policies of funds, which compel them to allocate capital domestically and invest in smaller, less liquid companies. Moreover, the results suggest that this phenomenon is particularly prevalent in the U.S. market. In other markets, where there are fewer constraints, this effect is not observed (Ferreira et al., 2013). The relationship between fund size and performance in emerging markets was studied by Ding et al. (2015) and Laes, da Silva (2014). The former found that in Asian emerging markets, the highest rates of return were achieved by both the largest and the smallest funds, compared to medium-sized ones. In contrast, the study by Laes and da Silva, focused on the Brazilian market, showed that the highest rates of return were generated by the largest entities.

Interesting research on the efficiency of investment funds was also conducted by Babalos et al. (2012). Their analysis focused on the Greek market and revealed a negative relationship between fund size and efficiency. Thus, the results were consistent with those observed in the

U.S. market, as discussed above. Additionally, and notably, their findings indicated a positive relationship between fund age and efficiency. The authors argue that this may be attributed to older funds having a more efficient organizational structure and a deeper understanding of the financial environment. They also point to the use of more effective management techniques, in contrast to younger, less experienced funds. However, it should be noted that these findings were not consistent with those obtained in a study of the Australian fund market by Heaney (2008), which showed that younger funds generated higher rates of return. The author emphasized that the age effect in the Australian market was particularly pronounced in risk-adjusted returns.

Analyses that have attracted considerable interest among researchers are those examining the persistence of investment fund returns over subsequent periods, or conversely, the phenomenon of return reversal. The study by Grinblatt and Titman (1992) demonstrated that over a five-year horizon, the performance of investment funds tended to persist for the following five years. This applied to both the highest- and lowest-performing funds. Similar patterns were confirmed in the U.S. market over shorter time frames-specifically annual and semi-annual periods - in studies conducted by Hendricks et al. (1993), Otten, Thevissen (2011), and Cuthbertson et al. (2022). Persistence in fund performance was also observed in the Australian market in research conducted by Liu et al. (2016). The results of these studies suggest that, during the analyzed periods, a momentum strategy - allocating capital to funds that generated the highest returns in the preceding period - would have been appropriate in the investment fund market. It is worth noting that the findings related to investment funds differ from those observed in developed stock markets. Most of the studies conducted on these markets indicate the occurrence of return repeatability over periods of up to 12 months and a reversal in the 2-3-year period (De Bondt, Thaler, 1985; Jegadeesh, Titman, 1993; Rouwenhorst, 1998; Lee, Swaminathan, 2000; Mun et al., 2000; Jegadeesh, Titman, 2001; Shen et al., 2005; Alwathainani, 2012; Li, 2016).

Another important group of studies focuses on the impact of fund manager skills on rates of return, as well as the influence of the management model they employ on fund effectiveness. Research conducted by Berk and Green (2004), Berk, van Binsbergen (2015), and Dong, Doukas (2020) indicated that above-average returns achieved by investment funds are primarily influenced by the skills and qualifications of fund managers, rather than by luck. These findings stand in contrast to the results of analyses by Fama and French (2010), which suggested that it is not the managers' skills, but rather their luck, that accounts for the generation of above-average returns by some funds. In turn, studies by Hornstein, Hounsell (2016) showed that individually managed entities tended to generate higher returns than those in which decisions were made collectively. Additionally, research by Prather et al. (2004) and Berkowitz et al. (2017) demonstrated that entities managed by managers overseeing multiple funds were less effective, and that changes in management boards did not improve fund efficiency.

There is also a body of literature on the impact of outsourcing asset management services on fund performance. Investment funds can manage their assets internally or outsource the management function to independent firms that, for example, may have more experience in managing a specific asset class. Research conducted on the global investment fund market (Chuprinin et al., 2015; Massa, Schumacher, 2020) and the U.S. market (Chen et al., 2013; Moreno et al., 2018) suggests that funds managed internally, within a group, tend to be more effective than those managed externally. However, different conclusions can be drawn from research conducted by Gajewski and Dieu (2021) on the European market, which showed no significant difference in performance between internally and externally managed funds. Moreover, their analyses found that, in the short term, externally managed funds typically achieved higher rates of return.

Another stream of research in the literature concerns the level of fund operating costs and their impact on the rates of return generated by these entities. In the U.S. market, this issue was examined by Prather et al. (2004), whose findings indicated that higher expenditures on research, personnel management, marketing, and administration do not lead to increased fund efficiency. Similarly, the results of Berkowitz et al. (2017), as well as those of Gil-Bazo, Ruiz-Verdu (2009), suggest that funds with higher management fees tend to generate lower rates of return for their shareholders.

Interesting research on the impact of higher cash holdings by funds on their rates of return was conducted by Graefe et al. (2018). Their analysis of investment funds in European Union countries showed that entities holding above-average levels of cash achieved higher risk-adjusted returns compared to those maintaining below-average cash levels.

The findings of the reviewed studies indicate that investment fund returns are positively associated with the skills and qualifications of fund managers, as well as with higher levels of cash holdings. In contrast, returns are negatively or insignificantly affected by above-average management fees and elevated expenditures on research, marketing, and related activities. Moreover, the literature provides evidence of return persistence in the fund market over both short- and long-term ranking periods. It should be emphasized, however, that some of the reported results are inconclusive, with conclusions varying depending on market characteristics. This applies, in particular, to studies examining the influence of fund size, duration of market presence, and the outsourcing of management services on performance outcomes.

The presented literature review demonstrates that the relationship between investment fund characteristics and their rates of return has been extensively examined. However, there remains a noticeable gap in the research concerning the dynamically developing U.S. REIT market in recent years. This study seeks to address this gap, at least to some extent. Furthermore, the research aims to assess the profitability of using selected fund characteristics as a foundation for constructing an investment strategy. Notably, most existing studies have not assessed

returns from investing based on individual fund characteristics from the investor's perspective. Additionally, they have not focused on the construction of specific investment portfolios.

## 3. Methodology

The research conducted for the purposes of this study focused on publicly traded REITs operating in the U.S. market, whose shares were listed on either the NYSE or NASDAQ. The analysis covered the rates of return that could have been achieved by investing in the shares of entities active between 2015 and 2024 in one of three REIT sectors, namely industrial, office, and retail (REITWatch, January 2024). These sectors represent the most traditional segments of commercial real estate leasing in which U.S. REITs typically operate.

The study included only those entities whose shares were publicly listed on the last day of portfolio selection, i.e., December 31, 2023. It is important to note that the number of entities analyzed varied over the study period, as some REITs classified within the selected sectors as of December 31, 2023, were not yet public in 2014 or operated in a different REIT sector at that time. As a result, the number of REITs included in the analysis increased from 41 in the first year (6 industrial, 17 office, 18 retail) to 63 in the final year (11 industrial, 22 office, 30 retail).

For the purposes of this study, the profitability of three different investment strategies was examined, each based on a distinct characteristic of REITs. These characteristics were: market capitalization, length of time active in the REIT market, and the rate of return generated in the period preceding the investment. These are characteristics that investors can relatively easily access and take into account when constructing their investment portfolios.

In order to analyze the profitability of the investment strategies, two hypothetical alternative investment portfolios were constructed for each of the three specified characteristics. The first portfolio consisted of entities with the highest value of a given characteristic, while the second portfolio consisted of entities with the lowest value of the same characteristic. The analysis of the profitability of each strategy was conducted both for all REITs selected for analysis, as well as separately for individual sectors (industrial, office, retail). Each investment portfolio consisted of five entities, meaning that, in the first period of entity selection for the portfolio (the so-called ranking period), the portfolio included approximately 12% of the 41 REITs analyzed.

It should be noted that, in the case of the industrial sector, only six entities operated during the early years of the analysis, making it impossible to construct two extreme portfolios of five REITs each. As a result, the number of entities in the portfolios was reduced accordingly, with only three REITs classified into each investment portfolio during the first period. In subsequent periods, as the number of REITs in the industrial sector increased, the number of

entities in the investment portfolios also increased, up to the aforementioned level of five per portfolio.

Furthermore, investment strategies were tested for two ranking periods: one year and two years. This means that the composition of individual portfolios was updated either once a year or once every two years. Therefore, in the one-year ranking period, the portfolio composition was updated ten times, while in the two-year period, it was updated five times. It is also important to note that changes to portfolio composition were always made on January 1.

The first characteristic of REITs, based on which entities were selected for the investment portfolio, was their market capitalization. In each ranking period, an investment portfolio was constructed, including 5 entities with the highest market capitalization, and an alternative portfolio, which included 5 entities with the lowest capitalization on the day of selecting REITs for the portfolio. The portfolio composition was then adjusted annually (for the annual ranking period) or every two years (for the two-year ranking period). The principles for selecting entities for the investment portfolios remained the same throughout the period. By constructing two portfolios consisting of entities with extreme values of the characteristic, it was possible to compare the rates of return resulting from the use of two opposing investment strategies. This approach allowed for determining whether investing in REITs with the highest or lowest capitalization was more profitable during the period under review.

Another characteristic used to build the REIT investment portfolios was the length of time they had been active on the market. In this case, the first portfolio consisted of REITs with the longest period of operation on the market, while the second portfolio consisted of those that had just started their operations. It is worth emphasizing that the composition of the REIT portfolio with the longest period of operation remained constant and did not change during the individual ranking periods. The only exception was the industrial sector. In this case, at the beginning of the investment period in 2015, only six entities operated in this sector-not at least 10, which would have allowed the construction of two five-entity investment portfolios. In the following years, more entities joined the sector, which allowed for the expansion of the investment portfolio composition. However, in the one-year ranking period, the portfolio composition could only be updated after one year, while in the two-year ranking period, it could only be updated after two years. This resulted in differences in the composition of the two portfolios built for this sector. On the other hand, the composition of the REIT portfolio with the shortest period of operation was adjusted during the ranking periods. This involved adding new entities that appeared on the market to the portfolio and replacing REITs with the longest period of operation. These analyses allowed for a comparison of the profitability of investing in portfolios consisting of entities with the greatest market experience and the least.

The last characteristic used to construct the investment portfolios was the rate of return generated by the analyzed REITs in the period preceding the investment period. The first portfolio consisted of 5 REITs that generated the highest rates of return in the period preceding the ranking period (the so-called "winners" portfolio), while the second included 5 REITs with

the lowest rates of return (the so-called "losers" portfolio). As with the previous strategies, adjustments to the portfolio composition were made every year and every two years, based on the ranking of annual and two-year rates of return, respectively. The analyses conducted allowed for a comparison of whether, during the period under review and for the selected ranking periods, higher rates of return were generated by investing in REITs with the highest rates of return, or, conversely, in REITs with the lowest rates of return.

In order to estimate whether the differences in rates of return between the two extreme portfolios constructed for individual characteristics were statistically significant, annual excess rates of return of the portfolios were calculated in relation to the benchmark, which was the average annual value of rates of return for all REITs in a given group. These excess returns were designated as $CAR_{W,n,t}$ and $CAR_{L,n,t.}$ Additionally, arithmetic averages of the excess rates of return for the portfolios over the entire analysis period were calculated - $ACAR_{W,t}$ and $ACAR_{L,t}$ . These data were then used to estimate the pooled variance of the population $CAR_t$ and the t-statistic (De Bondt, Thaler, 1985):

$$S_t^2 = \frac{\sum_{n=1}^{N}\left(CAR_{W,n,t}-ACAR_{W,t}\right)^2+\sum_{n=1}^{N}\left(CAR_{L,n,t}-ACAR_{L,t}\right)^2}{2\times(N-1)} \quad (1)$$

$$T_t = \frac{ACAR_{W,t}-ACAR_{L,t}}{\sqrt{\frac{2\times S_t^2}{N}}} \quad (2)$$

In summary, the analysis conducted for the purposes of this study involved the calculation of the following metrics for hypothetical investment portfolios: annual rates of return for individual sub-periods, average annual geometric rates of return for the years 2015-2024, total rates of return for the same period, and t-statistics. The obtained results were compared with the respective average values for all analyzed REITs, as well as with the metrics estimated for the FTSE Nareit All REITs Income Index. Return rates were calculated based on the share prices of individual REITs, taking into account dividends paid, subscription rights, and stock splits. Price data were sourced from the financial platforms Stooq (Stooq website, 2025) and Yahoo Finance (Yahoo Finance website, 2025). Additional information on individual REITs and their characteristics was gathered from monthly REITWatch reports published on the Nareit portal (Nareit website, 2025) and from the official websites of the respective REITs.

## 4. Results and discussion

The analyses conducted revealed significant differences in the profitability of the individual investment strategies, both across the entire group of analyzed REITs and within specific sectors. The performance of these strategies over the study period is presented in Tables 1-3. Table 1 displays the results of investing in REITs with the highest and lowest market capitalizations.

**Table 1.**
*Results of the application of the investment strategy in REITs with the highest and lowest capitalization, 2015-2024*

| REIT portfolio type | Average annual geometric rate of return | Total rate of return | Ranking period | t-statistic |
|---|---|---|---|---|
| **All analyzed REITs** | | | | |
| Highest market cap portfolio | 4.75% | 59.12% | Annual | 0.8712 |
| Lowest market cap portfolio | -1.30% | -12.25% | | |
| Highest market cap portfolio | 4.19% | 50.70% | Two-year | 0.7062 |
| Lowest market cap portfolio | -3.16% | -27.44% | | |
| FTSE Nareit All REITs | 5.58% | 72.08% | - | - |
| Average for all REITs in the sectors | 3.36% | 39.17% | - | - |
| **Industrial sector** | | | | |
| Highest market cap portfolio | 10.73% | 177.13% | Annual | 0.6411 |
| Lowest market cap portfolio | 10.27% | 165.76% | | |
| Highest market cap portfolio | 10.71% | 176.61% | Two-year | 0.5169 |
| Lowest market cap portfolio | 7.29% | 102.13% | | |
| Sector average | 10.53% | 172.17% | - | |
| **Office sector** | | | | |
| Highest market cap portfolio | 1.14% | 12.01% | Annual | 2.2662 |
| Lowest market cap portfolio | -7.87% | -55.93% | | |
| Highest market cap portfolio | 1.00% | 10.48% | Two-year | 2.0345 |
| Lowest market cap portfolio | -12.41% | -73.43% | | |
| Sector average | -2.40% | -21.56% | - | - |
| **Retail sector** | | | | |
| Highest market cap portfolio | 2.87% | 32.65% | Annual | 0.1491 |
| Lowest market cap portfolio | 3.74% | 44.38% | | |
| Highest market cap portfolio | 3.15% | 36.39% | Two-year | 0.1462 |
| Lowest market cap portfolio | 3.90% | 46.60% | | |
| Sector average | 4.17% | 50.42% | - | - |

Source: Author's own work.

An analysis of the data reveals that, over the period under review, the highest rates of return were generated by REIT portfolios composed of entities with the largest market capitalizations. This pattern is evident not only in the portfolios constructed from all analyzed REITs but also within the portfolios created for each individual sector. The only exception was the retail sector, where portfolios of REITs with the lowest capitalization outperformed those with the highest. However, for this sector, the average returns of both strategies were lower than the overall sector average. It should be noted that, in most cases, the differences in returns between portfolios consisting of REITs with the highest and lowest capitalization were not statistically significant. The sole exception was the office sector, where the return differential between the two portfolios amounted to 9.01 percentage points for the one-year ranking period and 13.41 percentage points for the two-year period (t-statistics: 2.27 and 2.03, respectively).

Another REIT characteristic that shaped the investment strategy was the length of time the entities had been active in the market. The results of investing in REITs with the longest and shortest operating histories are presented in Table 2.

**Table 2.**
*Results of the application of the investment strategy in REITs with the longest and shortest operating activity on the US market, 2015-2024*

| REIT Portfolio Type | Average annual geometric rate of return | Total rate of return | Ranking period | t-statistic |
|---|---|---|---|---|
| **All analyzed REITs** | | | | |
| Portfolio of the longest operating | 7.73% | 110.51% | Annual | 0.2207 |
| Portfolio of the shortest operating | 8.61% | 128.37% | | |
| Portfolio of the longest operating | 7.73% | 110.51% | Two-year | 0.2278 |
| Portfolio of the shortest operating | 6.83% | 93.67% | | |
| FTSE Nareit All REITs | 5.58% | 72.08% | - | - |
| Average for all REITs in the sectors | 3.36% | 39.17% | - | - |
| **Industrial sector** | | | | |
| Portfolio of the longest operating | 11.90% | 207.87% | Annual | 0.7365 |
| Portfolio of the shortest operating | 8.24% | 120.84% | | |
| Portfolio of the longest operating | 12.00% | 210.66% | Two-year | 1.5888 |
| Portfolio of the shortest operating | 6.49% | 87.50% | | |
| Sector average | 10.53% | 172.17% | - | - |
| **Office sector** | | | | |
| Portfolio of the longest operating | 1.30% | 13.80% | Annual | 1.1931 |
| Portfolio of the shortest operating | -2.09% | -19.03% | | |
| Portfolio of the longest operating | 1.30% | 13.80% | Two-year | 1.4866 |
| Portfolio of the shortest operating | -3.20% | -27.79% | | |
| Sector average | -2.40% | -21.56% | - | - |
| **Retail sector** | | | | |
| Portfolio of the longest operating | 6.20% | 82.48% | Annual | 0.6641 |
| Portfolio of the shortest operating | 3.41% | 39.82% | | |
| Portfolio of the longest operating | 6.20% | 82.48% | Two-year | 1.1395 |
| Portfolio of the shortest operating | 1.44% | 15.39% | | |
| Sector average | 4.17% | 50.42% | - | - |

Source: Author's own work.

The results of the investment strategy based on the length of REIT market activity, as presented in Table 2, indicate that portfolios composed of REITs with the longest operating histories generally outperformed those consisting of the newest market entrants (in 7 out of 8 analyzed cases). The only exception was the portfolio comprising all analyzed REITs (across the three sectors) under the one-year ranking period, where the portfolio of newer REITs achieved a slightly higher average annual return than that of the more established entities. The relative advantage of the long-operating REITs became more pronounced when the ranking period was extended from one year to two years. Notably, in every variant of the strategy, the portfolio of REITs with the longest market presence achieved a higher rate of return than the average for the respective group. However, none of the observed differences in returns between the two portfolios proved statistically significant. The largest return differential was recorded in the industrial sector with the two-year ranking period, amounting to 5.51 percentage points (t-statistic: 1.59).

The last investment strategy analyzed was based on investing in REITs that had generated either the highest ("winners") or the lowest ("losers") rates of return in the period preceding the investment. These approaches correspond to the well-known momentum and contrarian

strategies, respectively. The results of applying these strategies to the selected group of REITs over the analyzed period are presented in Table 3.

**Table 3.**
*Results of the application of the contrarian and momentum investment strategies on the US REIT market, 2015-2024*

| REIT Portfolio Type | Average annual geometric rate of return | Total rate of return | Ranking period | t-statistic |
|---|---|---|---|---|
| **All analyzed REITs** | | | | |
| "Winners" portfolio | 7.95% | 114.89% | Annual | 1.1964 |
| "Losers" portfolio | -8.20% | -57.50% | | |
| "Winners" portfolio | 12.27% | 214.34% | Two-year | 2.4831 |
| "Losers" portfolio | -8.55% | -59.08% | | |
| FTSE Nareit All REITs | 5.58% | 72.08% | - | |
| Average for all REITs in the sectors | 3.36% | 39.17% | - | |
| **Industrial sector** | | | | |
| "Winners" portfolio | 10.36% | 168.01% | Annual | 0.5115 |
| "Losers" portfolio | 10.21% | 164.39% | | |
| "Winners" portfolio | 11.58% | 199.12% | Two-year | 1.8977 |
| "Losers" portfolio | 7.28% | 101.95% | | |
| Sector average | 10.53% | 172.17% | - | |
| **Office sector** | | | | |
| "Winners" portfolio | -1.96% | -17.93% | Annual | 0.4154 |
| "Losers" portfolio | -4.05% | -33.88% | | |
| "Winners" portfolio | 1.71% | 18.47% | Two-year | 1.7859 |
| "Losers" portfolio | -5.45% | -42.91% | | |
| Sector average | -2.40% | -21.56% | - | |
| **Retail sector** | | | | |
| "Winners" portfolio | 4.56% | 56.21% | Annual | 0.4946 |
| "Losers" portfolio | -1.32% | -12.40% | | |
| "Winners" portfolio | 8.34% | 122.72% | Two-year | 1.3198 |
| "Losers" portfolio | -5.74% | -44.61% | | |
| Sector average | 4.17% | 50.42% | - | |

Source: Author's own work.

The analysis of the results reveals some clear patterns. During the examined period, the portfolio consisting of 5 REITs with the highest rate of return in the pre-investment period outperformed the portfolio of 5 REITs with the lowest rate of return in every variant analyzed. This indicates that the momentum strategy generated higher returns than the contrarian strategy. Moreover, the differences between the "winners" and "losers" REIT portfolios grew as the ranking period was extended from one to two years. The only exception occurred in the industrial sector, where, for the annual ranking period, the "winners" portfolio's average annual return was lower than the average return for all entities in the group analyzed. Similar to the previous strategies, the differences in return rates between portfolios of REITs with the highest and lowest growth rates during the ranking period were not statistically significant in most cases. The only statistically significant difference was observed in portfolios constructed for the entire group of REITs, across all three analyzed sectors, during the two-year ranking period (t-statistic: 2.48). In this case, the difference in average annual returns between the "winners" and "losers" portfolios amounted to 20.81 percentage points. Additionally, for this particular

variant, the "winners" portfolio outperformed the "losers" portfolio in 7 out of the 10 annual sub-periods.

Analyzing the results of applying the presented strategies for individual variants, certain regularities can also be observed. In the case of portfolios built from all three REIT sectors, the highest rate of return was achieved by the portfolio consisting of entities with the highest return in the period preceding the two-year ranking period. This portfolio generated a geometric mean annual rate of return of 12.27%. However, in the case of individual sectors, the results were not identical. For the industrial sector, the highest rate of return of 12.00% was brought by the portfolio of REITs operating the longest on the market in the two-year ranking period. In turn, for the office and retail sectors, the highest investment profitability was demonstrated, as for all REITs, by the portfolio consisting of entities with the highest rate of return during the two-year ranking period. These portfolios generated average annual rates of return of 1.71% and 8.34%, respectively. Therefore, it can be concluded that in the analyzed period and with the presented assumptions, the highest profitability was demonstrated by investing in the REIT portfolio of "winners" in the two-year ranking period. The only exception was the aforementioned industrial sector.

In summary, the results of the analyses indicate that, among the investment portfolios constructed based on REIT capitalization, the portfolios of entities with the highest capitalization generally yielded higher rates of return compared to those constructed from entities with the lowest capitalization. Conversely, among the portfolios formed based on the length of market activity, the highest return during the analyzed period was generated by portfolios consisting of REITs with the longest operational histories, compared to those formed from REITs with the shortest market histories. Regarding the final characteristic analyzed - the return rate during the period preceding the investment - the "winners" REIT portfolios outperformed those of the "losers" REIT portfolios. When comparing the results across all the analyzed portfolio groups, the highest rates of return during the studied period were also observed in the "winners" REIT portfolios.

It is important to note, however, that this study did not examine the potential returns of a portfolio constructed by combining all the analyzed characteristics. In such a scenario, investors might allocate funds exclusively to REITs with the highest capitalization, longest market presence, and the highest returns during the pre-investment period. While it can be assumed that the return on such an investment portfolio would likely be the highest, this hypothesis was not analyzed in detail.

## 5. Summary

Based on the conducted analyses and their results, it appears justified to conclude that constructing an investment strategy grounded in specific characteristics of REITs can be profitable and enhance portfolio performance. The findings suggest that investors may benefit from allocating capital to REITs that: (1) have the highest market capitalization; (2) have been active in the market the longest; and (3) achieved the highest rates of return in the period preceding the investment.

However, it is important to note that in most of the analyzed cases, the differences in returns between portfolios composed of REITs with extreme values of a given characteristic were not statistically significant. Nevertheless, it seems that investors should take these analyzed characteristics of REITs into account when constructing their investment portfolios, as doing so may help improve portfolio performance - especially if all of the considered characteristics are taken into account collectively rather than individually.

The results of these analyses may be valuable for both individual and institutional investors in the stock market who allocate funds to the public market of American REITs. They highlight specific characteristics of REITs that investors should consider when selecting entities for their investment portfolios. Given the vastness of the REIT market, selecting appropriate entities for an investment portfolio can be a complex task. Therefore, studies of this nature aim to simplify this process, at least to some extent, for portfolio managers.

It is also worth relating the results of this study to those conducted on the broad market of investment funds, which were presented in the literature review. The results of the analyses concerning the impact of REIT size on their rates of return were not consistent with those conducted on the broad market of American investment funds. In the case of the REIT market, contrary to the investment fund market, higher rates of return were generated by the largest entities, not the smallest ones. On the other hand, this study suggests, like the research conducted by Babalos et al. (2012) on the Greek market, that the profitability of investment funds may increase with their age. The results of this study also indicate that higher rates of return are generated from investing in "winners" portfolios than "losers" ones on the REIT market, which is consistent with the results of the research conducted on the broad market of American investment funds.

In conclusion, it should be emphasized that far-reaching conclusions should not be drawn from the analyses conducted for the purposes of this article, as they focus on selected sectors of the U.S. REIT market and a relatively short, ten-year period. Future research could explore other REIT sectors, as well as the REIT market in other countries. This would help determine whether the profitability of the strategies presented in this study is repeatable in the capital allocation process across different markets. Future analyses could also investigate the profitability of alternative investment strategies in the REIT market, such as those based on

market indicators like the price-to-earnings ratio, price-to-book value, or other fundamental metrics. Additionally, it may be worthwhile to consider examining the profitability of strategies that combine multiple characteristic features of REITs simultaneously. Such research could enhance the efficiency of capital allocation for investors in this market.

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# EMPLOYEE AUTONOMY AS ONE OF THE ELEMENTS OF ENTREPRENEURIAL ORIENTATION IN THE PRIVATE HEALTHCARE SECTOR

Ewa KOZERA

Jan Kochanowski University; ewa.kozera@ujk.edu.pl, ORCID: 0009-0000-7812-0596

**Purpose:** To analyze employee autonomy as one of the key components of entrepreneurial orientation in private healthcare organizations. The paper will examine how employee autonomy, as one of the five central elements of entrepreneurial orientation, shapes the innovative, risk taking and proactive capacities of healthcare providers and enhances their ability to adapt to a competitive environment.
**Design/methodology/approach**: A systematic literature review based on academic studies from 2014–2024, focusing on employee autonomy's relationship with innovation, proactiveness, risk-taking, and competitive aggressiveness.
**Findings**: Employee autonomy strengthens the innovative and proactive capacities of healthcare organizations and enhances their ability to adapt to a competitive environment.
**Research limitations/implications**: Limited empirical studies specific to private healthcare in Poland require further investigation. Future research should explore the mediating and moderating effects of employee autonomy on the components of entrepreneurial orientation.
**Practical implications**: Recommendations for healthcare managers to implement policies fostering autonomy as part of entrepreneurial orientation.
**Originality/value**: Highlights the role of employee autonomy in shaping entrepreneurial behaviors in a critical and evolving sector.
**Keywords**: Employee autonomy, entrepreneurial orientation, private healthcare, healthcare workers.
**Category of the paper**: Literature review.

## 1. Introduction

Apart from the legal changes, technological advancements and changes in consumer preferences have contributed to the stiff competition in Poland's private healthcare sector. Also, a set of measures targeted at modernizing the Polish healthcare sector, which were carried out, has further contributed to the spread and development of the Polish private healthcare system (Nieszporska, 2016). Against the backdrop of these developments, entrepreneurial

orientation has been identified as a crucial managerial perspective for healthcare organizations to become more flexible and reactive (Skica et al., 2018). EO includes main components which include innovation, proactivity, risk taking, competitive aggressiveness and employee autonomy that can assist the healthcare organisations to address the issues and prospects that are offered by the current environment (Alolayyan, Alyahya, 2023).

### 1.1. Problem Statement

Research in the area of autonomy of health care workers as part of the concept of entrepreneurial orientation is insufficient (Vecchiarini, Mussolino, 2013). The available literature is devoid of an in-depth appreciation of the role that employee autonomy, as a significant dimension of EO, plays in shaping the innovative, proactive and risk taking capacities of private health care sector. While previous research has analyzed the relationship between EO and various factors, the extent to which employee autonomy serves to promote this strategic orientation in the context of private healthcare has not been sufficiently explored. The objective of this paper is to fill this gap by examining the avenues whereby employee autonomy. The purpose of this article is to fill this gap by exploring the ways in which employee autonomy, can strengthen the EO of private healthcare institutions to help them cope up with competition. Specifically, the study will examine how employee autonomy relates to and shapes the innovative, proactive, risk-taking, capacities of healthcare organizations.

This research identifies ‘autonomy’ as an important element within the EO framework which is anticipated to enhance the adaptive and responsive capacity of private providers in the fiercely competitive private healthcare sector (Alolayyan, Alyahya, 2023).

The paper will be organized into the following sections. The Methodology section explains the techniques adopted for the systematic review of literature and the guidelines to be utilized in selecting and analyzing relevant academic articles published between the years 2014 to 2024. This section will elaborate on the strategy of searching for and screening studies that explored the relationship between employee autonomy and components of EO. The Results section will review the literature selected in the previous step, offering an overview of the role of employee autonomy in determining the innovative, proactive, and also risk taking capabilities of private healthcare organizations. The Discussion section will interpret what the findings of this research mean in the context of theory as well as practice. Lastly, the Conclusion will reiterate the most relevant points made by this research and present suggestions for further studies on the topic and how to best tackle the issues at hand in healthcare management.

## 2. Methodology

This study will use a systematic literature review approach whereby the author will conduct an extensive review of current literature in order to examine the relationship between employee autonomy and the entrepreneurial orientation in private healthcare organizations in detail. The review will concentrate on reviewing articles in reputed journals in the time frame of 2014 to 2024 with the help of databases like Scopus, PubMed, and Google Scholar. The comprehensive search criteria will include a diverse set of keywords, such as "employee autonomy", "entrepreneurial orientation", "private healthcare", „health care workers". Search has been limited to Polish and English articles. The primary objective of this research is to review and evaluate the current literature on the relationship between employee empowerment and the innovative, proactive, and risk taking of firms in the private healthcare sector. In light of these central themes, the study intends to offer a deeper insight into the role of autonomy within the entrepreneurial orientation framework and the consequences for the improvement of the adaptive and responsive capacities of healthcare organizations in the private sector. The first process in the literature review will be to identify the most appropriate articles that will be used in this study then the selected articles will be analysed critically with regards to the findings, and theoretical frameworks. Moreover, the analysis will focus on how much and which ways employee autonomy affects the different aspects of entrepreneurial orientation and also the conditions that may influence these relationships in the private healthcare industry.

## 3. Results and Implications

Entrepreneurial orientation largely shapes the financial performance of companies, making it crucial in economies (Akkaya et al., 2024).

In the face of increasing competition and dynamic changes in the sector, entrepreneurial orientation is becoming crucial for effective management (Lisowska, 2018). Empirical research, which is based on the analysis of data collected from the managers of small and medium-sized enterprises, confirms this thesis. The findings indicate that the organizations that are more entrepreneurial have higher levels of innovative behavior, organizational flexibility, and market orientation which in turn enhance the organizational financial and market performance (Wójcik-Karpacz, 2017).

Entrepreneurial development in the private healthcare sector has been too slow. Government regulations and internal organizational rules are often obstacles to entrepreneurial initiatives. In turn, what motivates such efforts can come from the market environment, competitive pressures, financial incentives, as well as technological and social advances.

The autonomy of the facilities involved, as well as the entrepreneurial and cooperative mindset of healthcare leaders, decision-makers and employees, also play an important role. Entrepreneurial activities undertaken are usually aimed at improving the quality and efficiency of healthcare services provided. Therefore, it is crucial to create a favorable environment for entrepreneurship, which will enable innovative development of the sector (Brandt el al., 2021).

At the organizational level, autonomy means the ability of the organization to exercise judgment and to act, without regard to the structures that define the organization. It enables the company to act promptly to shifts in the market condition, assess the potential and seize it as well as come up with new strategies. At the individual level, autonomy is the ability of employees to work and make decisions and to act on their own initiative. It promotes innovation, engagement and ownership that helps in the recognition and development of new business strategies (Karpacz, 2016).

There is a considerable amount of research that supports the notion that autonomy increases innovation in employees of healthcare organizations. The literature indicates that when healthcare professionals are allowed to make more decisions and work in an environment that allows for flexibility, they are likely to come up with creative solutions and innovative ways of working (Ferraz et al., 2021).

In a similar manner, we can say that when the employees are allowed to own their work and try new things, it is possible to foster an innovative health care culture that is capable of adapting to the changing needs of the patients (Cheraghi et al., 2021).

The basis of this relationship can be grounded through the use of the self-determination theory which asserts that autonomous motivation enhances intrinsic interest and personal volition which results to creativity and innovation (Feri et al., 2016). When the healthcare professionals are allowed to make their own decisions in the workplace they feel more motivated, involved and are likely to come up with out of the box ideas. In turn, this may lead to creation of an environment that is conducive to testing and improvement thus allowing the organization to be relevant in the ever evolving health care system (KIM, 2021).

Empowerment can enhance knowledge sharing, ideas, and best practices among the healthcare teams which in turn fosters innovation (Apostolopoulos et al., 2022).

Through giving employees the ability to manage their work and share information, organizations can tap into the collective wisdom and diverse thoughts of their employees to come up with new and improved ways of working (Trifunović, 2024).

Thus, the current research findings provide a strong evidence that employee autonomy is crucial to support innovation in healthcare environment. Through giving the power to decide, the opportunity to try out new ideas and the ability to work together, organizations can allow their employees to be more innovative and productive in their work thereby enhancing their ability to deliver quality and responsive services (Timmins, Adams, 2014).

The relationship between employee autonomy and proactivity has been extensively researched in healthcare organizations (Waddimba et al., 2020).

When healthcare professionals are allowed to make decisions and work in an environment that is flexible, they tend to actively identify the problems and come up with solutions to improve the quality of service delivery (Alolayyan, Alyahya, 2023).

When the healthcare employees are provided with autonomy in their working environment, they are able to develop the ability of anticipating the needs of the patients instead of just being able to respond to them (Elahi et al., 2020). Autonomy at work can enhance the transfer of knowledge, ideas and practices within the healthcare teams which in turns enhance proactive behaviors (Türk et al., 2022).

By giving employees the freedom to manage their work and express themselves, organizations can tap into the employees' innovation and unique viewpoints to help solve issues. In turn, this can help to encourage a culture of improvement and resilience, which will allow healthcare organizations to meet the challenges that are present in the ever-changing environment (Andersson et al., 2023). Previous research has indicated that employee autonomy helps create a culture where risk taking is not only allowed but encouraged in private healthcare organizations. Through giving the healthcare practitioners the chance to make decisions and try out new ideas, managers can create a culture that is based on trust and safety where employees are able to go for new ideas (Øygarden et al., 2023). It has been demonstrated that the workers within the healthcare sector have an increased tendency to engage in activities that aim to step out of their usual practices. This self-determination means that they are more likely to be willing to carry out new activities (Goyal, Kaur, 2023). The organization factors in the trust on the employee which enhances the proficiency of the employee as the employee is willing to take in tasks with risk (Anfajaya, Rahayu, 2020).

**Table 1.**
*Overview of the impact of employee autonomy on innovation, proactivity and risk-taking*

| EO dimensions | Autonomy impact | Examples from the health sector |
|---|---|---|
| Innovativeness | Employees in an environment where there is a high level of autonomy are more likely to introduce creative and innovative solutions. | Creating new medical procedures that improve the quality of patient care. |
| Proactiveness | Autonomy allows employees to anticipate patient needs and proactively respond to changes. | Develop initiatives to improve the quality of care in response to patient needs. |
| Risk taking | Fostering autonomy increases the organization's willingness to take on new challenges and risks. | Experimenting with new treatments or workflows in response to market challenges. |

Source: own study.

Therefore, it can be concluded that based on the current literature review, it is clear that employee autonomy is a major decision-making force, a factor in implementing new ideas, increasing risk taking and challenging traditional private approaches to healthcare in organizations (Slåtten et al., 2020).

## 4. Discussion and recommendation

In The main findings show that autonomy is a very important component of entrepreneurial orientation in the private healthcare sector and have major impact on innovativeness, proactiveness and risk taking. Independence makes the healthcare practitioners to feel that they are in a position to predict and meet the patients' current and future needs instead of just being responsive (Vecchiarini, Mussolino, 2013). This proactive, entrepreneurial thinking enhances the willingness to adopt risk-taking approaches and envisions change (Rastoka, 2023). In addition, autonomy fosters exchange of knowledge, creativity and other resources between healthcare workers thus enhancing the search for solutions. Thus, through giving employees the opportunity to work with greater levels of autonomy and freedom to innovate and contribute to decision-making, private healthcare organizations can tap into the collective intelligence of their employees to navigate the dynamic environment solve and the problems that are likely to arise in the future (Trifunović, 2024). The combination of autonomy and other EO factors like risk-taking and competitive aggressiveness make private healthcare organizations to be prepared to tackle the challenges that are likely to occur in the evolving environment (Kearney et al., 2020).

The following are some of the practical recommendations for managerial practices in the private healthcare based on the findings of this study. First, healthcare managers should work towards the creation of organizational culture that will support empowerment of employees where they are allowed to make more decisions on their own. This can include enabling the healthcare workers to be allowed to try out new ideas, question existing practices and try out new ways of delivering services. Thus, by creating trustworthy environment and feeling that everyone is safe in the organization, it is possible to unleash the creative potential and enterprising attitude of employees.

Further, the private healthcare organizations should encourage the transfer of knowledge, information and ideas with the help of cross functional teams. Stimulation of communication and collaborative approach to the problem solving may contribute to generation of the creative and viable strategies which could become the source of competitive advantage for the organization and ensure its flexibility. It is recommended that managers should design knowledge management systems and create forums that will bring together people with different points of view.

Last, healthcare leaders should understand that the role of employee autonomy is crucial in supporting measured risk-taking. This means that organizations should allow their professionals to make decisions, innovate and adapt to changes in the market to be ready for future challenges in the ever evolving health care environment. The implementation of performance management systems that encourage risk taking and creativity should also be introduced to enhance this entrepreneurial spirit in the organization.

**Table 2.**
*Compilation of practical recommendations for managers*

| Area of activity | Recommendation | Expected result |
|---|---|---|
| Organizational culture | Introduce a culture of trust and psychological safety, where employees can make decisions and test new ideas. | Increase creativity and employee engagement, leading to innovation. |
| Knowledge management | Establish knowledge management systems and platforms for sharing experiences between departments. | Better exchange of information and ideas, which supports organizational development. |
| Risk taking | Implement performance appraisal systems that reward innovation and responsible risk-taking. | Building a culture of entrepreneurship and readiness to take on new challenges. |
| Innovativeness | Encourage employees to share their own ideas and implement systems to support innovative initiatives. | More innovations implemented, improved competitiveness of the organization. |

Source: own study.

Due to a rather limited focus of research works that correlate to this specific sector, any conclusions that can be drawn on the presented research remain inconclusive. This serves as a dire case of the general research focus as an analysis of the local environment is required for the core concepts applied in the analysis to be put into practice. More research is needed in order to test how well the current theories can be applied and whether there are any differences or conditions that could affect the link between autonomy, risk-taking, innovativeness and proactiveness in this particular context.

### 4.1. Future Research Directions

The present study also points out the necessity to conduct more research in order to explore the connection between employee autonomy and entrepreneurial orientation more deeply and to the specific context of the private healthcare sector with the example of Poland. Moreover, comparative research on an international level would be very useful in order to understand the mechanisms of these concepts' interaction and their manifestations in various analyses contexts. Hence, this the kind that would involve a number of countries could help explain the effects of cultural, regulatory and economic variables on the relationship between autonomy, risk-taking, innovativeness and proactiveness in private healthcare organizations. This will make the understanding of the phenomenon more systemic and will allow to determine the effective strategies that may be applied in the private healthcare organizations to promote entrepreneurial orientation in the conditions of the global competition.

## 5. Conclusion

The autonomy provided to healthcare practitioners considerably complements the other features of entrepreneurial posture, and consequently, has an influence on the medical facility growth potential and adaptability (Lopes et al., 2018). Autonomy makes the healthcare practitioners to feel that they are in a position to be able to predict and adapt to the changes in the needs of the patients rather than being in a position to only respond to them (Zhu et al., 2020). This entrepreneurial thinking makes the person concerned willing to assume certain risk, albeit controlled, and to question traditional approaches, which in turn fosters innovation and competitive edge of the organization. Through giving employees more decision making power and creating a culture of trust, private healthcare organizations can tap into the collective wisdom and variety of their employees' ideas which will help the organizations thrive in the future (Ntwiga et al., 2021).

From a practical perspective the paper provides relevant findings and suggestions to help managers of healthcare organizations to enhance the entrepreneurial orientation. Findings of the study reveal that healthcare managers should encourage the culture of trust and safety, give employees more decision making power and encourage cross functional cooperation. Such managerial practices will enable private healthcare providers to tap into the collective intelligence of their employees, diverse opinions that are crucial in the current environment of fast changes and competition. The outcomes offer a guide for healthcare organizations to build the required entrepreneurial attitude and actions to foster innovation and improve flexibility.

The following are the strategies that healthcare managers should employ to ensure that they support employee autonomy as a key factor to entrepreneurial orientation in private healthcare: First, they should create a culture of trust and psychological safety where health care professionals are allowed to think innovatively, initiate, and adapt to the changes in the market. Therefore, through giving employees more decision-making power, organizations can allow them to bring their ideas, which can help them to address patients' needs early and efficiently.

In addition, managers should also put in place performance management systems that recognise and reward risk management and innovation. This will also enhance the entrepreneurial thinking culture within the organization and hence encourage the healthcare professionals to think out of the box and come up with new and unique strategies that can be used to compete within the market. The managers should also ensure that there is the flow of information, knowledge, and innovation and the best practices across the departments and between different teams. Such exchange of diverse perspectives can lead to generation of innovative ideas that help organizations to grow and transform in the current ever-changing environment.

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# DIAGNOSIS OF THE APPLICATION OF RENEWABLE ENERGY SOURCES IN AGILE ORGANIZATIONS – ANALYSIS OF OWN RESEARCH

Artur KWASEK[1], Maria KOCOT[2*], Adrianna TRZASKOWSKA-DMOCH[3], Mariusz SALWIN[4]

[1] University of Technology and Economics in Warsaw; artur.kwasek@uth.edu.pl, ORCID: 0000-0003-4386-1444
[2] University of Economics in Katowice; maria.kocot@ue.katowice.pl, ORCID: 0000-0001-5150-3765
[3] Warsaw University of Technology; adrianna.dmoch@pw.edu.pl, ORCID: 0000-0002-4825-3635
[4] Warsaw University of Technology; mariusz.salwin@pw.edu.pl, ORCID: 0000-0001-9325-8796
* Correspondence author

**Purpose:** The aim of the article is to present a balance of benefits and risks related to the use of renewable energy sources in agile organizations and to identify dominant social attitudes towards such solutions. The analysis is set in the context of the growing importance of sustainable development and energy transformation.
**Design/methodology/approach**: A quantitative method was used, based on a survey conducted among 820 respondents in January–February 2025. The data was subjected to multivariate correspondence analysis (MCA), which allowed for visualization of relationships between responses and extraction of patterns of assessments.
**Findings:** Respondents mostly positively assess the impact of renewable energy sources on the environment, climate, job market and energy independence, while expressing moderate concerns about costs and uncertainty about potential side effects. MCA analysis revealed a convergence of positive attitudes and a dispersion of critical assessments.
**Research limitations/implications**: The study was cross-sectional and relied on declarative opinions of respondents, which limits the ability to capture changes in attitudes over time. The industry and geographic specificity of the organizations surveyed was also not taken into account.
**Practical implications:** The study was cross-sectional and based on respondents' declarative opinions, which limits the ability to capture changes in attitudes over time. The industry and geographical specificity of the organizations studied was also not taken into account.
**Social implications:** The article highlights the importance of social acceptance for the development of renewable energy sources and the need to support energy transformation through dialogue, education and transparency.
**Originality/value:** The study brings new value by combining the perspective of organizational agility with the issue of renewable energy sources, pointing out their potential synergy and impact on the sustainable development strategy.
**Keywords:** agile organizations, renewable energy sources, sustainable development.
**Category of the paper:** research paper.

# 1. Introduction

In the face of increasing climate challenges and growing expectations for environmental responsibility, organizations that bear the hallmarks of agile face the need to combine operational flexibility with the implementation of sustainable development goals. One of the integral areas of this transformation is the implementation of renewable energy sources. They can support energy independence, reduce the carbon footprint and build long-term organizational value. Despite the growing interest in this topic, there is still a lack of in-depth analyses showing how agile organizations perceive the benefits and risks associated with the use of renewable energy.

The article addresses this issue by combining theoretical perspectives with the results of empirical research conducted among 820 respondents. The added value of the study is to show social assessments and attitudes towards the use of OER in organizations with an agile management structure. This allows for a better understanding of the potential and barriers of this transformation.

The structure of the article includes a theoretical part, which is devoted to the idea of sustainable development and renewable energy sources in agile organizations. Then, a balance of benefits and threats is presented, and in the following part, an analysis of the research results, conclusions and recommendations.

The originality of this study lies in the combination of two areas that are usually analyzed separately: agile management and the use of renewable energy sources (RES). In the existing literature, RES are primarily treated as a technological or environmental issue. In contrast, this article attempts to situate them within the structural and organizational context specific to agile organizations. The presented research addresses a cognitive gap by showcasing social perceptions of the benefits and risks associated with implementing RES in such organizations. A topic that has rarely been the subject of empirical analysis to date. The approach to data analysis is also innovative. The use of Multiple Correspondence Analysis (MCA) enabled the identification of relationships between qualitative variables and the extraction of dominant perception patterns. This gives the study both an exploratory and an applied character.

## 1.1. The idea of sustainable development in agile organizations

The idea of sustainable development in agile organizations has become a response to the need to integrate environmental, social and economic goals with management practices that are based on flexibility, adaptability and innovation (Reyes-Mercado, 2023). Sustainable development is understood as striving for a balance between the needs of current and future generations. This concept is increasingly used in organizations operating in a dynamic market environment. Such conditions force them to respond quickly to changes, while taking into account social and ecological responsibility (Wüstenhagen, Menichetti, 2012).

In agile organizations, characterized by short decision-making cycles, an iterative approach to achieving goals, and an organizational culture based on learning and collaboration, sustainability can be considered an integral element of the strategy (Wells, Lin, 2024). It is not understood as a separate field. It is defined as a set of principles that permeate all levels of the organization's functioning: from operational planning, through human resources management, to innovation and investment policy (Reyes-Mercado, 2023). Integrating the principles of sustainable development with agile management practices promotes the creation of business models that respond to market needs while minimizing negative impact on the environment and supporting social development (Wüstenhagen, Menichetti, 2012; Devine-Wright, 2007).

Sustainable development and organizational agility are two approaches that increasingly complement each other. Agile companies, thanks to their flexibility and quick response to change, are well positioned to implement solutions that support environmental protection and social responsibility. Instead of treating sustainable development as a separate area, they incorporate its principles into everyday operations – from planning and team management to investment decisions. As a result, they can not only reduce their environmental impact but also gain the trust of customers and partners, and in the long term, build a competitive advantage. Combining agility with the idea of sustainable development helps organizations better prepare for the challenges of energy transformation and growing social expectations.

Organizational agility allows for rapid implementation of environmentally friendly solutions, such as renewable energy sources, circular economy or digitalization of processes that reduce resource consumption (Roy, 2024; Styczynski, 2024). High adaptability also allows for effective response to growing stakeholder expectations regarding social responsibility and transparency of actions (Van der Waal et al., 2019). In this aspect, sustainable development becomes a practice embedded in everyday operations, which are constantly monitored, assessed and improved in agile organizations (Wüstenhagen, Menichetti, 2012).

Sustainability in agile organizations should also be supported by digital and analytical tools. They enable ongoing assessment of the impact of the organization's activities on the environment and implementation of improvements in real time (Roy, 2024; Rosario, Raimundo, 2021). Technologies such as artificial intelligence, blockchain or the Internet of Things can be effectively used to increase energy efficiency, monitor carbon footprint or support responsible supply chains (Wüstenhagen, Menichetti, 2012).

Thus, technological agility becomes an integral determinant that supports the implementation of sustainable development goals. The concept of sustainable development in agile organizations does not only mean focusing on elological aspects. It also includes actions for equal opportunities, inclusiveness, employee well-being and social involvement (Reyes-Mercado, 2023; Wells, Lin, 2024). An agile organizational structure promotes the formation of a work environment based on shared responsibility, autonomy and continuous development of competencies. This results in increased social capital and organizational resilience.

As a result, sustainable development in the sense of agility becomes both a goal and a way of functioning of the organization in conditions of uncertainty and transformation. Taking into account the principles of sustainable development in the agile management model allows for building a competitive advantage, but also for increasing the social legitimacy of the organization's activities. This takes on integral importance in conditions of increasing regulatory pressure and growing consumer awareness (Wüstenhagen, Menichetti, 2012; Devine-Wright, 2007; Wells, Lin, 2024). In the long term, the synergy between agility and sustainable development can lead to the creation of resilient, ethical and innovative organizations, bearing the characteristics of agile. Such organizations can harmoniously combine operational efficiency with responsibility towards the environment (Reyes-Mercado, 2023).

### 1.2. Using Renewable Energy Sources in Agile Organizations

The use of renewable energy sources in agile organizations can be considered an important determinant that effectively supports their ability to flexibly respond to changing external conditions, as well as a tool for implementing a long-term development strategy. In the turbulent market conditions in which modern organizations operate, adaptability becomes both a factor of competitive advantage and a condition for survival. In this aspect, the implementation of technologies based on renewable energy sources allows an agile organization to achieve greater energy autonomy, as well as to optimize costs in the long term by reducing the risk associated with external price and regulatory shocks (IRENA, 2023; Tester et al., 2012; REN21, 2023).

The decentralization of decision-making and incremental approach to implementing innovations, characteristic of agile organizations, favor testing and gradual implementation of RES solutions, which include photovoltaic installations, heat pumps, energy storage systems, and microgrids (Roy, 2024). This approach allows for rapid adaptation to local conditions, scaling solutions depending on implementation results, and engaging employees in the technology adaptation process. This certainly increases their acceptance and efficiency of use (Jobert, Laborgne, Mimler, 2007; Sovacool, Ratan, 2012). Agile project management methodologies, based on iterative cycles of action, also allow for ongoing monitoring of the effectiveness of RES solutions and their corrections without the need to suspend the entire process (Haggett, 2011).

The use of renewable energy sources in agile organizations also helps to redefine the relationship between technology and organizational structure. Energy solutions based on prosumer models, intelligent energy management systems and integration with digital data platforms contribute to reducing the environmental footprint. They also allow for the generation of new sources of value that can be integrated with basic business processes. For example, the possibility of automated control of energy consumption depending on changing environmental conditions can be correlated with production planning, logistics or resource

management systems. This in turn leads to higher operational efficiency (Tester et al., 2012; Ansolabehere, Konisky, 2016).

The implementation of renewable energy in agile organizations also takes on a cultural and symbolic dimension. Investing in pro-ecological solutions can be considered an expression of responsibility and commitment to achieving goals that go beyond economic interests. This certainly strengthens stakeholder trust and contributes to building a positive image of the organization (Funk, 2023; Leiserowitz et al., 2025; Devine-Wright, 2007). In an organizational culture based on transparency, cooperation, and value orientation, which characterizes agile organizations, green transformation activities can be considered a natural extension of the management philosophy. Renewable energy functions here both as a technical resource and, at the same time, as a carrier of values and an integral part of the organizational identity (Fast et al., 2016; Sovacool, Ratan, 2012).

The use of renewable energy sources in agile organizations also creates an open space for creating cross-sector partnerships and developing local innovation ecosystems. The flexibility of structures and the ability to quickly prototype solutions lead to closer cooperation with technology providers, energy startups, research institutions and public administration (Gkeka-Serpetsidaki, 2024; Eleogu, Okonkwo, Daraojimba, 2024). Such connections support implementation processes, promote knowledge sharing, allow for testing new business models and the development of solutions adapted to local realities and needs (REN21, 2023; Haggett, 2011).

In conclusion, the use of renewable energy sources in agile organizations affects the overall organizational transformation. It includes both the modernization of infrastructure, as well as changes in the approach to management, relations with the environment and defining organizational values. In this approach, RES become a catalyst for innovation and an impulse for deeper reflection on the role of the organization in the processes of shaping a sustainable future (Tester et al., 2012; Ansolabehere, Konisky, 2016; Grant, Green, Mason, 2024).

### 1.3. Renewable Energy Sources in Agile Organizations – Balance of Benefits and Risks

The turbulence and unpredictability of the business environment means that organizations that want to maintain their competitiveness and ability to survive in a dynamic environment reach for solutions consistent with the idea of sustainable development. The implementation of renewable energy sources allows to reduce the impact of activities on the climate, as well as increase the energy independence and operational resilience of the organization (Wells, Lin, 2024). Technologies based on renewable energy are a real answer to the need to reduce risks related to fluctuations in fossil fuel prices, instability of raw material supplies or regulatory pressure. For agile organizations, whose attribute is flexibility and rapid adaptation, renewable energy is an important component of the long-term development strategy (Wells, Lin, 2024).

In an agile management model, an iterative approach and decentralized decision-making structures play an integral role. Such an organizational architecture promotes a culture of innovation in a gradual manner and adapted to local conditions. Renewable energy solutions, including photovoltaic installations, heat pumps, local energy storage or micro-grids, should be implemented on a pilot basis, tested and scaled depending on the results obtained (Gkeka-Serpetsidaki, 2024; Letcher, 2020). Such practices promote greater efficiency while increasing the level of acceptance of new technologies among employees. In addition, the use of agile methods allows for ongoing monitoring of implementation results, rapid identification of barriers and introduction of corrections without the need to suspend entire processes (Letcher, 2020).

The use of renewable energy in such organizations transforms the relationship between technology and operational structure. Modern energy management systems, integrated with digital tools and data platforms, allow organizations to reduce emissions, but also generate new value that supports business processes (IRENA, 2018; Batel, Devine-Wright, Tangeland, 2013). Thanks to solutions such as smart energy grids or automatic energy consumption control systems, it is possible to effectively manage production, logistics or resource use (IRENA, 2018; Jacobson et al., 2015; Styczynski, 2024).

There is also a cultural dimension to investing in renewable technologies. Pro-environmental activities strengthen the reputation of the organization and emphasize its commitment to social responsibility. This is reflected in a positive perception by stakeholders (Twidell, Weir, 2021; Gkeka-Serpetsidaki, 2024; Ellabban, Abu-Rub, Blaabjerg, 2014). In an organizational culture based on values, trust and cooperation, such decisions become a natural extension of the organizational mission. Renewable energy also becomes a carrier of meanings and an expression of organizational identity (Huijts, Molin, Steg, 2012; Hall, Ashworth, Devine-Wright, 2013).

Renewable energy sources are undoubtedly an impulse for building relationships between different sectors. Agile organizations, thanks to their openness to implementing innovations, are able to quickly engage in partnership initiatives. They engage technology suppliers, energy startups, research institutes and public administration (Larson, Lewis, 2023). Such mutual cooperation accelerates the process of implementing innovations, and also promotes the exchange of knowledge and the creation of common values (Wüstenhagen, Menichetti, 2012; Letcher, 2020; Van der Nat et al., 2024). Thanks to the flexibility of operation, it is possible to quickly adapt solutions to local needs and conditions. In addition, it can increase employment in the energy sector and support the development of competences in new professional areas (Twidell, Weir, 2021; Styczynski, 2024).

The implementation of RES in agile organizations leads to profound changes in the technological field, but also in the management and culture. The implementation of such solutions promotes the modernization of infrastructure, the reconstruction of business models

and the redefinition of relations with the environment (Wüstenhagen, Menichetti, 2012; Wells, Lin, 2024).

Renewable energy sources bring many strategic benefits, but it is also worth remembering that they require taking into account potential challenges. On the benefits side, the main benefits are the positive impact on the natural environment and climate, increased energy independence, the possibility of creating new jobs and improving the image of the organization as responsible and modern. On the other hand, there are also concerns, especially related to the initial investment costs, the potential increase in energy prices and the uncertainty about the impact of some technologies on human health and the environment. This balance requires careful management, implementation of agile management methods and support for implementation processes through education, transparency of actions and involvement of stakeholders.

### 1.4. Research Methodology

The aim of the conducted research was to identify the perception of benefits and threats related to the use of renewable energy sources in an agile organization. The basic assumption was to determine how respondents assess the impact of such solutions on the natural environment, the labor market, energy independence and economic and health aspects. The research aimed to deepen knowledge about social attitudes towards energy transformation, with particular emphasis on aspects important for organizations operating in the agility model. A research hypothesis was formulated, according to which the use of renewable energy sources in an agile organization is perceived by respondents as a solution that brings mainly environmental, social and strategic benefits, while taking into account concerns related to the potential increase in energy costs and possible side effects.

The research sought answers to questions about how respondents assess the impact of renewable energy sources on environmental protection, combating climate change, energy independence and the labor market. Attention was also paid to the assessment of potential threats, such as harmfulness to human health and the environment or an increase in energy prices. The research method used was a survey conducted in the period from January to February 2025 on a sample of 820 respondents. The data obtained as a result of the survey were then analyzed using the Multiple Correspondence Analysis technique. The aim of using this method was to identify relationships between qualitative variables and to capture response patterns, which allowed for a graphical presentation of the relationships in a two-dimensional space. The choice of MCA allowed for a better illustration of the patterns of perception of individual aspects of the use of renewable energy sources and facilitated the interpretation of multifactorial relationships between the attitudes of respondents.

In order to ensure interpretative consistency and enhance the validity of the respondents' answers, selected terms used in the survey were accompanied by explanatory notes. The term "energy independence" was defined as the reduction of an organization's or a country's reliance on external energy suppliers, particularly fossil fuels, in favor of local and renewable solutions.

The term “harmful to the environment” was explained in the questionnaire as the potential negative impact of RES technologies on ecosystems, landscape, soil, water or air quality, as well as interference with natural habitats. Such clarification aimed to reduce the risk of ambiguous interpretations and improve the reliability of the collected empirical data.

### 1.5. Presentation of Research Findings

The research aimed to diagnose the use of renewable energy sources in an agile organisation by analysing the opinions of 820 respondents (Table 1).

**Table 1.**
*Diagnosis of the use of renewable energy sources in an agile organization – benefits and threats (N = 820)*

| | Definitely not | I don't think so | I have no opinion | I guess so | Definitely yes |
|---|---|---|---|---|---|
| It helps protect the natural environment | 68 | 44 | 110 | 363 | 235 |
| Combats climate change | 81 | 87 | 115 | 278 | 259 |
| It helps reduce dependence on imported energy resources | 90 | 39 | 80 | 347 | 264 |
| It provides new jobs | 86 | 44 | 79 | 270 | 341 |
| It causes an increase in energy prices | 87 | 46 | 105 | 315 | 267 |
| It is harmful to the environment | 71 | 41 | 77 | 369 | 262 |
| It is harmful to humans | 81 | 43 | 131 | 341 | 224 |

Study: own.

Table 1 presents the distribution of 820 respondents’ answers to seven statements, taking into account a five-point rating scale. In the case of the statement that renewable energy sources help protect the natural environment, the largest number of respondents selected the answer “rather yes” – 363 people, followed by “definitely yes” – 235. Only 68 people definitely denied this statement, and 44 selected the answer “rather no”. 110 people declared no opinion.

For the statement on combating climate change, the answers were slightly more evenly distributed. 278 respondents indicated “rather yes” and 259 – “definitely yes”. Negative answers (“definitely no” and “rather no”) were given by 81 and 87 people, respectively, while 115 people remained undecided. With regard to reducing dependence on imported energy resources, 347 people considered it to be rather true, and 264 – definitely yes. “Definitely no” and “rather no” answers were given by 90 and 39 respondents, respectively. 80 people expressed no opinion.

In the context of creating new jobs, as many as 341 respondents strongly agreed with the statement, and 270 – rather yes. Negative answers were given by 86 ("strongly no") and 44 ("rather no") survey participants, respectively, while 79 people had no opinion. In relation to the possible impact of renewable energy sources on the increase in energy prices, the largest number of people – 315 – indicated the answer "rather yes", and 267 – "strongly yes". 87 people were strongly against this view, and 46 considered it rather untrue. The answer "I have no opinion" was selected by 105 respondents.

The question about the potential harmfulness of renewable energy sources for the environment was met with mainly positive responses in the sense of denying the thesis – 369 people stated that it was rather yes, and 262 – that it was definitely yes, which indicates a conviction about the lack of harmfulness. Negative answers – "definitely no" and "rather no" – were given by 71 and 41 respondents, respectively. 77 people remained undecided. Finally, in the case of the statement about the harmfulness of renewable energy sources for humans, 341 people indicated the answer "rather yes", and 224 – "definitely yes", which in this case should also be understood as rather a lack of agreement with the thesis. Negative answers to the statements – "definitely no" and "rather no" – were given by 81 and 43 respondents, respectively, while 131 people had no formed an opinion.

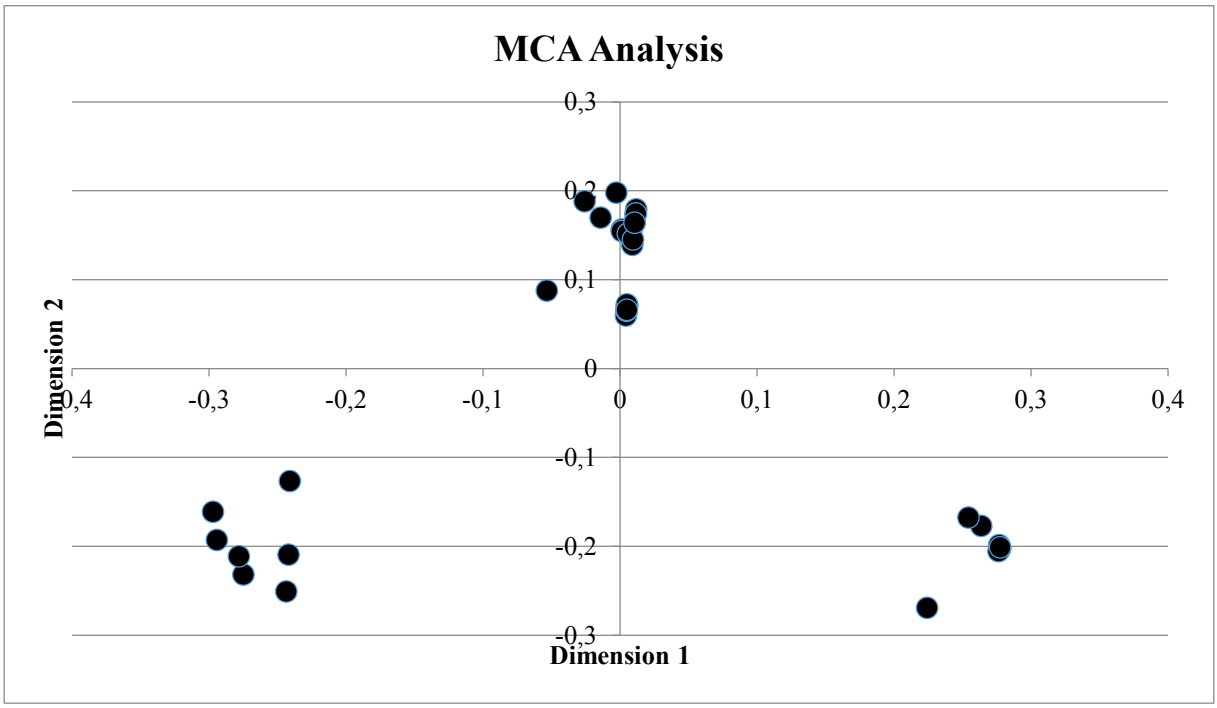



**Figure 1.** MCA analysis.

Study: own.

Figure 1 presents a graphical interpretation of multivariate correspondence analysis, used as a tool for dimension reduction and visualization of complex relationships between respondents' answers on the use of renewable energy sources in an agile organization. The analysis was conducted based on data from Table 1, which presents the distribution of 820 people's answers to seven statements regarding both the benefits and potential threats resulting from the implementation of such solutions.

The purpose of using MCA analysis was to simplify the structure of qualitative data by transforming it into a two-dimensional space, enabling the identification of response patterns and relationships between individual categories. Thanks to this method, it was possible to illustrate which responses are correlated and to what extent certain statements are perceived in a similar way by the study participants.

Figure 1 shows the distribution of response categories (such as “Strongly agree”, “Rather disagree”, etc.) for each of the statements in Table 1 along two dimensions. The horizontal axis (Dimension 1) and the vertical axis (Dimension 2) represent the main factors differentiating respondents’ attitudes. The coordinates of the points correspond to specific combinations of responses and illustrate their interrelationships and semantic distances. The closer the points corresponding to specific responses are to each other, the more similar they are in terms of the patterns of respondents’ assessments.

It is observed that certain categories of answers cluster in the graph space, which may indicate the existence of common perceptions or dominant narratives regarding certain aspects of renewable energy sources. For example, positive evaluations of benefits, such as environmental protection, combating climate change or creating jobs, may be grouped in one part of the graph, while answers indicating threats or concerns, such as potential harm or increased costs, may be grouped in another. This structure allows for the detection of not only the general trend, but also subtle differences in the perception of individual issues.

Applying MCA to the data in Table 1 therefore enables a better understanding of the internal dynamics of the ratings and common response patterns, which is a valuable complement to traditional tabular analysis. This enables a deeper interpretation of the results and the identification of potential attitudinal segments among the study population.

## 2. Discussion

The results of the conducted research allow for the formulation of several important conclusions concerning the perception of the use of renewable energy sources in an agile organization. Based on the respondents' declarations, there is a clear conviction about the dominant benefits that result from the implementation of such solutions. Respondents most often indicated the positive impact of natural energy sources on the protection of the natural environment. Combating climate change was also important. A significant part of the respondents also considered that their use promotes energy independence by reducing dependence on resource imports. It can also be an impulse for the creation of new jobs.

Despite the fact that the main assessments were positive, the existing fears and scepticism were not ignored. Some respondents expressed the belief that the implementation of renewable energy sources could lead to an increase in energy costs. In turn, questions concerning the harmfulness to the environment and people were mostly met with answers suggesting a lack of such concerns. Nevertheless, the presence of undecided people indicates a certain level of uncertainty or lack of sufficient knowledge in this area.

The interpretation of the distribution of responses in the tabular analysis indicates a clear trend of pro-ecological and pro-modern opinions. Respondents overwhelmingly perceive the strategic importance of energy transformation. They also identify it with activities consistent with the goals of sustainable development. This attitude may result from the growing social awareness of ecology, as well as from the narrative observed in the public debate, which promotes green transformation as an opportunity, not a burden for organizations and societies. The use of multidimensional correspondence analysis allowed for an in-depth interpretation of the interdependencies between the responses. The MCA graph showed that positive responses to statements of a beneficial nature (environmental protection, combating climate change, creating jobs, energy independence) are grouped in a two-dimensional space in a relatively coherent manner. This confirms their mutual connection in the perception of respondents. It also indicates that people who perceive one benefit are very likely to indicate the others as well. In turn, responses concerning threats, although they are generally less frequent, are distributed in a more dispersed manner, which suggests a less uniform assessment of these aspects. This may indicate that potential threats are not perceived as dominant or unambiguous.

The presence of a significant number of neutral responses, especially in relation to controversial aspects such as the increase in energy prices or the harmfulness of technology, indicates the need for further social education and providing reliable information on the real effects of implementing renewable energy sources. Neutrality in responses may also mean a lack of a well-established opinion or uncertainty resulting from insufficient knowledge of the subject. In light of the data obtained, it can be stated that the social perception of renewable energy sources in the aspect of an agile organization is clearly positive and oriented towards benefits, both environmental, strategic and social. At the same time, certain areas of uncertainty are noticeable , which may constitute a challenge in the process of implementing these solutions, but also a starting point for shaping a more effective communication and educational policy in the field of energy transformation.

Based on the obtained research results and formulated conclusions, it seems reasonable to formulate recommendations supporting organizations in effective and responsible implementation of renewable energy sources in the agile management model. First of all, it is worth emphasizing that the dominant positive attitude among respondents towards energy transformation creates favorable conditions for initiating pro-environmental activities. Therefore, organizations are recommended to actively use social acceptance as a resource that supports the implementation of RES technologies and as an element of building reputation and social responsibility.

Due to the benefits perceived by respondents in the form of increased employment and increased energy independence, it is reasonable to integrate the strategy of investment in renewable energy sources with a long-term sustainable development policy and local economic initiatives. The introduction of energy solutions can be perceived as an ecological necessity, but also as a tool for developing employee competences and a source of innovation and

competitive advantage. In this aspect, the creation of new job roles supporting both the implementation and ongoing maintenance of RES systems is of particular importance. The uncertainty and neutrality in the responses observed among some respondents, primarily in relation to potential threats and costs, indicates the need to increase the transparency of communication and education among planned investments. It is recommended that organizations undertake information activities aimed at dispelling fears related to alleged harmfulness or increased costs, presenting empirical data, benefits resulting from the use of renewable energy sources and good practices. These activities should be directed to both employees and local communities and external stakeholders.

In addition, taking into account the different attitudes towards risk and the complexity of assessing innovative technologies, it is recommended to use participatory and consultative methods. They enable the voice of employees and business partners to be aligned in the decision-making process. Building an open dialogue around renewable energy can increase trust, raise the level of involvement in the transformation process and minimize employee resistance. Finally, in light of the MCA analysis, which showed the interconnections between positive assessments of various aspects of renewable energy sources, it is recommended to formulate coherent communication narratives that combine ecological, social and economic benefits into a single message system. This approach increases the chances that the organization will be perceived as modern, agile, responsible and at the same time well-prepared for the challenges of the future.

To enhance the practical applicability of the research findings, a structured, phased model for implementing renewable energy sources in agile organizations has been proposed. The first stage involves diagnosing internal organizational capacities and assessing the level of technological and cultural readiness for energy transformation. The second stage assumes the implementation of pilot projects in selected units or locations, with the use of monitoring and evaluation tools. The third stage focuses on scaling up proven solutions, integrating them with existing management systems, and simultaneously conducting educational activities addressed to employees and external stakeholders. The fourth stage concerns long-term innovation and risk management, based on iterative improvement of solutions and the development of partnerships supporting sustainable development.

From the perspective of future research, it is worth considering the use of qualitative methods. Such approaches would allow for capturing more subtle factors, such as individual motivations or concerns related to the implementation of renewable energy sources within agile organizations. This type of analysis could complement the obtained quantitative results and provide a deeper understanding of respondents' attitudes. It also seems justified to broaden the research scope to include other industries and to take into account geographical and cultural differences. This would enable a more comprehensive understanding of the local contexts in which green solutions are implemented. Longitudinal studies would bring additional value,

as they allow for tracking changes in attitudes over time, particularly in light of evolving energy policies and the development of environmental technologies.

## 3. Conclusions

Comparing the research results with the findings of other researchers, one can see both similarities and differences in the perception of renewable energy sources. The respondents taking part in the study clearly emphasized the positive impact of renewable energy sources on environmental protection, combating climate change, energy independence and the situation on the labor market. Similar trends were observed in studies conducted internationally. Funk (2023) indicates that the development of alternative energy sources is a key priority for societies, and energy transformation is perceived as a desirable direction of development. The convergence of these observations is also confirmed by the research of Leiserowitz et al. (2025), in which respondents are in favor of a wider use of renewable energy. This is undoubtedly related to concern for the environment and energy security.

The perception of renewable energy sources as a factor supporting the development of the labor market is also reflected in the literature. According to the findings of the International Renewable Energy Agency, this sector is developing dynamically and generating demand for new skills and jobs. This is an important argument for organizations deciding to invest in low-emission technologies (IRENA, 2023). In our own study, respondents also showed a tendency to perceive RES as a development opportunity for the labor market. It can be concluded that the social understanding of the energy transformation goes beyond the purely ecological perspective and also includes economic issues.

At the same time, both in our own research and in the literature on the subject, certain concerns and uncertainties related to the implementation of RES are noticeable. This is particularly noticeable in the aspect of possible costs or side effects. In some cases, respondents expressed a neutral position towards statements about the potential harmfulness of the technology or the impact on energy prices. This indicates a lack of a clear opinion or insufficient knowledge. Funk (2023) also indicates that despite the general support for energy transformation, caution appears in the context of changes that could affect the current way of life and thus arouse uncertainty. Sovacool et al. (2012) also note that despite the fact that the majority of respondents do not see significant health risks associated with RES, a small number of respondents report concerns, especially regarding wind and photovoltaic technologies.

Analyzing the aforementioned comparisons, it can be stated that a positive social attitude towards renewable energy sources is obtained both on a local scale and on a global scale. This indicates a growing acceptance of energy transformation as a solution beneficial from the environmental, strategic and social point of view. At the same time, there is a noticeable need

to continue educational and communication activities that can dispel doubts and simultaneously build more conscious and stable attitudes towards the implementation of renewable energy sources in social and organizational structures.

The limitations of the conducted research mainly concerned the declarative nature of the collected data, which was based on the subjective opinions of respondents. This may be associated with the risk of declarative social compliance. In addition, the study was cross-sectional, which makes it impossible to capture changes in attitudes over time and their dependence on dynamic external factors, such as the economic situation or energy policy. The selection of the sample, although large, did not take into account geographical or industry diversity. This may limit the possibility of generalizing the results to all types of organizations operating in the agile model. Additionally, the five-point scale used did not allow for capturing more nuanced attitudes and reasons behind the selection of individual answers.

Future research directions may focus on in-depth analysis of barriers related to the implementation of renewable energy sources in different types of organizations and on the analysis of motivations, taking into account the industry context, culture and local regulatory conditions. It also seems reasonable to conduct longitudinal studies that would allow for capturing changes in attitudes over time and their dependence on external factors such as climate policy, economic situation or technological progress. It is also worth expanding the research to include the perspective of organizational decision-makers and operational employees. This will allow for a multidimensional assessment of the organization's readiness for energy transformation. Additionally, it is advisable to use qualitative and mixed methods, which will allow for a better understanding of the contexts, intentions and hidden mechanisms influencing decisions regarding investments in renewable energy sources.

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# DIVERSIFICATION OF REVENUE IN FMCG SECTOR ENTERPRISES

Patrycja ŁUCAK

Jan Kochanowski University of Kielce, Management Institute; patrycja.lucak@ujk.edu.pl,
ORCID: 0009-0005-3518-625X

**Purpose:** The aim of this study is to analyse and evaluate FMCG sector enterprises from the perspective of revenue analysis in the context of their diversification. The research period covers the years 2019-2023. During the analysed period, there were two key moments when enterprise revenues could have been destabilised (the year 2020 and the year 2023).
**Design/methodology/approach**: A literature review was carried out. In addition the study applied the Hirschman-Herfindahl measurement concept, which developed the HHI Index for revenue diversification. During the analysis, the share of sales revenue, other operating revenue, and financial revenue in the total revenue was determined. Particular attention was given to the structural composition of revenue generated from sales.
**Findings:** The revenue diversification index for FMCG sector companies, as determined by the HHI index, shows values close to 1, indicating a strategy of revenue concentration. The analysis of the structural composition of revenue confirms that FMCG sector enterprises generate income mainly from the sale of goods, materials, and products. When examining the structural composition of revenues using the HHI index, values close to 1 were again obtained, indicating the absence of a diversification strategy.
**Research limitations/implications**: The empirical study used the convenience sampling method, therefore the obtained results cannot be generalized to the entire FMCG sector.
**Practical implications:** The article reveals that companies of sector FMCG apply a strategy of revenue concentration.
**Originality/value:** The article partially fills the research gap in empirical studies on revenues and their diversification. It also provides a basis for a later, in-depth stage of empirical research on the impact of revenues (and incurred costs) on the financial result.
**Keywords:** revenue, diversification, FMCG sector.
**Category of the paper:** Research paper.

## 1. Introduction

Revenues constitute one of the most important categories in the operation of an enterprise (Czubakowska, Gabrusiewicz, Nowak, 2009). Alongside costs, they are the fundamental volume shaping the financial result. The financial result of an enterprise reflects the effect of

the unit's operations over a given period. It is the difference between the revenues achieved and the costs incurred. The actions of an enterprise aim to achieve a surplus of revenues over costs. Therefore, the most favorable solution is the maximisation of revenues (and their diversification) and the optimisation of costs.

The aim of this study is to analyse and evaluate FMCG sector enterprises from the perspective of revenue analysis in the context of their diversification. The analysis of diversification strategies was dealt with by classics of management, such as Chandler A.D. (Chandler, 1997), Ansoff H.I. (Ansoff, 1957) or Porter M.E. (Porter, 1987). In Poland, there is a research gap in this subject. Despite a relatively good recognition of the motives and premises for implementing diversification, there are still no clear research results assessing its effectiveness (Benito-Osorio, Guerras-Martín, Zuñiga-Vicente, 2012). The study uses the Hirschman-Herfindahl Index (HHI) concept for revenue diversification measurement. The research period covers the years 2019-2023. During the analysed period, there were two moments when enterprise revenues could have been destabilised. The year 2020 was a time of uncertain epidemic and economic situation, while the year 2023 saw deep changes in the credit market and an increase in inflation. The aforementioned situations hampered consumption plans, which could be reflected in the enterprise's revenues. The FMCG sector is characterised by the introduction of a high volume of products into circulation, which is why enterprises from this sector were analysed. The FMCG market is one where products with fast rotation and relatively low production costs are produced and sold (Bilińska-Reformat, 2010). This sector provides essential goods necessary for standard functioning. The FMCG industry is studied on many levels, for example: Karczewska M. and Śmigielska G. analysed the FMCG sector in terms of its development in the light of the transaction costs theory (Karczewska, Śmigielska, 2012); Rumniak P. assessed the premises for shaping profitability and financial liquidity (Rumniak, 2009); Liczmańska K. focused her research on product brand strategies on the FMCG market (Liczmańska, 2016); Makar M. and Karkula M. presented the SCCT concept and the possibilities of its application on the example of a retail enterprise (Makar, Karkula, 2018). However, in the literature there are no studies referring to and reporting on the subject of revenue diversification by companies in this industry.

## 2. Literature review

Defining revenues is a complex process. In business practice, revenue definitions are inherently linked to accounting procedures. As a result, this leads to the determination of revenue being intertwined with the determination of the moment of its occurrence and the obligation to measure revenue since, in accounting, the measurement of phenomena is a condition for their reflection in financial statements (Cieciura, 2010). According to the

definition in the Accounting Act, revenues and gains refer to the probable inflow of economic benefits within a reporting period, with a reliably measurable value, in the form of an increase in assets or a decrease in liabilities, which leads to an increase in equity or a reduction in its deficit, in a manner other than contributions made by shareholders or owners (Accounting Act, 1994). This definition implies that revenue and profit are synonymous concepts, yet in practice, they are not identical. Profits are positions in the profit and loss account that meet the definitional requirements of revenues but, in reality, represent the surplus of revenues over the costs incurred to generate them (Dreliszak, Kania, 2009). Revenues, on the other hand, are presented separately without deducting the costs associated with their generation. The literature emphasises the need for a more precise distinction between these categories while acknowledging the challenges involved. In accounting theory, revenues are defined as the stream of goods and services created by a given enterprise within a specific period, which can be described as the enterprise's output (Hendriksen, Van Breda, 2002). Revenue is the monetary expression of aggregated products or services delivered by enterprises to consumers within a given timeframe (American Accounting Association, Committee on Accounting Concepts and Standards, 1957). Revenues in the reporting period may result from various activities undertaken by the entity and should be determined based on the overriding accrual principle. The basis for revenue calculation is fair value, typically expressed as the net selling price (e.g., in the case of a traditional sales transaction) (Walińska, 2010). The most common criterion for classifying revenues is the type of business activity conducted by the enterprise (Kowalska, 2014).

A business entity may engage in various types of activities, each associated with generating revenues and incurring costs. For the purposes of the profit and loss account, business activities are divided into two main types: operational activities (core and other) and financial activities (Nowak, 2016). The primary goal of an entity's core operational activities is to fulfill its fundamental objectives, for which it was established. Operational revenues are generated through the sale of products, construction works, services, and merchandise (Gabrusiewicz, 2009). Within operational activities, these revenues are classified as product sales revenue, merchandise sales revenue, and material sales revenue. Other operational activities refer to the economic activities of an entity that are indirectly related to its core operations. Other operating revenues may originate from various sources. From the perspective of their origin, the following categories of other operating income can be distinguished: group 1 - revenues from current period events, group 2 - revenues from provision reversals (unrelated to financial activities), group 3 - revenues from revaluation of the value of non-financial assets and liabilities, and group 4 - revenues from previous years' settlements (Walińska, 2010). Revenues related to a company's financial activities are referred to as financial revenue. Financial revenue necessitates the management of cash and securities.

The achievement of a company's primary objective—profit maximisation—results from the interaction between revenue and costs. Cost optimisation is one of the key decision-making areas in business management. To enhance efficiency, revenue optimisation is equally important. Therefore, a crucial aspect of business strategy is the appropriate planning of revenue levels. One method for revenue planning is forecasting based on historical revenue data recorded in past financial accounts (Kozicki et al., 2018). To improve financial stability and reduce dependence on a single source of income, companies implement diversification. Diversification involves spreading business activities across multiple areas and allocating resources across different sectors (Urbanowska-Sojkin, Banaszyk, Witczak, 2007). This strategy entails reallocating the company's available resources toward activities that are fundamentally different from those previously conducted. It requires engagement in new industries, technologies, and markets, often involving new products for the company (Ansoff, 1971). Revenue diversification is a strategy that entails varying the methods and sources of revenue generation within a company. In practice, this means expanding operations to include new products, services, markets, or customer segments, allowing the company to balance potential business risks and increase growth opportunities.

## 3. Empirical research methodology

The study examines FMCG sector enterprises. The FMCG market produces and sells fast-moving consumer goods with high turnover rates and relatively low production costs. The FMCG abbreviation stands for Fast Moving Consumer Goods (Bilińska-Reformat, 2010). The FMCG sector includes both food and non-food frequently purchased goods (Kowalska, 2012). The companies analyzed are Dino, Eurocash Group, Jeronimo Martins, Hortex and Żabka. They were selected due to their high popularity on the Polish market among retail customers, but also due to their share in the FMCG market in Poland. According to GfK Consumer Panel Services data, in 2023 Jeronimo Martins recorded the highest sales revenue in this sector. The Eurocash Group came in third, followed by Dino and Żabka. In contrast, due to a significant decrease in the volume of retail sales in the juice and non-carbonated beverage category in 2023 (by 7.6%), Hortex was selected for analysis. However, the empirical study used the convenience sampling method, therefore the obtained results cannot be generalized to the entire FMCG sector. The revenue of the analysed companies in this sector has shown consistent growth during the examined period (2019-2023). The analysis of selected financial statement elements aims to determine the extent to which these companies diversify their revenue sources. This study utilises the Hirschman-Herfindahl Index (HHI) for revenue diversification measurement. The HHI values range from 0 to 1. A value closer to 0 indicates greater diversification, whereas a value approaching 1 signifies a revenue concentration

strategy, which is the opposite of revenue diversification. A higher diversification score is advantageous as it leads to lower revenue volatility, whereas greater revenue concentration is beneficial for building financial potential (Chikoto, Ling, Neely, 2016). In this analysis, the HHI index was used to measure revenue concentration and diversification. The index was calculated using the following formula:

$$\mathrm{DI} = \left(\frac{r1}{R}\right)^2 + \left(\frac{r2}{R}\right)^2 + \ \ldots\ + \left(\frac{rn}{R}\right)^2 = \sum_{i=1}^{N} \left(\frac{ri}{R}\right)^2, i = 1, \ldots, n,$$

where:

DI = Revenue Diversification.

N = Number of Revenue Sources.

r = Revenue from i-th Source.

R = Total Revenue from All Sources.

The panel analysis based on the results obtained through this methodology provides valuable insights into the current state of revenue diversification among the analysed entities during the period 2019-2023. The study assesses revenue composition, including sales revenue, other operational revenue, and financial revenue. Additionally, it examines the structure of sales revenue and recalculates the HHI index. The revenue figures under investigation are derived from accounting records (in compliance with the Accounting Act regulations) and are reported in financial statements.

The selected time frame was determined based on several factors, including significant external economic events. In 2020, the COVID-19 pandemic led to economic uncertainty, mandatory isolation measures, and restrictions, which could have influenced consumer spending patterns. Additionally, in 2022, the outbreak of war in Ukraine had a substantial impact on business operations. Furthermore, in 2023, credit market changes and rising inflation affected economic conditions. Factors such as inflation rates, interest rates, exchange rate fluctuations, energy prices, and disrupted supply chains were influenced not only by ongoing military actions and sanctions imposed on Russia but also by the monetary policies of central banks and the fiscal policies of various governments. All these factors may have been reflected in the revenue patterns of the analysed companies during the period 2019-2023.

## 4. Results of the empirical research

The analysed entities exhibited consistent revenue growth during the period 2019-2023. Among them, Dino recorded the highest total revenue increase of +237%, followed by Żabka

with +128%. The lowest revenue growth was observed in Wawel (+19%) and Grupa Żywiec (+20%).

The analysis of the proportion of different revenue types within the total revenue of these companies revealed that in all examined entities, the primary source of revenue was sales-related revenue. Sales revenue accounted for over 98% of total revenue across all businesses.

**Table 1.**
*Share of Different Types of Revenue in the Total Revenue of FMCG companies (2019-2023) (in thousand PLN)*

| Company | Type of Revenue | Years | | | | | Change 2023-2019 |
|---|---|---|---|---|---|---|---|
| | | 2019 | 2020 | 2021 | 2022 | 2023 | |
| Dino | Sales Revenue | 7 624 411 | 10 115 839 | 13 339 312 | 19 764 769 | 25 658 552 | 18 034 141 |
| | Other Operating Revenue | 6 283 | 6 374 | 12 755 | 14 262 | 11 347 | 5 064 |
| | Financial Revenue | 7 218 | 8 777 | 5 757 | 9 979 | 36 409 | 29 191 |
| | Total | 7 637 912 | 10 130 990 | 13 357 824 | 19 789 010 | 25 706 308 | 18 068 396 |
| Eurocash | Sales Revenue | 24 852 240 | 25 411 041 | 26 281 430 | 30 857 665 | 32 451 963 | 7 599 723 |
| | Other Operating Revenue | 87 034 | 147 446 | 110 728 | 77 960 | 64 877 | -22 157 |
| | Financial Revenue | 36 307 | 31 345 | 28 639 | 58 727 | 67 121 | 30 814 |
| | Total | 24 977 600 | 25 591 852 | 26 422 818 | 30 996 374 | 32 585 984 | 7 608 384 |
| Jeronimo Martins | Sales Revenue | 55 573 747 | 61 216 804 | 68 246 695 | 85 034 775 | 98 022 928 | 42 449 181 |
| | Other Operating Revenue | 46 726 | 71 082 | 37 544 | 105 762 | 66 217 | 19 491 |
| | Financial Revenue | 24 256 | 22 811 | 134 992 | 230 162 | 281 977 | 257 721 |
| | Total | 55 644 729 | 61 310 697 | 68 419 231 | 85 370 699 | 98 371 122 | 42 726 393 |
| Hortex | Sales Revenue | 343 919 | 582 217 | 372 935 | 409 636 | 442 802 | 98 883 |
| | Other Operating Revenue | 1 133 | 925 | 19 836 | 5 713 | 5 911 | 4 778 |
| | Financial Revenue | 1 448 | 1 747 | 596 | 1 405 | 1 788 | 340 |
| | Total | 346 500 | 584 889 | 393 367 | 416 754 | 450 501 | 104 001 |
| Żabka | Sales Revenue | 8 515 311 | 10 189 949 | 12 363 188 | 15 750 953 | 19 408 711 | 10 893 400 |
| | Other Operating Revenue | 16 137 | 17 023 | 23 098 | 23 294 | 25 903 | 9 766 |
| | Financial Revenue | 44 032 | 157 368 | 77 591 | 91 569 | 205 945 | 161 913 |
| | Total | 8 575 480 | 10 364 340 | 12 463 877 | 15 865 816 | 19 640 559 | 11 065 079 |

Cont. table 1.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Grupa Żywiec | Sales Revenue | 3 199 242 | 3 603 704 | 3 482 126 | 3 870 151 | 3 953 755 | 754 513 |
| | Other Operating Revenue | 8 556 | 16 062 | 127 | 6 040 | 1 330 | -7 226 |
| | Financial Revenue | 104 500 | 0 | 75 664 | 29 205 | 23 171 | -81 329 |
| | Total | 3 312 298 | 3 619 766 | 3 557 917 | 3 905 396 | 3 978 256 | 665 958 |
| Wawel | Sales Revenue | 564 440 | 488 621 | 517 949 | 585 142 | 663 444 | 99 004 |
| | Other Operating Revenue | 760 | 6 239 | 735 | 1 092 | 1 417 | 657 |
| | Financial Revenue | 3 657 | 2 095 | 1 141 | 8 932 | 12 013 | 8 356 |
| | Total | 568 857 | 496 955 | 519 825 | 595 166 | 676 874 | 108 017 |

Source: Own study based on financial statements.

The primary revenue stream for the analysed entities comes from sales revenue. Other operational and financial revenues constitute only a marginal share of the total revenue of these companies. Other operating revenue mainly derives from the disposal of non-financial fixed assets, while financial revenue primarily comes from interest. The most significant changes in terms of revenue derived from other operating revenue were observed in companies such as Hortex, Wawel, Grupa Żywiec, and Eurocash. Hortex, in particular, experienced a substantial increase, with growth reaching 422% from 2019 to 2023.

**Table 2.**
*Percentage share of different types of revenue in the total revenue of FMCG companies in 2019-2023 (in thousand PLN)*

| Company | Type of Revenue | Years | | | | | Change 2023-2019 (%) |
|---|---|---|---|---|---|---|---|
| | | 2019 | 2020 | 2021 | 2022 | 2023 | |
| Dino | Sales Revenue | 99,82% | 99,85% | 99,86% | 99,88% | 99,81% | 237% |
| | Other Operating Revenue | 0,08% | 0,06% | 0,10% | 0,07% | 0,04% | 81% |
| | Financial Revenue | 0,09% | 0,09% | 0,04% | 0,05% | 0,14% | 404% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 237% |
| Eurocash | Sales Revenue | 99,50% | 99,29% | 99,46% | 99,55% | 99,59% | 31% |
| | Other Operating Revenue | 0,35% | 0,58% | 0,42% | 0,25% | 0,20% | -25% |
| | Financial Revenue | 0,15% | 0,12% | 0,11% | 0,19% | 0,21% | 85% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 30% |
| Jeronimo Martins | Sales Revenue | 99,87% | 99,85% | 99,75% | 99,61% | 99,65% | 76% |
| | Other Operating Revenue | 0,08% | 0,12% | 0,05% | 0,12% | 0,07% | 42% |
| | Financial Revenue | 0,04% | 0,04% | 0,20% | 0,27% | 0,29% | 1063% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 77% |
| Hortex | Sales Revenue | 99,26% | 99,54% | 94,81% | 98,29% | 98,29% | 29% |
| | Other Operating Revenue | 0,33% | 0,16% | 5,04% | 1,37% | 1,31% | 422% |
| | Financial Revenue | 0,42% | 0,30% | 0,15% | 0,34% | 0,40% | 23% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 30% |
| Żabka | Sales Revenue | 99,30% | 98,32% | 99,19% | 99,28% | 98,82% | 128% |
| | Other Operating Revenue | 0,19% | 0,16% | 0,19% | 0,15% | 0,13% | 61% |
| | Financial Revenue | 0,51% | 1,52% | 0,62% | 0,58% | 1,05% | 368% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 129% |

Cont. table 2.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Grupa Żywiec | Sales Revenue | 96,59% | 99,56% | 97,87% | 99,10% | 99,38% | 24% |
| | Other Operating Revenue | 0,26% | 0,44% | 0,00% | 0,15% | 0,03% | -84% |
| | Financial Revenue | 3,15% | 0,00% | 2,13% | 0,75% | 0,58% | -78% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 20% |
| Wawel | Sales Revenue | 99,22% | 98,32% | 99,64% | 98,32% | 98,02% | 18% |
| | Other Operating Revenue | 0,13% | 1,26% | 0,14% | 0,18% | 0,21% | 86% |
| | Financial Revenue | 0,64% | 0,42% | 0,22% | 1,50% | 1,77% | 228% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 19% |

Source: Own study based on financial statements.

The company Hortex recorded its highest increase in other operating revenue in 2021. This was due to income included in other operating revenue from sources such as licenses, IT services, marketing support, packaging sales, and re-invoicing. As a result, other operating income accounted for 5.04% of the company's total revenue that year. In the following years, this share decreased to 1.37% in 2022 and 1.31% in 2023.

Another company that experienced a significant increase in other operating revenue is Wawel, with an 86% growth between 2019 and 2023. The most substantial increase occurred in 2020, mainly due to subsidies received from the Voivodeship Labour Office. These funds came from the Guaranteed Employee Benefits Fund to support job protection by co-financing the wages of employees affected by economic downtime or reduced working hours due to the COVID-19 pandemic. The total subsidy amounted to 5,263 thousand PLN. In 2021, the level of other operating revenue was similar to that of 2019. However, in 2022 and 2023, a significant portion of this category came from gains on the disposal of non-financial fixed assets and subsidies.

Among the analysed companies, there are also those showing a declining trend in other operating revenue. These include Eurocash and Grupa Żywiec.

The Eurocash company is an example of a business where other operating revenue decreased by 25% during the analysed period of 2019–2023. However, in 2020, this revenue increased by 69% compared to the previous year. This growth was significantly influenced by the valuation of Frisco S.A. shares for sale purposes and the settlement of VAT - related deposits. In the following years, the value of other operating revenue declined, reaching its lowest level in 2023. Despite the low share (0.58% in 2020, 0.20% in 2023) of other operating revenue in total revenue, its structure is diversified. This income is derived primarily from: contractual charges, other sales, subleasing of premises, disposal of tangible fixed assets, compensations, and donations. In Grupa Żywiec, a decrease of 84% in other operating revenue was observed. The primary source of this revenue was dividends, which reached its highest level in 2021 but dropped to its lowest level in 2023.

Another category of revenue is financial revenue, which represents the smallest percentage share, generally below 1% of total company revenue. However, despite its low overall contribution, some businesses recorded significant growth in financial revenue during 2019-

2023. The largest increase was observed in Jeronimo Martins and Dino. In contrast, Grupa Żywiec experienced a decline in financial revenue.

Jeronimo Martins achieved a financial revenue increase of +1063% over the analysed period. The most significant growth was recorded in 2021 (+492% compared to the previous year), primarily due to dividend payments. In the following years (2022 and 2023), interest income played a major role in shaping financial revenue.

Dino is another company that experienced a significant rise in financial revenue, with an increase of +404% from 2019 to 2023. In 2020, Dino reported the lowest financial revenue within the examined period, but in 2021, it recorded its highest growth (+105%), maintaining an upward trend through 2023. The company's main sources of financial revenue include cash discounts, which saw the largest increase in 2023 (+75% year-over-year), and interest income, which was at its lowest level in 2021 and peaked in 2022.

In contrast, Grupa Żywiec recorded a decline of -78% in financial revenue over the period. The highest value was reported in 2019, primarily due to gains from the redemption of shares in subsidiaries. Between 2021 and 2023, the company's financial revenue mainly originated from the refund of overpaid excise tax. Based on a submitted claim for reimbursement of excise tax overpaid between 2007 and 2018 on flavoured beers, Grupa Żywiec also received interest refunds on the overpaid tax, which were reported as additional financial revenue.

Table 3 presents the diversification levels of revenue sources in FMCG companies, measured using the HHI index. Assessing these levels allows company executives to better understand revenue composition and identify potential strategic adjustments.

**Table 3.**
*Revenue diversification in the FMCG sector (2019-2023)*

| Company | Years | | | | | Change 2023-2019 |
|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2021 | 2022 | 2023 | |
| Grupa Żywiec | 0,93 | 0,99 | 0,96 | 0,98 | 0,99 | +0,05 |
| Dino | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 0,00 |
| Eurocash | 0,99 | 0,99 | 0,99 | 0,99 | 0,99 | 0,00 |
| Jeronimo Martins | 1,00 | 1,00 | 0,99 | 0,99 | 0,99 | 0,00 |
| Żabka | 0,99 | 0,97 | 0,98 | 0,99 | 0,98 | -0,01 |
| Wawel | 0,98 | 0,97 | 0,99 | 0,97 | 0,96 | -0,02 |
| Hortex | 0,99 | 0,99 | 0,90 | 0,97 | 0,97 | -0,02 |

Source: Own elaboration.

The calculated HHI index indicates that none of the analysed FMCG companies implement a revenue diversification strategy. The analysed entities show an index close to 1, which signifies revenue concentration. Over the examined years, Grupa Żywiec increased its index value by 0.05, in contrast to Żabka and Wawel, whose indexes decreased (Żabka by -0.01, Wawel by -0.02). The remaining companies consistently maintained the same index value throughout the entire period. The changes recorded between 2019 and 2023 are minor and do not affect the assessment of these entities' revenue diversification levels. Based on these findings, a deeper analysis of the revenue generated through sales was conducted. The product

structure of sales revenue was assessed, followed by a recalculation of the HHI index for these values. Table 4 presents the structure of revenues by types of products and services, while Table 5 displays the percentage share of the components of sales revenue.

**Table 4.**
*Structure of revenues by types of products and services of FMCG sector Companies in 2019–2023 (in monetary terms)*

| Company | Type of Activity | Years | | | | |
|---|---|---|---|---|---|---|
| | | 2019 | 2020 | 2021 | 2022 | 2023 |
| Dino | Service Sales | 15 973 | 21 615 | 31 173 | 75 320 | 132 998 |
| | Goods Sales | 7 608 438 | 10 094 224 | 13 308 139 | 19 689 449 | 25 525 554 |
| | Total | 7 624 411 | 10 115 839 | 13 339 312 | 19 764 769 | 25 658 552 |
| Eurocasch | Goods Sales | 24 719 807 | 25 284 125 | 26 166 936 | 30 723 669 | 32 331 090 |
| | Service Sales | 127 140 | 118 050 | 108 376 | 127 934 | 117 176 |
| | Materials Sales | 5 293 | 8 866 | 6 118 | 6 062 | 3 697 |
| | Total | 24 852 240 | 25 411 041 | 26 281 430 | 30 857 665 | 32 451 963 |
| Jeronimo Martins | Product Sales | 1 234 004 | 1 319 404 | 1 500 782 | 2 085 236 | 245 420 |
| | Goods and Materials Sales | 54 339 743 | 59 897 401 | 66 745 914 | 82 949 539 | 97 777 508 |
| | Total | 55 573 747 | 61 216 804 | 68 246 695 | 85 034 775 | 98 022 928 |
| Hortex | Own Product Sales | 323 164 | 504 062 | 365 905 | 398 067 | 421 577 |
| | Industrial Product Sales | 5 578 | 55 228 | 6 989 | 11 562 | 21 223 |
| | Service Sales | 12 573 | 21 757 | 0 | 0 | 0 |
| | Other | 2 604 | 1 170 | 41 | 7 | 3 |
| | Total | 343 919 | 582 217 | 372 935 | 409 636 | 442 803 |
| Żabka | Sales Revenues under Franchise Agreement | 8 515 311 | 10 135 684 | 12 304 173 | 15 662 828 | 19 258 160 |
| | Wholesale and Retail Sales in Own Stores | 35 039 | 19 309 | 16 339 | 35 035 | 60 440 |
| | Commission from Sales Intermediation | 26 998 | 34 956 | 37 739 | 40 322 | 57 494 |
| | Other | | | 4 937 | 12 768 | 32 617 |
| | Total | 8 577 348 | 10 189 949 | 12 363 188 | 15 750 953 | 19 408 711 |
| Grupa Żywiec | Sales Revenues from Products, Goods, Materials | 3 153 947 | 3 566 755 | 3 459 279 | 3 841 052 | 3 922 178 |
| | Service Sales | 45 295 | 36 949 | 22 847 | 29 099 | 31 577 |
| | Total | 3 199 242 | 3 603 704 | 3 482 126 | 3 870 151 | 3 953 755 |
| Wawel | Product Sales | 543 811 | 476 258 | 499 372 | 561 587 | 631 688 |
| | Goods and Materials Sales | 12 953 | 6 791 | 11 140 | 13 313 | 18 968 |
| | Retail Sales | 7 676 | 5 572 | 7 437 | 10 242 | 12 788 |
| | Total | 564 440 | 488 621 | 517 949 | 585 142 | 663 444 |

Source: Own study based on financial statements.

**Table 5.**
*Structure of Revenues by Types of Products and Services of FMCG Companies in 2019–2023 (Percentage Breakdown)*

| Company | Type of Activity | Years | | | | |
|---|---|---|---|---|---|---|
| | | 2019 | 2020 | 2021 | 2022 | 2023 |
| Dino | Service Sales | 0,21% | 0,21% | 0,23% | 0,38% | 0,52% |
| | Goods Sales | 99,79% | 99,79% | 99,77% | 99,62% | 99,48% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |

Cont. table 5.

| | | | | | | |
|---|---|---|---|---|---|---|
| Eurocasch | Goods Sales | 99,47% | 99,50% | 99,56% | 99,57% | 99,63% |
| | Service Sales | 0,51% | 0,46% | 0,41% | 0,41% | 0,36% |
| | Materials Sales | 0,02% | 0,03% | 0,02% | 0,02% | 0,01% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |
| Jeronimo Martins | Product Sales | 2,22% | 2,16% | 2,20% | 2,45% | 0,25% |
| | Goods and Materials Sales | 97,78% | 97,84% | 97,80% | 97,55% | 99,75% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |
| Hortex | Own Product Sales | 93,97% | 86,58% | 98,11% | 97,18% | 95,21% |
| | Industrial Product Sales | 1,62% | 9,49% | 1,87% | 2,82% | 4,79% |
| | Service Sales | 3,66% | 3,74% | 0,00% | 0,00% | 0,00% |
| | Other | 0,76% | 0,20% | 0,01% | 0,00% | 0,00% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |
| Żabka | Sales Revenues under Franchise Agreement | 99,28% | 99,47% | 99,52% | 99,44% | 99,22% |
| | Wholesale and Retail Sales in Own Stores | 0,41% | 0,19% | 0,13% | 0,22% | 0,31% |
| | Commission from Sales Intermediation | 0,31% | 0,34% | 0,31% | 0,26% | 0,30% |
| | Other | 0,00% | 0,00% | 0,04% | 0,08% | 0,17% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |
| Grupa Żywiec | Sales Revenues from Products, Goods, Materials | 98,58% | 98,97% | 99,34% | 99,25% | 99,20% |
| | Service Sales | 1,42% | 1,03% | 0,66% | 0,75% | 0,80% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |
| Wawel | Product Sales | 96,35% | 97,47% | 96,41% | 95,97% | 95,21% |
| | Goods and Materials Sales | 2,29% | 1,39% | 2,15% | 2,28% | 2,86% |
| | Retail Sales | 1,36% | 1,14% | 1,44% | 1,75% | 1,93% |
| | Total | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |

Source: Own study based on financial statements.

In Dino, revenue from operating activities is divided into two categories: service sales and goods sales. Based on the data, it is clear that revenue from goods sales is dominant. The share of service sales revenue in total sales revenue increased from 0.21% in 2019 to 0.52% in 2023. However, it is worth noting that the company has been increasing its service sales revenue year by year. The most significant increases were recorded in 2022 (+142% compared to the previous year) and 2023 (+77% compared to the previous year).

In Grupa Żywiec, we also observe two revenue categories: revenue from the sale of products, goods, and materials, and revenue from service sales. Revenue from the sale of products, goods, and materials is the most significant category, accounting for 99% of total revenue.

In companies such as Eurocash and Jeronimo Martins, sales revenue is divided into three categories: revenue from the sale of goods, revenue from the sale of materials, and revenue from the sale of services.

The revenue structure of Jeronimo Martins shows that the primary revenue source is the sale of goods and materials. The highest revenue was recorded in 2023, while the lowest was in 2019. Between 2019 and 2023, revenue from goods and materials sales increased by 76%. However, revenue from product sales peaked in 2022, followed by a drastic 88% decline in 2023.

For Eurocash, goods sales represent the primary revenue source. Between 2019 and 2023, revenue from goods sales increased by 31%. The highest service sales revenue was recorded in 2022, while the highest revenue from materials sales was in 2020. However, over the analysed period, both categories declined: service sales revenue dropped by 8%, while material sales revenue decreased by 30%.

The analysis of the product structure of sales revenue shows that Hortex generates the highest revenue from its own products and industrial products. The share of revenue from own products in total sales revenue fluctuated between 86% (lowest in 2020) and 98% (highest in 2021).

Wawel generates revenue from the sale of products, goods, materials, and retail sales. Revenue from product sales is the largest component of total sales revenue, increasing by 16% over the analysed years. Other revenue categories also showed growth: revenue from the sale of goods and materials increased by 46%, while retail sales revenue grew by 67%. If this growth rate continues, these two categories could significantly change Wawel's revenue structure in the long run.

Żabka's primary sales revenue comes from franchise agreements. This includes all fees from franchisees, revenue from the sale of goods, and revenue from subleasing store space and equipment to franchisees. Revenue growth is driven by an increase in the number of stores and a rise in average sales per store and per franchisee. The highest revenue was recorded in 2023, partly due to an 11% increase in store count (compared to a 13% increase in 2022). The "commission from sales intermediation" category includes electronic services, lottery games, and postal services.

Table 6 presents the levels of revenue diversification indicators for FMCG companies, determined using the HHI index.

**Table 6.**
*Revenue Diversification Structure of FMCG Companies in 2019-2023 (HHI Index)*

| Company | Lata | | | | |
|---|---|---|---|---|---|
| | 2019 | 2020 | 2021 | 2022 | 2023 |
| Dino | 1 | 1 | 1 | 0,99 | 0,99 |
| Eurocash | 0,99 | 0,99 | 0,99 | 0,99 | 0,99 |
| Jeronimo Martins | 0,96 | 0,96 | 0,96 | 0,95 | 1 |
| Hortex | 0,88 | 0,76 | 0,96 | 0,95 | 0,91 |
| Żabka | 0,99 | 0,99 | 0,99 | 0,99 | 0,98 |
| Grupa Żywiec | 0,97 | 0,98 | 0,99 | 0,99 | 0,98 |
| Wawel | 0,93 | 0,95 | 0,93 | 0,92 | 0,91 |

Source: Own elaboration.

After analysing the revenue structure of sales in the FMCG sector from 2019 to 2023 in the context of diversification, it is evident that sales revenues are not diversified. The HHI index shows values close to 1, indicating a lack of diversification. Implementing a diversification strategy can, on one hand, contribute to a company's development and growth, while on the other, it may lead to negative economic effects by engaging in too many areas, preventing

greater efficiency in operational activities (Sutherland, Canwell, 2007). Therefore, it is important to remember that the decision to diversify a company should be a well-thought-out one, taking into account the firm's current situation, including its market position and the attractiveness of its existing business operations. It can be concluded that the analysed companies do not opt for revenue diversification. After reviewing the financial statements of the examined enterprises, it can be observed that their core revenues are generated from sales; however, these sales are carried out through various distribution channels. The primary revenue generated by the examined companies comes from operational activities, accounting for over 98% of total revenue. The analysis of the structural composition of revenue confirms that FMCG sector enterprises generate income mainly from the sale of goods, materials, and products. Other operating and financial revenues contribute only marginally to overall revenue. Other operating revenue primarily originates from the disposal of non-financial fixed assets, while financial revenue mainly stems from interest earnings. Between 2019 and 2023 revenues grew, indicating resilience to economic and market changes.

## 5. Conclusions

In business operations, a significant focus is placed on cost analysis, which is one of the most critical aspects of enterprise management. However, another key factor in the management process is revenue. Proper planning of revenue levels from business activities (as well as their diversification) significantly impacts financial stability and risk mitigation.

The objective of this study was to examine the level of revenue diversification among FMCG sector enterprises between 2019 and 2023. The study applied the Hirschman-Herfindahl measurement concept, which developed the HHI Index for revenue diversification. During the analysis, the share of sales revenue, other operating revenue, and financial revenue in the total revenue was determined. Particular attention was given to the structural composition of revenue generated from sales. The highest total revenue growth in the analysed period was recorded by Dino (+237%), followed by Żabka (+128%). In contrast, the lowest increases were noted for Wawel (+19%) and Grupa Żywiec (+20%). The analysis of FMCG enterprises from 2019 to 2023 indicates that these entities do not implement a revenue diversification strategy. The primary revenue generated by the examined companies comes from operational activities, accounting for over 98% of total revenue. Other operating and financial revenues contribute only marginally to overall revenue. Other operating revenue primarily originates from the disposal of non-financial fixed assets, while financial revenue mainly stems from interest earnings. The revenue diversification index for FMCG sector companies, as determined by the HHI index, shows values close to 1, indicating a strategy of revenue concentration. The analysis of the structural composition of revenue confirms that FMCG sector enterprises generate

income mainly from the sale of goods, materials, and products. When examining the structural composition of revenues using the HHI index, values close to 1 were again obtained, indicating the absence of a diversification strategy. Despite the uncertain epidemiological and economic conditions in 2020, as well as significant changes in the credit market and rising inflation in 2023, the revenues of the analysed entities remained stable. This suggests that, as FMCG market enterprises provide essential consumer goods, they are resilient to economic and market fluctuations. It can be assumed that this resilience is one of the reasons why these entities do not implement revenue diversification strategies. The analysed enterprises have a core specialisation that defines their identity and reputation. As a result, management does not opt for revenue deconcentration. The study indicates that the examined companies, due to their strong market position, do not decide to diversify their revenue streams. A review of the financial statements of the analysed enterprises reveals that their core revenue is derived from sales; however, this sales revenue is generated through a variety of distribution channels. It is also worth noting that, although other operating and financial revenues constituted a small portion of total revenue during the study period, they showed a growth trend. This suggests that company management is increasingly recognising the importance of these revenue streams and their role in the overall financial structure of the enterprise. However, the empirical study used the convenience sampling method, therefore the obtained results cannot be generalized to the entire FMCG sector. Changing the structure of a company's revenues can help increase its financial stability and adapt to changing market conditions. The current trend on the market is sustainable development, so introducing ecological or vegan products and recyclable packaging to the range could contribute to increased revenues and expanding the customer group. In addition, using energy-efficient solutions to reduce the carbon footprint can contribute to reducing costs. Online shopping is very popular among retail customers, so this distribution channel is key. E-commerce can increase the company's reach and introduce new revenue streams. In addition, the company can earn through affiliate marketing - recommending products from other companies, which can be a new source of revenue. It is also important to increase income from investments such as investing in technology or commercial real estate. Investing in technology will allow for the automation of processes and reduction of operating costs, which can increase profits in the long term. On the other hand, commercial real estate can generate additional revenue through rent or sale.

Research on FMCG revenue diversification has a significant impact on broader areas such as management, marketing, corporate strategy, and competitiveness. Revenue diversification is one way to reduce the risk associated with a company's operations. In the FMCG market, changing consumer preferences, fluctuations in raw material prices, and changes in regulations can significantly affect a company's financial performance. Research in this area helps companies better understand how to manage risk by dispersing revenue sources, which reduces reliance on one market segment. Diversification can include expanding product offerings and entering new geographic markets or segments. Revenue diversification can also affect

a company's ability to compete in the market. Research in this area can help develop strategies that not only increase profitability but also align with growing consumer expectations regarding corporate social and environmental responsibility. Better management of different revenue sources can help with better budget planning and controlling operating costs.

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# FORECASTING THE FUTURE OF RENEWABLE ENERGY SOURCES IN POLAND AGAINST THE BACKGROUND OF THE EUROPEAN UNION STATES

Anna MARCINIUK-KLUSKA[1], Monika OJDANA-KOŚCIUSZKO[2*]

[1] University of Siedlce, Faculty of Social Science; anna.marciniuk-kluska@uws.edu.pl,
ORCID: 0000-0002-1659-0610
[2] University of Siedlce, Faculty of Social Science; monika.ojdana-kosciuszko@uws.edu.pl,
ORCID: 0000-0003-0150-2953
* Correspondence author

**Purpose**: The aim of the article is to develop a forecast for electricity generation from renewable energy sources (RES) in Poland using predictive methods based on an approximating function. The study is situated within the broader context of the energy transition and the growing importance of RES in both national and EU policy agendas.
**Design/methodology/approach**: The study employs a quantitative approach based on statistical data from the Central Statistics Office (GUS) for the years 2008-2024 concerning photovoltaic energy production. The primary forecasting method is a trend function, approximated and transformed into a linear form through logarithmisation. The parameters of the power function were estimated, and the accuracy of the forecast was assessed using the coefficient of determination, mean residual error, and the coefficient of variation of residuals.
**Findings**: The results obtained indicate a clear upward trend in photovoltaic energy production, with a projected output of 31,219 GWh by 2028. The coefficient of convergence (0.0244) demonstrates a high degree of consistency between the empirical data and the theoretical model. The findings confirm the dynamic growth of the RES sector in Poland and the increasing interest of enterprises in investing in green energy.
**Research limitations/implications**: The photovoltaic sector has been expanding year on year, despite facing challenges such as grid connection refusals and administrative constraints. These issues primarily affect large-scale photovoltaic farms, which are frequently curtailed by the Transmission System Operator during periods of high productivity due to the limited flexibility of the grid. Energy storage systems, when integrated with large PV installations, offer a potential solution – contributing to grid stability and ensuring reliable delivery of green energy. A limitation of the study lies in the variability of weather conditions that influence solar energy production, introducing uncertainty into the forecasts. The article highlights the need for further research on integrating forecasting models with grid management systems, as well as incorporating energy storage solutions. Future analyses could extend the model to include other renewable energy sources (such as wind or biogas).
**Practical implications**: The study provides forecasting tools for businesses and policymakers, supporting investment planning in the energy sector. The results may be applied in the development of long-term energy procurement strategies (e.g. Power Purchase Agreements),

grid modernisation, and the liberalisation process of the RES market. The forecasts also contribute to cost optimisation and improved energy security.
**Social implications**: The development of RES contributes to improved air quality and reduced greenhouse gas emissions, positively affecting public health. Promoting green energy may influence social attitudes towards climate responsibility and enhance environmental awareness. The research findings may also inform public policy in the areas of decarbonisation and climate protection.
**Originality/value**: The article offers original value by developing an accurate predictive model of photovoltaic energy production in Poland based on a power function. It provides practical tools for businesses, analysts, and energy policymakers, supporting the advancement of a low-emission economy. Furthermore, it constitutes a significant contribution to the literature on energy transition in both the Polish and EU contexts.
**Keywords**: Renewable energy; energy production; clean energy; energy security; environmental impact of energy consumption.
**Category of the paper**: Literature review.

## 1. Introduction

Renewable energy sources (RES) play a key role in achieving climate targets, ensuring energy security, and reducing greenhouse gas emissions (Beal, King, 2022). Among these, solar energy—particularly photovoltaic technology—has experienced dynamic global development, driven by declining costs and technological progress (Lewis, 2015). This study presents a forecast of photovoltaic electricity generation in Poland based on predictive modelling using an approximating function.

Given the strategic importance of energy in the economy, it constitutes a key component of many countries' economic policies. Issues such as the structure of electricity generation, sources of primary fuel supply, infrastructure investments, and energy intensity are central to energy policy formulation. However, energy policy cannot be viewed in isolation from climate policy. Today, energy and climate policy are increasingly integrated, reflecting a comprehensive approach to sustainable development. Consequently, discussions about the structure of energy generation are often linked to concerns over the continued reliance on solid fossil fuels, which are among the highest contributors to greenhouse gas emissions. Similar concerns apply to the sources of primary fuel supply.

The objective of this study is to develop a forecast for electricity generation from RES using a mechanical method and make a prediction on the basis of an approximating function. Given the inherent uncertainty related to atmospheric conditions, the analysis focuses on forecasting solar energy production.

To structure the analytical approach, the study puts forward the following hypothesis: The volume of photovoltaic electricity production in Poland follows a power trend that enables reliable forecasting for the upcoming years.

## 2. Literature review

In the era of sustainable development and growing energy awareness, energy efficiency in enterprises is no longer merely an advantage but a necessity. Majority of Polish small and medium-sized enterprises (SMEs) regard the transition to renewable energy as an inevitable process, with 82% of surveyed companies expressing this view. The primary benefits identified by respondents include reduced operational costs and enhanced competitiveness, as indicated by 60% of participants (Ciesielski, 2023).

Only 3% of enterprises reported that rising energy prices have had little impact on their operations. In contrast, 59% of manufacturing companies stated that the increase in energy carrier prices has significantly affected both the pricing and cost structure of their final products. Moreover, SMEs have reported experiencing power outages, with 44% considering them disruptive (Ciesielski, 2023, Energia odnawialna i konkurencyjność polskich przedsiębiorstw).

Eurostat provides comprehensive country-by-country data on energy production and consumption (Eurostat, Renewable Energy Statistics: Share of Renewable Energy More Than Doubled Between 2004 and 2021, 2022). In addition, governmental agencies and independent research institutions regularly produce energy-focused reports analysing the environmental, economic, and energy security impacts of renewable energy sources (Pacesila et al., 2016). In 2020, hydropower (about 40%) and biomass (about 30%) accounted for the largest share of electricity generation from RES within the European Union. Wind and photovoltaic energy constituted about 25% of the total renewable electricity output, while other sources and forms of energy, such as biogas, geothermal energy and wind energy made up the remaining 5%. EU member states are actively working to increase the share of RES in energy production. As part of this effort, the European Union has committed to reach a 32% share of renewable energy in gross final energy consumption by 2030 (Musiał et al., 2021).

The adoption of renewable energy sources (RES) across European Union member states shows significant variation. Countries such as Germany and Denmark have achieved shares of nearly 50%, whereas Poland and Italy remain at lower levels, ranging between 15% and 20%. These disparities are largely attributed to differences in geographic conditions, resource availability, and infrastructure development (Inês et al., 2020; Gajdzik et al., 2022).

According to the amendment to the Renewable Energy Act, the share of renewable energy in electricity generation is to increase steadily – from around 20% at present to about 38% in 2025. In 2030, it is projected to reach about 50%, in 2040 – 65%, and in 2050 – as much as 80%. Such programs and initiatives support the achievement of renewable energy targets while addressing the challenges related to climate protection and energy security (Wałachowska, Ignasiak-Szulc, 2021).

Poland, by contrast, is one of the European countries lagging behind in the drive to increase energy recovery from RES (Swain et al., 2022). Nevertheless, recent years have seen a notable increase in interest in RES, as evidenced by a growing number of investments in this sector (Suharevska, Blumberga, 2019). In 2020, the share of energy derived from RES was approximately 15%, with solar energy and biogas accounting for about 20% and 15% of RES production, respectively (Child et al., 2019, p. 80).

Italy, like Poland, is also pursuing the development of RES, but the pace remains slow. In 2020, the share of energy from RES in Italy stood at around 20%, with a primary focus on increasing energy generation from solar panels and wind turbines (Wolniak, Skotnicka-Zasadzień, 2022, p. 662).

The recovery of renewable energy contributes to reducing environmental impact by lowering emissions of harmful substances, above all, greenhouse gases. Among EU member states, the total share of RES in 2020 nearly doubled compared to 2010. The largest increases were recorded in Cyprus (from 1.4% to 12.0%), Luxembourg (from 3.8% to 13.9%), Greece (from 12.3% to 35.9%), the Netherlands (from 9.6% to 26.4%), Estonia (from 10.3% to 28.3%) and Lithuania (from 7.4% to 20.2%). In Poland, the share of electricity generated from RES rose from 2.5% in 2005 to 16.2% in 2020 (Bluszcz, Manowska, 2020).

Until recently, electricity generated from RES was much more expensive than electricity produced in power plants using fossil fuels. However, technological advancements and economies of scale have reshaped the economic landscape and improved the level of profitability. This shift is also reflected in the philosophy of business entities, for whom securing energy supplies from RES has become a cornerstone of active performance. As a result, they are now investing in solar projects or entering into long-term purchase agreements with independent suppliers (Howie, Atakhanova, 2022). At the same time, support for the idea of energy transition will transform not only the conditions for the development of individual economic sectors, but also the structure of energy markets in a sustainable direction. Nevertheless, disparities in the conditions of electricity generation and the cost of final energy are likely to exacerbate existing differences in economic and social development, and contribute to global polarisation.

## 3. Research methodology

The research was conducted on the basis of data from the Central Statistical Office in Poland for 2008-2024 (Bluszcz, Manowska, 2020). The linear regression model, presented in equation (1), depends on two unknown parameters, $a$ and $b$. The parameters of the linear trend function were estimated using formulas (2) and (3).

$$y = at + b \tag{1}$$

$$a = \frac{\sum \mathrm{yt\ t} - \mathrm{n}\bar{\mathrm{y}}\dot{\mathrm{t}}}{\sum t^2 - n\dot{\mathrm{t}}^2} \tag{2}$$

$$b = \bar{\mathrm{y}} - a\,\dot{\mathrm{t}} \tag{3}$$

When a good approximant of the trend is the power function, as defined by equation (4), linearisation should be carried out when extracting the trend using the least-square method.

$$\hat{y}t = b\ t^a \tag{4}$$

Equation (5) was obtained after both sides of the equation of the power trend function were logarithmised to express it in linear form.

$$ln\ \hat{y}t = ln\ b\ +\ a\ ln\ t \tag{5}$$

Next, a substitution was made by denoting the logarithms of the variables with the variables with asterisks (*); as illustrated in formulas (6), (7), (8).

$$ln\ \hat{y}t = \hat{y}t^* \tag{6}$$

$$ln\ b = b^* \tag{7}$$

$$ln\ t = t^* \tag{8}$$

This substitution resulted in the linearised form of the power trend function, defined by equation (9).

$$\hat{y}t^* = a\ t^{\,*} + b^* \tag{9}$$

Finally, the parameters of the power trend function were delogarithmised, as shown in formulas (10), (11).

$$a = \frac{\mathrm{n}\sum_t y_t^* t^* - \sum_t y_t^* \sum_t t^*}{\mathrm{n}\sum_t t^{*2} - (\sum_t t^*)^2} \tag{10}$$

$$b^* = \overline{y^*} - a\overline{t^*} \tag{11}$$

Linear regression enables the use of quantitative variables that follow a normal distribution. Four key assumptions relating to the linear regression model were considered in this study:

1. Linearity – a linear relationship between the independent variable and the dependent variable.
2. Homoskedasticity – the variance of the residuals remains constant across all observations.
3. Random parameters (of residuals) are uncorrelated and normally distributed.
4. Independence of variables – none of the independent variables can be correlated with any other independent variable.

To generate forecasts, several methods were applied: the simple moving average, the weighted moving average, the exponential smoothing model, the Holt model, and the trend function method. Among these, only the trend function method yielded precise forecasts with the smallest errors. In addition, the mean residual error, coefficient of convergence and coefficient of residual variation were calculated to test the consistency of empirical data with theoretical data (Marciniuk-Kluska, Kluska, 2023). The coefficient of convergence indicates the percentage of information not explained by the independent variable. The coefficient of

residual variation reflects what percentage is accounted for by random deviations of the trend equation relative to the average level.

## 4. Results and discussion

Electricity, serving as the driving force behind machinery and equipment, plays a pivotal role in manufacturing processes. It enables factories to operate smoothly, efficiently, and in compliance with defined quality standards – factors that directly impact the overall productivity and performance of the enterprise.

The year 2022 marked the most expensive year on record for electricity prices on European power exchanges (Figure 1).

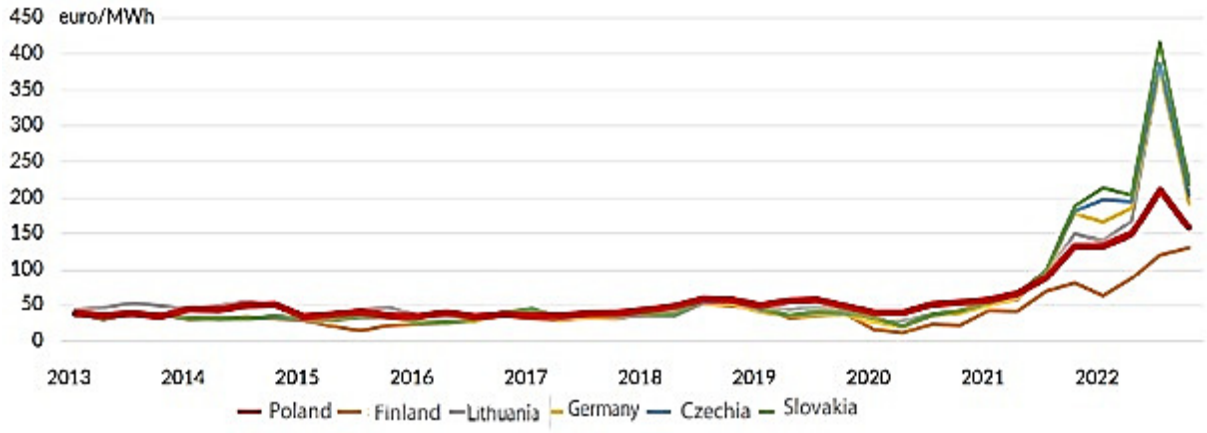



**Figure 1.** Comparison of SPOT electricity prices in neighbouring countries' markets in the years 2013-2022.

Source: Quarterly Report on Energy Markets, ENTSO-E, 2022.

The record-high prices in the third quarter of 2022 were caused by the tense situation within the European power systems. Additionally, a drought in France reduced electricity generation from nuclear reactors, which was already limited due to renovations. An embargo on Russian coal was imposed, and three out of four Nord Stream pipelines were destroyed. Coupled with the earlier shutdown of the Yamal gas pipeline, these developments led to a surge raw material prices on the TTF exchange, reaching over EUR 340/MWh. The decline in the prices on the electricity exchange at the end of 2022 was primarily triggered by falling natural gas prices on European exchanges, which determines electricity prices in most EU member states. With a relatively small share of gas energy in its energy mix, Poland emerged as a cheaper market than most of its neighbouring countries.

In mid-2023, over 33% of the surveyed entities used electricity generated from renewable energy sources, and 18% had such systems installed on-site. In turn, 67% of respondents declared having intelligent energy management systems. Moreover, nearly 49% of companies indicated plans to introduce renewable energy installations and digital energy consumption monitoring. High implementation costs (48%) and the lack of state support (35%) were considered to be the primary barriers to the use of renewable energy sources.

Companies in Poland can pursue one of two main pathways to adopt renewable energy: they can conclude green energy purchase agreements (PPAs) or make their own investments in the sector. PPAs reduce energy purchase costs and are long-term. This facilitates cost management, contributes to reducing carbon footprint, and eases pressure on the national power system. These contracts are popular in many countries, and the leaders in the field are: Spain, Sweden, Norway, Germany, and the UK. In Poland, however, at the end of 2021, they amounted to only 800 MW. Nonetheless, the analysis shows enormous potential. Should 34% of industrial energy consumption be sourced from renewables by the end of the decade, PPAs would need to cover 40 TWh, exceeding Poland's current total renewable energy production. But this cannot be achieved without removing barriers to emission-free energy development. Encouragingly, the number of companies using PPAs and/or investing in their own installations is growing. Biedronka, or Jeronimo Martins, serves as an example. The company concluded a long-term PPA agreement with the Swiss company GoldenPeaks Capital, as well as a separate contract to equip its stores with energy from renewable sources by 2025, reducing the consumption of traditional energy by 15 % per single location. However, the largest self-producer of electricity remains IKEA, which has, among others, a wind farm (80 turbines) and which has acquired a solar park (Grupa IKEA inwestuje w kolejne farmy wiatrowe). Similar steps have also been taken by Ciech, PolPharma, Asseco, AGD Amica, and Grupa Azoty. Without decisive action and an integrated decarbonisation policy, energy prices in Poland will decline more slowly than in other EU countries. This means that the competitiveness of Polish exports will decrease, particularly as rising labour costs in Poland affect the situation in an analogical way, and the rate of minimum wage increase is outpacing the rate of productivity growth. Therefore, there is a need to liberalise the renewable energy production market, modernise grid infrastructure, and promote enterprises' self-production of energy and the use of short direct transmission lines. In parallel, there is a need to popularise clean energy purchases under long-term PPAs and implement technologies that optimise energy consumption. In the years ahead, a completely new allocation of work is expected across the European market. Leading positions will be secured by economies that employ new technologies that enable the production and use of low-emission energy in their industrial processes.

The data for selected EU countries presented in Figure 2 shows an increase in the share of renewable energy in final energy consumption in 2020 compared to 2017.

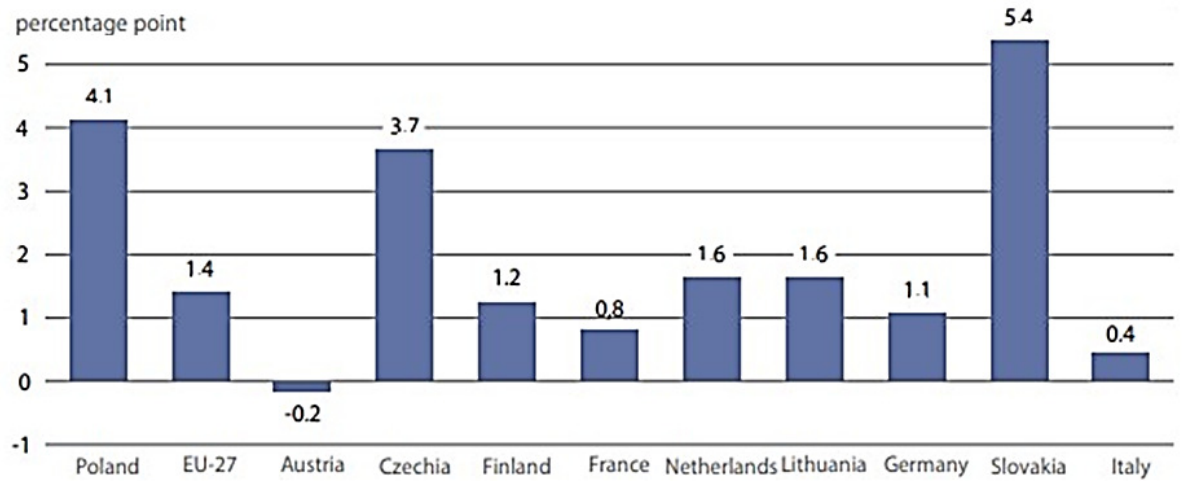



**Figure 2** Growth rate of the share of renewable energy in final energy consumption in 2020 (compared to 2017).

Source: Environmental Protection in 2021, CSO, Warsaw 2022.

The largest increase in the share of renewable energy in final energy consumption were recorded in Slovakia (5.4 pp), Poland (4.1 pp), and the Czech Republic (3.7 pp). In contrast, a decrease was observed only in Austria (of 0.2 pp). Across the EU–27, the increase amounted to 1.4 pp. The national targets for the share of energy from renewable sources in gross final energy consumption in 2020 were aligned with European Parliament and Council Directive (EU) 2018/2001 of 11 December 2018 on the promotion and use of RES.

Poland has recently witnesses a substantial rise in the total installed capacity of power plants using RES. According to the Energy Regulatory Office (ERO) data, halfway through 2018, the installed capacity of photovoltaic power plants was 110.563 MW (602 photovoltaic installations). In 2019, there was an increase in the installed capacity, especially in photovoltaic power plants, reaching 478 MW, and wind power plants, reaching 5.917 GW (Energetyka Dystrybucja i Przesył). The draft Energy Policy of Poland until 2040 assumes a further increase in the share of RES in gross final energy consumption to at least 23% in 2030 (Miłek et al., 2022, p. 5576). Starting in 2025, offshore wind power is to be additionally developed, reaching about 5.9 GW (in 2030) and 8-11 GW (in 2040). Currently, RES meets about 16% of energy demand (an increase of 2.5% compared to 2018) (Rybak et al., 2022, Energetyka Dystrybucja i Przesył).

Among renewable sources, solar energy holds particular significance and is considered one of the most abundant and important energy resources on Earth. Solar energy can be converted into heat in solar collectors (photothermal conversion) and used to produce electricity using photovoltaic cells relying on semiconducting properties of silicon (photovoltaic conversion, Figure 3).

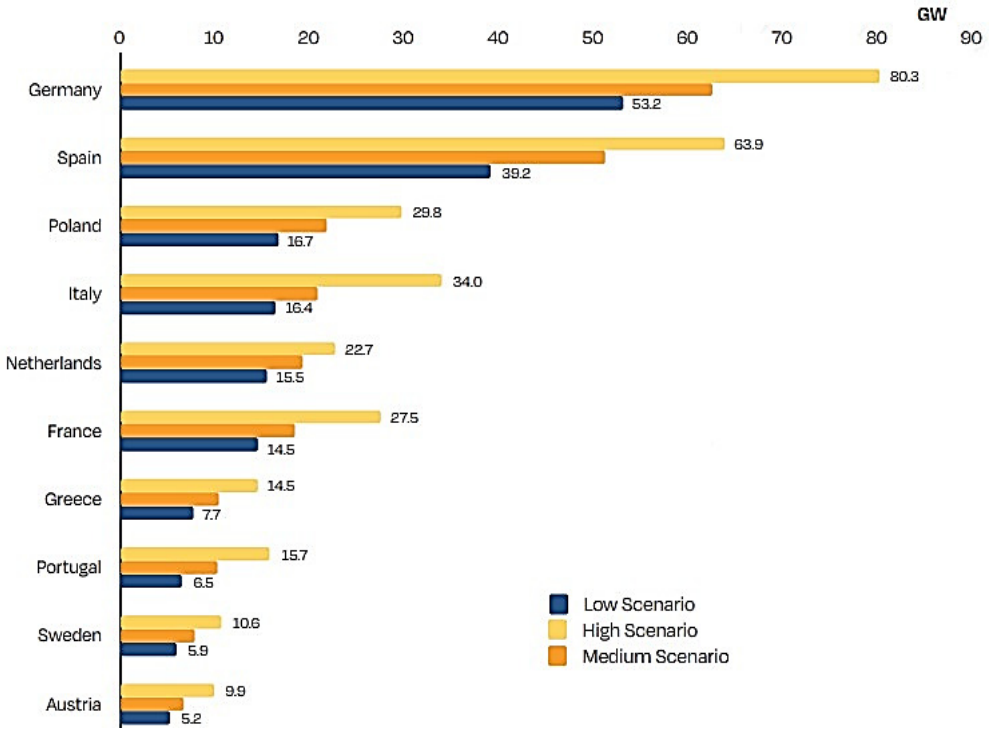



**Figure 3.** EU-27 top 10 solar PV markets additions 2023-2026.

Source: SolarPower Europe, 2022.

Another solution is the conversion of solar energy into chemical energy, known as photochemical conversion. This process occurs in green plants and is called photosynthesis. Solar energy is used on a large scale in solar power plants. In 2020, the world leaders in the use of solar energy were the Netherlands (26.2%), Italy, and Germany (Figure 4).

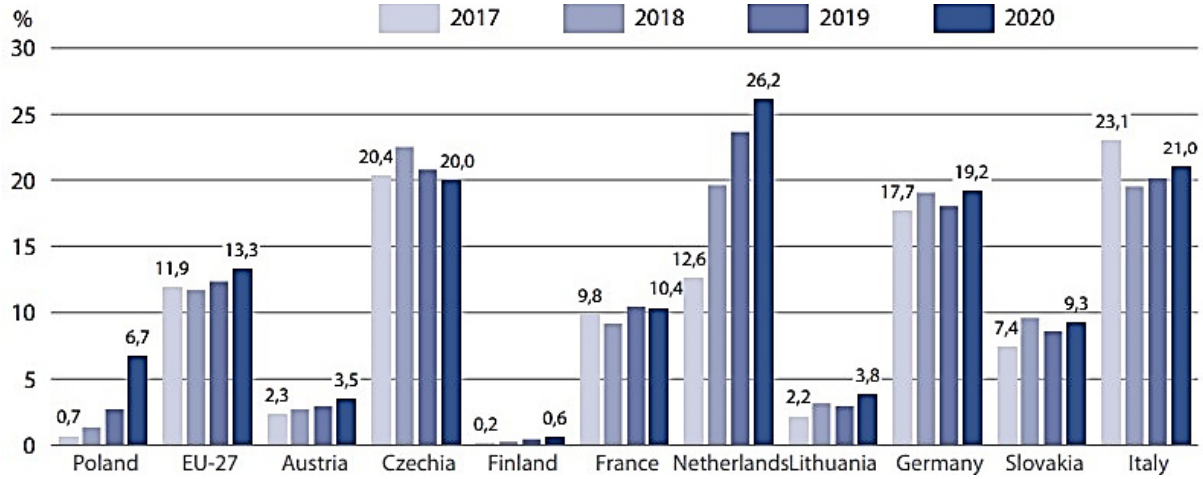



**Figure 4.** Share of solar energy in the production of electricity from renewable sources in Poland and selected EU–27 member states.

Source: Renewable energy in 2021, CSO, Warsaw 2022.

One of the European Union's goals for the development of renewable energy is to increase the share of electricity generated from RES in gross final consumption of electricity (Figure 5).

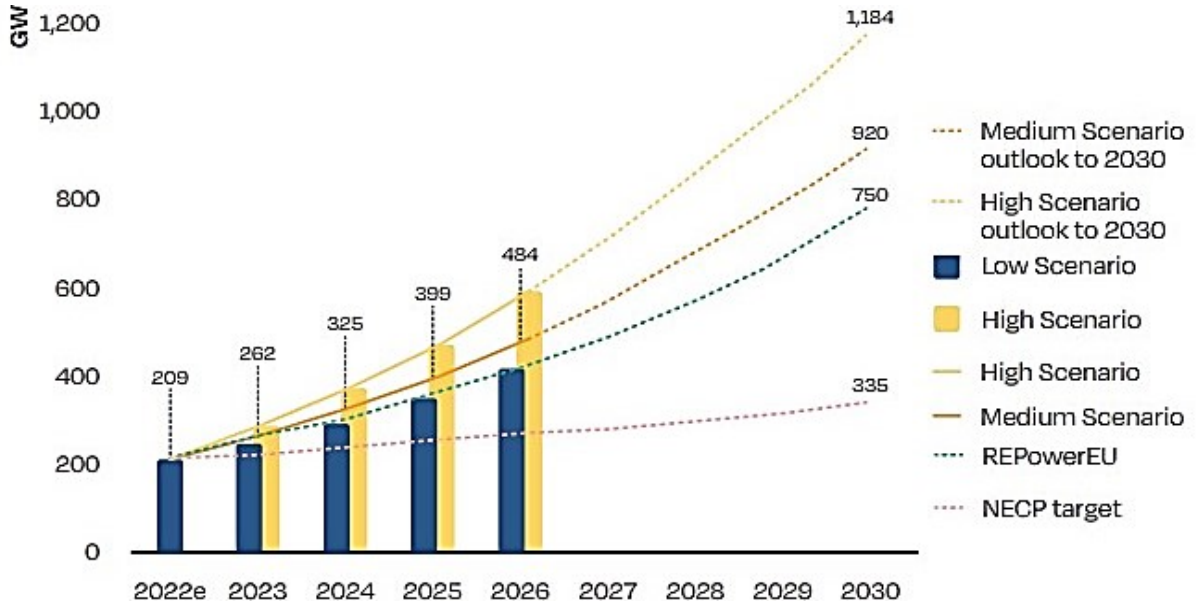



**Figure 5.** EU-27 total solar PV market scenarios 2022-2030.

Source: Solar Power Europe, 2022.

According to the medium scenario projection shown in Figure 6, the total amount of solar energy in the EU is expected to rise from 209 GW installed at the end of 2022 to approximately 920 GW in 2030. The increase in energy obtained through PV is particularly important in the context of reducing energy demand within the total energy balance. The value of this indicator for Poland in 2017-2020 increased from 14.4% to 18.4%. The primary factor influencing the energy production of photovoltaic panels is insolation. As illustrated in Figure 7, insolation levels vary considerably across Europe. The highest values are found in southern countries, namely Spain, Portugal, Italy, and Greece.

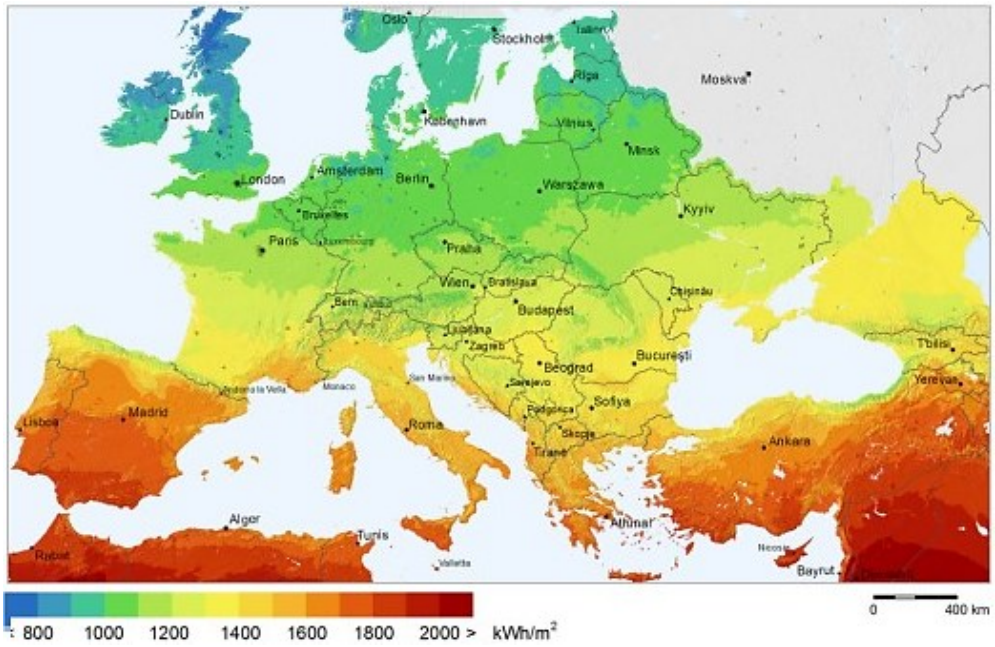



**Figure 6.** Annual map of average insolation in Europe.

Source: Clean Energy Project, Słupsk 2020.

In Poland, insolation varies by region, between 949 and 1168 kWh/m$^2$, while in Greece it is considerably higher, ranging from 1168 to 1899 kWh/m$^2$. Similarly, energy capacity in Poland is lower (949-1168 kWh/kWp) compared to energy yield in Greece, where it ranges from 1314 to 1753 kWh/kWp.

Renewable energy is currently one of the most rapidly developing segments of the energy sector in Poland. Owing to the country's diversity in terms of geological, climatic and hydrological conditions, it is possible to utilise diverse resources, creating a balanced energy supply system based on RES. According to Bloomberg New Energy Finance (New Energy Outlook 2024), by 2050 half of energy will be produced from wind or sun. This transformation will be driven by significant cost reductions – up to 71% for photovoltaic (PV) installations and up to 58% for wind energy. Between 2017 and 2021, electricity generation from RES showed a steady upward trend, except for 2018 when there was a decrease by 14.15% compared to 2017 caused by a fall in the production of wind power. Despite this decline, the volume of wind power generation in 2021, compared to 2017, was 8.9% higher (an increase from 14,909 GWh to 16,233.5 GWh). The photovoltaic power generation has recently gone up. In 2021, it was 100.9% higher than in 2020, and more than 23.7 times higher than in 2017.

Currently, transmission and distribution system operators are facing a growing problem of maintaining a supply-demand balance. This is due to the growing share of RES power plants in the overall energy mix. With the development of RES, it is necessary to develop tools to support operators in the efficient management of the network. These tools include forecasting models of energy production from renewable energy power plants. Issues relating to the forecasting of energy production volumes, especially in photovoltaic power plants, have recently come to the fore.

To approximate the development trend of photovoltaic electricity production (in GWh) over time, it was assumed that the development trend is non-linear. In Poland, the production of electricity from photovoltaic cells has shown a markedly upward development trend during the period analysed. The annual growth rate in energy production using photovoltaic cells has been increasing. It can be hypothesised that a power function serves as a good approximant for the trend. Linearisation was carried out when extracting the trend using the least square method (Table 1).

**Table 1.**
*Supporting calculations for determining the parameters of the power function representing the trend in photovoltaic electricity production (in GWh) for the period 2013-2024*

| t | $y_t$ | ln t | ln$y_t$ | ln$y_t$ ln t | (ln t)$^2$ | $yt_{teor.}$ | $(vt-vt_{teor})^2$ | $(vt-vt_{śr})^2$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.000 | 0.000 | 0.000 | 0.000 | 1 | 0 | 11793501 |
| 2 | 7 | 0.693 | 1.946 | 1.349 | 0.480 | 9 | 3 | 11752327 |
| 3 | 57 | 1.099 | 4.043 | 4.442 | 1.207 | 43 | 187 | 11412010 |
| 4 | 124 | 1.386 | 4.820 | 6.682 | 1.922 | 134 | 104 | 10963825 |
| 5 | 165 | 1.609 | 5.106 | 8.218 | 2.590 | 323 | 24841 | 10693990 |
| 6 | 300 | 1.792 | 5.704 | 1.220 | 3.210 | 661 | 130032 | 9829270 |
| 7 | 711 | 1.946 | 6.567 | 1.778 | 3.787 | 1211 | 249893 | 7421084 |

Cont. table 1.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | 1958 | 2.079 | 7.580 | 1.761 | 4.324 | 2047 | 7883 | 2182021 |
| 9 | 3934 | 2.197 | 8.277 | 1.187 | 4.828 | 3252 | 465103 | 248835 |
| 10 | 8309 | 2.303 | 9.025 | 2.781 | 5.302 | 4921 | 11480703 | 23754251 |
| 11 | 11107 | 2.398 | 9.315 | 2.337 | 5.750 | 7157 | 15601344 | 58857027 |
| 12 | 14549 | 2.485 | 9,585 | 23.819 | 6.175 | 10076 | 20008026 | 123517291 |
| ∑78 | ∑41 222 | ∑19.987 | ∑71.68 | ∑144.574 | ∑39.575 | ∑29 833 | ∑47968117 | ∑282425432 |

Source: own study.

Projections for photovoltaic energy production have shown exponential growth in the subsequent years and are expected to reach 31,219 GWh by 2028 (Figure 7).

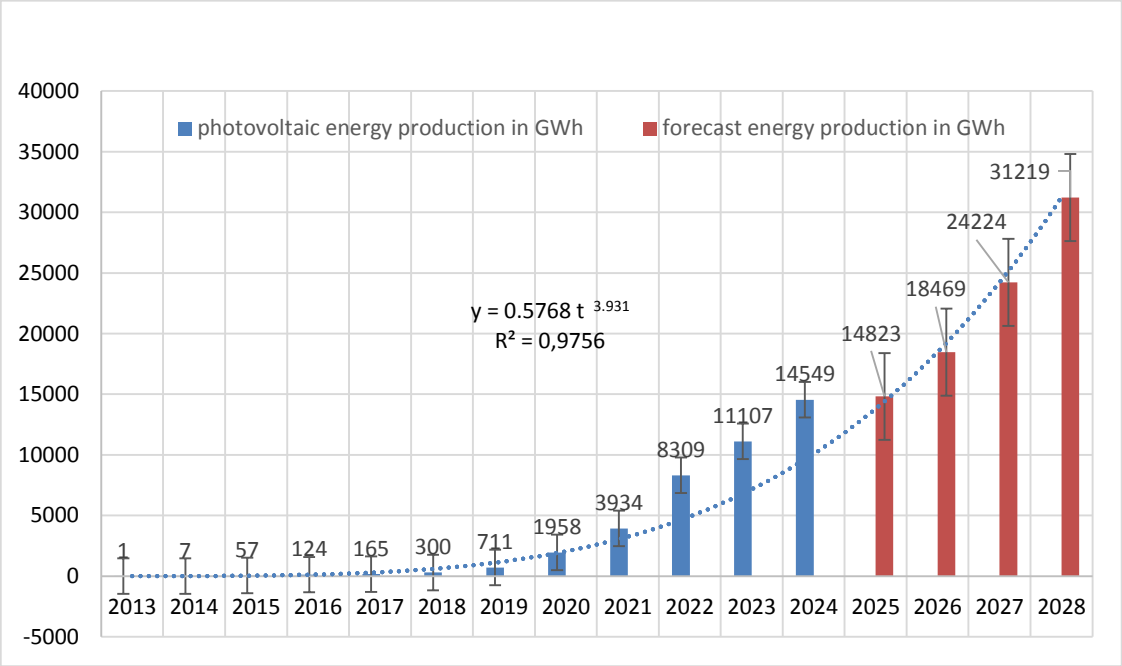



**Figure 7.** Projections of photovoltaic electricity generation for the period 2013-2028 (in GWh).
Source: own compilation based on data from CSO, Renewable Energy 2014-2022.

The calculated coefficient of convergence indicates that only 0.024% of the variance in photovoltaic energy production remained unexplained by the independent variable (Table 2).

**Table 2.**
*Forecasts and forecast errors of photovoltaic electricity production by 2028 (in GWh)*

| Years | Photovoltaic electricity production forecasts | Convergence factor $\varphi^2$ | Average error of residuals | Residual variation factor % |
|---|---|---|---|---|
| 2025 | 14 823 | 0.0244 | 219.0 | 0.6376 |
| 2026 | 18 469 | | | |
| 2027 | 24 224 | | | |
| 2028 | 31 219 | | | |

Source: own study.

The standard deviation of the residuals indicates that the average deviation of the empirical values of energy production from the theoretical values determined from the trend equation is 2.81 GWh.

## 5. Conclusions

Many global exporters – both countries and enterprises – are increasingly aware that green energy may alter their position in the global economy, as the European Union is introducing a carbon border adjustment mechanism which will impose levies on goods generating a carbon footprint. This development will significantly worsen the competitive conditions of competition in the EU market for products manufactures using fossil fuels. It is one of the key drivers behind China's implementation of energy transition policies, as the world's largest exporter. Climate commitments by global corporations are not solely motivated by regulatory pressures. More than 34% of the world's largest companies have already pledged to achieve net zero emissions by 2050. However, most of them are unlikely to meet this commitment if they do not double the rate of emissions reduction by 2030. According to the International Energy Agency, approximately 60% of gross revenues in the technology sector are generated by companies that have declared climate neutrality as a strategic objective. In other sectors, such commitments account for 30-40% of operations in aviation and maritime transport, 15% in logistics, and 10% in the construction industry. Achieving net zero emissions necessitates the adoption of smart technologies for monitoring emissions across the entire value chain (including both direct and indirect emissions) and the integration of ESG indicators into companies' core operational and strategic goals.

The findings of this study confirm the dynamic development of the renewable energy sector in Poland, particularly in the field of photovoltaics, and highlight the need to intensify efforts supporting the ongoing energy transition. To enhance the effectiveness of RES deployment and meet climate and economic challenges, a set of strategic recommendations is proposed for key stakeholder groups.

Transmission and distribution system operators (TSO/DSO) must prioritise the modernisation and expansion of energy infrastructure to accommodate the increasing share of RES in the energy mix. This involves improving network capacity, implementing smart substations, and decentralising transmission systems. Furthermore, advanced forecasting models based on artificial intelligence and machine learning should be deployed to optimise the prediction of both production and demand, ensuring grid stability. The integration of energy storage systems—including stationary batteries, pumped-storage power stations, and hybrid solutions—can provide a buffer during peak demand or reduced production. In parallel, simplified access for prosumers to the electricity grid is essential, requiring streamlined connection procedures and transparent administrative frameworks.

Businesses and energy sector investors are encouraged to develop in-house RES installations and hybrid systems (e.g. PV combined with storage) to reduce operational costs, increase energy independence, and fulfil ESG commitments. The adoption of long-term Power Purchase Agreements (PPAs), particularly within energy clusters or cooperatives, offers price

stability and supports strategic planning. Additionally, digital Energy Management Systems (EMS) should be implemented to optimise energy usage in real-time, improving efficiency and competitiveness. Diversification of the RES portfolio beyond photovoltaics—by incorporating wind, biogas, or biomass—can mitigate seasonality-related risks and enhance reliability.

Public authorities and policymakers play a critical role in shaping a conducive environment for RES expansion. Streamlining administrative procedures through digital platforms and "one-stop shops" can accelerate project approvals and grid connections. Increased access to public funding—through EU mechanisms, the National Recovery Plan, or climate funds—should support both preparatory and investment stages of RES projects. A comprehensive national energy storage strategy is also needed, encompassing ownership regulations, grid services, and financial incentives. Moreover, collaboration between academic institutions and industry, along with vocational training programmes, is necessary to address the growing demand for skilled professionals in the renewable energy sector.

For society and individual consumers, awareness-raising campaigns should be implemented at all levels—from school education to media initiatives—to foster social acceptance and engagement in the energy transition. Support for individual prosumers must also be reinforced through financial incentives, simplified installation procedures, and stable billing mechanisms (such as net metering or net billing). Finally, ensuring equitable access to clean energy is essential. Targeted programmes for low-income households, rural areas, and peripheral regions (e.g. energy communities) can help prevent energy exclusion.

In summary, Poland's energy transition is an inevitable process requiring a coordinated, multi-actor approach. The proposed actions serve as a roadmap for fostering the development of renewable energy sources while enhancing economic competitiveness, energy security, and climate protection.

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# QUIET QUITTING: TREND OR TEMPORARY PHENOMENON IN THE LABOR MARKET?

Katarzyna OLEJNICZAK-SZUSTER

The Management Faculty, Czestochowa University of Technology; k.olejniczak-szuster@pcz.pl,
ORCID: 0000-0002-7820-4746

**Purpose:** The phenomenon of quiet quitting has gained significant popularity in public discourse and on social media, especially in the aftermath of the COVID-19 pandemic. It refers to performing only those tasks that are formally part of one's job description, without putting in extra effort, working overtime, or "going above and beyond." Quiet quitting does not mean physically leaving one's job, but rather giving up the identification of one's self-worth with productivity. The aim of this study is to determine whether quiet quitting is a temporary trend or a lasting shift that will influence perceptions of job responsibilities and workplace relationships.
**Design/methodology/approach**: In addition to a literature review, the study draws on survey data from 162 active respondents across three generations: X, Y, and Z. The Cramér's V coefficient was used to analyze the relationships between the survey variables, and their statistical significance was tested.
**Findings:** The survey results reveal significant generational differences in attitudes toward various aspects of work in the context of quiet quitting. Younger generations place greater emphasis on well-being, work-life balance, and independence, which can lead them to disengage from excessive involvement in situations that do not meet their expectations. In contrast, older generations tend to adhere to a more traditional approach, valuing loyalty to the employer and a willingness to make sacrifices for career advancement.
**Originality/value**: This study provides a timely and relevant perspective on one of the most widely discussed phenomena in today's labor market. It presents quiet quitting not as a fleeting trend, but as a reflection of deeper changes in employees' expectations toward employers. The findings can serve as a valuable resource for HR departments and organizational leaders in developing strategies to manage employee engagement and satisfaction.
**Keywords:** quiet quitting, engagement, Generation X, Generation Y, Generation Z, Motivation, Work-Life Balance.
**Category of the paper:** Research paper.

## 1. Introduction

The crisis caused by the COVID-19 pandemic and the rapidly changing labor markets in the post-pandemic period have led to a reevaluation of career paths and the broader significance of work in people's lives (Rossi et al., 2024; Pearce, 2022). Many workers have come to realize that work should not be the sole source of their identity or fulfillment. Consequently, there has been a noticeable increase in the number of individuals choosing to change careers or leave their current jobs in search of greater professional and personal satisfaction (Park et al., 2024). The pandemic also exposed numerous shortcomings in existing work systems, including issues such as job burnout and the lack of work-life balance (Burrowes et al., 2023; Costin et al., 2023; Kuralová et al., 2024). As a result, many employees have begun to seek more flexibility in the workplace, leading to the rising popularity of remote and hybrid work models (Smite et al., 2023). This shift has influenced changes in how employers structure work arrangements and adapt their offerings to better meet employees' needs. In response to these transformations in the labor market, a trend known as quiet quitting has emerged. It refers to employees' growing tendency to reduce their professional engagement without formally resigning from their positions (Hamouche et al., 2023). Although the term was first introduced by Mark Boldger during an economics symposium at Texas A&M University in 2009, it only gained widespread attention in the social media era, especially on the TikTok platform (Drela, 2024; Nikolova, 2024; Yıldız, 2023). A key moment in the popularization of the phenomenon was a video posted by user Zaid Khan (@zaidlepplin), who famously stated: "Work is not your life, and your value is not defined by productivity." This type of content sparked widespread online discussion and quickly became a topic of academic interest as well (Yikilmaz, 2022; Moczydłowska, Moczydłowska, 2024).

The purpose of this study is to answer the question posed in its title — namely, whether quiet quitting is merely a temporary trend or a lasting shift that will permanently influence how job responsibilities and workplace relationships are perceived. This study aims to address a gap in the existing literature and contribute to ongoing research on this topic in the following ways:

1. Currently, research on quiet quitting is still in its early stages, with initial studies primarily focused on defining the concept (Campton et al., 2023; Nikolova, 2024).
2. Existing literature has largely concentrated on the effects of the COVID-19 pandemic (Yıldız, 2023; Lu et al., 2023).

The findings of this study will provide insights into employees' general attitudes toward quiet quitting and explore generational differences in perspectives on the phenomenon — among Generations X, Y, and Z.

## 2. Theoretical Background and Hypotheses

Recently, the concept of quiet quitting has emerged as a significant framework for understanding the behavior of employees who deliberately minimize their commitment and effort at work (Mahand, Caldwell, 2023; Klotz, Bolino, 2022; Caldwell et al., 2023). In many ways, quiet quitting can be seen as an evolution of the concept of turnover intention—the intention to leave one's job—which, in this case, does not culminate in actual resignation. Instead, employees remain formally employed but limit their efforts strictly to the scope of their contractual obligations (Lu et al., 2023; Ellis, Yang, 2022; Scheyett, 2022). Unlike traditional quitters, meek quitters reject the notion that work should dominate their lives (Formica, Sfodera, 2022). These employees perform only the minimum required to retain job stability, consciously avoiding overtime, excessive commitment, extracurricular work activities, or emotional investment in the workplace (Boy, Sürmeli, 2023; Bell, Kennebrew, 2023; Wu, Wei, 2024). In this way, quiet quitting can be interpreted as a form of protest or a response to perceived organizational neglect, especially when employees feel that their needs and expectations are not acknowledged or addressed—ultimately leading to a decline in motivation and engagement (Dilekçi et al., 2025; Johar et al., 2023; Kim, Sohn, 2024). It is important to note that this withdrawal from additional effort is not due to personal laziness or lack of ambition. Rather, employees often see no meaningful incentive to take on extra responsibilities without fair compensation or recognition (Malinsky, 2022). Instead of viewing work as central to their identity and the ultimate life goal, an increasing number of employees—especially those from Generation Z—are prioritizing work-life balance (Lipinski, Koczy, 2023; Galanis et al., 2023; Zieba, 2023). This shift stems from a growing awareness of the importance of psychological well-being, the quality of personal relationships, and the pursuit of self-actualization outside the professional sphere (Arar et al., 2023). Work-life balance is now perceived not only as essential to health and life satisfaction, but also as a form of resistance to a culture of overcommitment—one that expects employees to be constantly available, flexible, and willing to exceed formal job duties without any guarantee of appropriate compensation or recognition (Schieman et al., 2009; Sirgy, Lee, 2018; Dillard et al., 2024). This emphasis on balance may therefore reflect a broader socio-cultural transformation in which work is no longer viewed as the supreme value, but rather as one of many aspects of life that should coexist in harmony with others (Twenge, 2017; Seemiller, Grace, 2016). Employees engaging in quiet quitting may perceive their actions as the only viable way to express dissatisfaction or a sense of misalignment with the new professional reality—shaped by remote work, increased flexibility, and evolving organizational cultures (Xueyun et al., 2023). This approach can be understood through the lens of boundary balancing (Pearce, 2022), wherein employees consciously define where professional obligations end and personal life begins. According to Anand et al. (2023),

quiet quitting is also a response to factors such as excessive workloads, long working hours, unrealistic performance expectations, workplace stress, and burnout.

Based on the above, the following hypotheses are proposed:

*H1: Quiet quitting is an enduring trend, driven by emerging values such as work-life balance and professional independence.*

*H2: Quiet quitting is a short-lived fad, amplified by social media and online influencers.*

## 3. Research Methodology, Research Subject and Research Sample

To achieve the main objective of this study, a diagnostic survey was conducted using a questionnaire inspired by the work of Nikolov (2024) and Patel et al. (2023), who examined the phenomenon of quiet quitting in relation to employee engagement, job satisfaction, and perceptions of work-life boundaries. The questionnaire included items addressing these aspects, supplemented with original questions developed by the author to explore quiet quitting in the context of current labor market trends and social dynamics.

A purposive sampling method was employed (Chen, 2023), targeting individuals from three generational cohorts: Generation X, Generation Y (Millennials), and Generation Z (Table 1).

**Table 1.**
*Characteristics of Generation X, Y, Z*

| Generation | Birth Years | General Characteristics | Work Expectations | Preferred Work Environment |
|---|---|---|---|---|
| **X** | 1964-1979 | Loyal, disciplined, value stability and security. Attached to full-time employment and clear rules. | Stable employment, clearly defined responsibilities, social security. Respect authority and hierarchy. | Office with a structured environment, clear division of roles, stable work schedule. |
| **Y** | 1980-1994 | Flexible, ambitious, development-oriented. Raised in times of prosperity. | Opportunities for growth, feedback, flexible working hours, remote work. Value work-life balance and team atmosphere. | Project-based work, flexible hours, home office, startup-like work culture, less hierarchy. |
| **Z** | Since 1995 | Digital generation, fully immersed in technology. Value authenticity, speed, diversity, and freedom of choice. | Clear company values, diversity, flexibility, development opportunities, influence, and fast career progression. Expect mental health support. | Hybrid or remote work, culture of openness and collaboration, strong focus on technology, creative spaces. |

Source: Wiktorowicz, Warwas (2016); Krawczyńska-Zaucha (2021); Pietruszyńska (2023).

The selection of participants was based on their generational affiliation and current employment status. A total of 162 individuals participated in the study, of whom 70.4% were women and 29.6% were men. Regarding generational distribution, the sample included 36 participants from Generation X, 42 from Generation Y, and 84 from Generation Z. All respondents were economically active at the time of the survey.

## 4. Presentation of research results

The survey revealed that 48.1% of all respondents currently identify with the concept of quiet quitting, indicating that this phenomenon is relatively widespread among employees across generations. However, generational differences appear to influence how individuals perceive and experience quiet quitting. Notably, 33.3% of respondents stated that they had previously identified with the idea of quiet quitting, which may suggest fluctuating attitudes toward professional engagement at various stages of one's career. In contrast, only 18.5% of respondents reported never identifying with the concept throughout their professional lives, implying that the majority of employees have encountered this phenomenon—whether temporarily or more consistently—at some point during their careers.

As part of the study, employees' perceptions and behaviors related to quiet quitting were analyzed. The results of these analyses are presented in Table 2.

**Table 2.**
*Opinions on employee behavior through the lens of Generation X, Y, Z*

| Research Aspect | Generational Approach | | | Chi² | Cramér's V |
|---|---|---|---|---|---|
| | Gen X | Gen Y | Gen Z | | |
| Concern for mental health, even at the cost of work | Moderate | Mixed | Very strong agreement | 86.85 | **0.522** |
| Willingness to show greater commitment when aiming for promotion | Strong agreement | Agreement | Mixed | 69.53 | 0.466 |
| Engagement limited to official working hours | Agreement | Mixed | Strong agreement | 57.47 | 0.429 |
| Reducing involvement due to exhaustion | Agreement | Mixed | Strong agreement | 57.16 | 0.427 |
| Working without sacrificing personal time | Agreement | Agreement | Agreement | 65.94 | 0.451 |
| Performing only contractually defined duties | Agreement | Mixed | Strong agreement | 25.33 | **0.281** |

Source: own research.

The survey results indicate significant generational differences in attitudes toward various aspects of work related to quiet quitting. Based on the chi-square (Chi²) test, it was found that for all examined aspects, there are statistically significant relationships between generational affiliation (Gen X, Y, Z) and attitudes towards work. The strongest relationship appeared in the area of prioritizing mental health over work duties (Chi² = 86.85), indicating clear generational differences. In other areas, such as engagement limited to working hours or response to exhaustion, the Chi² values also exceed the significance thresholds, confirming that attitudes towards work vary by generation. The strongest correlation observed in the study (Cramér's V = 0.522) concerns the importance of mental health, even at the expense of work. Generation Z expressed the strongest agreement with this notion, highlighting their prioritization of mental well-being over complete work dedication. This likely reflects their stronger emphasis on maintaining a healthy work-life balance. In contrast, Generation X showed a more moderate stance, suggesting that values such as loyalty to work and full commitment remain more

important for older cohorts. Another notable relationship (V = 0.466) pertains to the level of commitment expected for career advancement. Respondents from Generations X and Y were more inclined to agree that greater personal investment is necessary for promotion. In comparison, Generation Z demonstrated less support for this idea, which may reflect a growing detachment from traditional work-centric values and a stronger inclination toward alternative priorities, such as personal health and leisure. This generational divergence points to a broader cultural shift in workplace expectations and values, especially among younger professionals. Additional differences emerged in responses to working strictly within designated hours (V = 0.429) and reducing involvement due to fatigue (V = 0.427). Generation Z clearly demonstrates their approach to the limits of work-life balance. Generation Z strongly defends work-life boundaries, treating work as something that should be confined to defined hours and not extended—particularly in cases of fatigue. In contrast, older generations, especially Generation X, tend to view these boundaries more flexibly and are more accepting of sacrificing personal time for professional duties. When it comes to the issue of performing work without compromising private time (V = 0.451), responses were consistent across all generations, suggesting that this aspect is universally important. This points to a growing cross-generational awareness of the importance of maintaining a healthy balance between work and personal life. Regarding the notion of performing only the duties outlined in one's employment contract (V = 0.281), the differences between generations were minimal. All age groups shared similar views, treating defined job responsibilities as a standard framework for work, without significant divergence in opinions. The results of the survey showed that the phenomenon of quiet quitting is seen by the majority of respondents (85.2% of representatives of all generations) as a trend that could permanently affect the way work will be approached in the future. Taking into account the different generations, it is noted that:

- Generation X sees quiet quitting as a phenomenon that could lead to permanent changes in work organization, which may reflect their stronger attachment to stability and structure in the workplace.
- Generation Y is more divided on the sustainability of the phenomenon. While some in this group recognize the potential for changes in how work is organized, not all are convinced that quiet quitting is a trend that will persist in the long term.
- Generation Z is the most convinced of the long-term viability of quiet quitting, which may stem from their greater flexibility in approaching work, their strong preference for work-life balance, and their emphasis on intangible values, such as psychological well-being.

Thus, in reference to hypothesis *H1—that quiet quitting is a phenomenon with the potential for lasting change in work organization*—and *H2—that it is a term trend*—it appears more reasonable to support H1. The data suggest that quiet quitting reflects a deeper, value-driven shift in employee attitudes, rather than a fleeting social media trend. The generational differences observed in the study further illustrate how evolving values and expectations,

particularly around work-life balance, autonomy, and well-being, are likely to influence the future structure and culture of work. These findings indicate that quiet quitting may indeed contribute to a long-term transformation in the way work is perceived and organized across the labor market.

## Summary

This study examined perceptions of the quiet quitting phenomenon, with a particular focus on its potential sustainability as a long-term trend in the workplace. The survey findings indicate that the majority of respondents view quiet quitting as a development that could bring about lasting changes in how work is organized and experienced. Although interpretations of the phenomenon vary by generation, its growing prominence reflects broader shifts in professional values—particularly concerning work-life balance and psychological well-being. Generation Z appears to be the most convinced of the phenomenon's permanence, prioritizing flexibility, mental health, and personal fulfillment over traditional notions of occupational dedication. Generation X also recognizes the potential for long-term organizational changes, albeit from a perspective that values structure and may be more accepting of work encroaching on private time. Meanwhile, Generation Y demonstrates more mixed views: while some see quiet quitting as indicative of lasting transformation, others remain skeptical of its enduring impact. These generational differences highlight the evolving landscape of employee expectations and suggest that the future of work may increasingly revolve around balance, autonomy, and well-being.

In conclusion, the study reveals that younger generations place greater emphasis on work-life balance and autonomy, whereas older generations expect a higher degree of professional commitment. These changing attitudes toward work suggest that organizations must adapt their human resource management strategies to accommodate the diverse needs of different generations.

As the future of work continues to evolve, the implications for organizations are significant: they will need to implement flexible and responsive HR strategies that align with the expectations of newer generations. Therefore, further research is necessary to gain deeper insights into the impact of quiet quitting across various professional sectors and to develop effective approaches for managing employees in this dynamic environment.

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# CYCLICALITY OF THE CRYPTOCURRENCY MARKET

Krzysztof PODGÓRSKI[1], Mateusz MUSZYŃSKI[2*]

[1] University of Economics in Katowice; krzysztof.podgorski@ue.katowice.pl, ORCID: 0000-0002-7549-1997
[2] University of Economics in Katowice; mateusz.muszynski@ue.katowice.pl, ORCID: 0000-0001-8722-5541
* Correspondence author

**Purpose:** This article examines the cyclicality of the cryptocurrency market, focusing on Bitcoin and Litecoin. The study aimed to understand the characteristics of price movements and identify halving-related patterns that may indicate recurring trends or anomalies.
**Design/methodology/approach**: The paper adopted two research hypotheses: (H1) the cryptocurrency market is characterized by cyclicality resulting from Bitcoin halvings, and (H2) halving cyclicality is not exclusive to Bitcoin. The study was conducted based on data covering the period from August 16, 2014, to August 31, 2024, spanning across the second, third, and part of the fourth Bitcoin cycle. Classic Bitcoin cycle models were employed.
**Findings**: The results indicate significant connections between Bitcoin and altcoin prices, confirming Bitcoin as a leading indicator in forecasting altcoin price highs and lows. Additionally, Litecoin analysis showed halving cyclicality is not exclusive to Bitcoin, though weaker in altcoins. The findings highlight cyclicality's significance in cryptocurrency market analysis and suggest further investigation.
**Research limitations/implications**: The limitation of the conducted research was the amount of available data. The cryptocurrency market is very young, less than a dozen years old.
**Practical implications:** The research results can be used to shape the investment decisions for investors.
**Originality/value:** The small number of studies related to the behavior of cryptocurrency prices other than Bitcoin within its halving cycles and the lack of studies on potential cycles resulting from halvings of other cryptocurrencies constitute a research gap worth filling.
**Keywords:** cryptocurrencies, bitcoin, altcoins, cyclicality.
**Category of the paper:** research paper, conceptual paper.

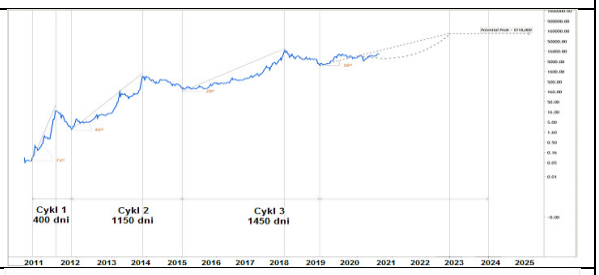
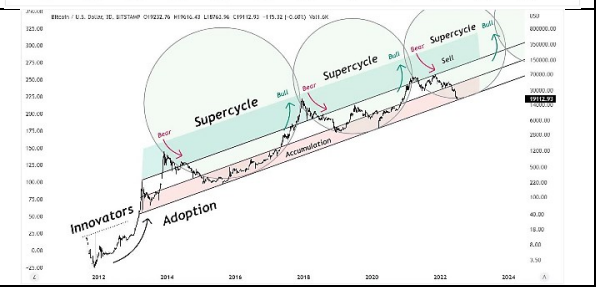
## 1. Introduction

In recent years, cryptocurrencies have attracted considerable attention from investors, researchers, and the media due to their volatility, unique market mechanisms, and potential for high returns. This phenomenon is justified because no asset class has reached a market capitalization of one trillion dollars faster than Bitcoin. Given the growing popular appeal of

cryptocurrencies, it is becoming increasingly critical to understand the factors that influence their value on the financial market. Importantly, cryptocurrency prices show evident fluctuations, and these, in turn, may suggest the existence of cyclical patterns. Although the literature devoted to this subject is extensive, there is still a lack of precise results that could help us better understand these cycles.

Cyclic models are used to forecast the Bitcoin price. In the literature and investment practice, four basic concepts can be distinguished in chronological order: classic cycles, lengthening cycles, the stock-to-flow model, and circular cycles (see Table 1).

**Table 1.**
*Bitcoin cyclic concepts*

| Cycle | Description | Diagram |
|---|---|---|
| Classic cycles | They result from *halvings* that occur approximately every four years. Each cycle consists of three phases: an upward phase lasting about a year and ending with a new high, a downward phase lasting about a year and ending with a new low, and a two-year consolidation. |  |
| Lengthening cycles | They refer to the classical concept, assuming at the same time that each subsequent cycle is longer and that the returns on investment, measured by the ROI indicator, decrease over time. |  |
| *Stock-to-flow model* | It was built based on the relationship between Bitcoin's supply and its creation possibilities. It takes into account more variables than the classic and lengthening cycles. |  |
| Circular cycles | According to the concept of circular cycles, the Bitcoin rate aligns with self-similar circular patterns. Unlike the previously described circular patterns, several distinct concepts can be identified. |  |

Source: own study based on Podgórski, 2023, pp. 197-201.

The study aimed to understand the characteristics of price movements in the cryptocurrency market and identify possible patterns centered around the halving phenomenon, which could indicate recurring trends or anomalies. Market practice suggests that attempts to find such patterns can be successful, which, in turn, can significantly contribute to understanding the

mechanics of the better-known cyclicality of Bitcoin and the cyclicality specific to other cryptocurrencies with a halving mechanism. The potential for cycles or market patterns to occur is rooted in a key economic theory known as efficient markets, which asserts that the prices of financial assets reflect all available information (Dobrowolski, 2014).

Research demonstrates that cryptocurrency cycles are significantly influenced by various macroeconomic factors, including exchange rates, stock indices, and commodity prices, in both short-term volatility and long-term trends.

Short-term analyses detail that Bitcoin volatility significantly responds to several factors. Akkaya (2021) reports that changes in the EUR/USD exchange rate, gold price, USD 10-year bond yield, US Dollar Index, and VIX all affect volatility at the 1% level. In a similar time frame, Błoński (2023) finds strong positive Pearson correlations between Bitcoin and the S&P 500 (0.87), the Warsaw Stock Exchange Index (0.82), and gold price (0.76). By contrast, Nakagawa and Sakemoto (2020a, 2020b) observed no significant short- term effect of individual indicators such as inflation or money supply on cryptocurrency returns.

Long-term relationships also emerge. Błoński (2023) shows that the S&P 500 (0.88) and gold price (0.63) maintain strong correlations with Bitcoin over a five- year horizon, while Gökçe (2023) identifies long-term influences from the US 10-year bond yield, West Texas Intermediate crude oil price, Dollar index, and NASDAQ-100 index. Additional insights include findings that GARCH models capture volatility patterns (Akkaya, 2021), two or three principal factors account for 77% of yield variation (Kozubík), and that regulatory policies, expert opinions, media intensity, tax restrictions, and payment acceptance shape price dynamics (Pudło, 2018). Regional effects also appear, with Błoński (2023) linking Bitcoin closely to both US and Polish market indices, even as Pudło (2018) argues for market independence from national economies. Collectively, these studies support the view that both short-term fluctuations and long-term trends in cryptocurrencies - primarily Bitcoin - are influenced by an array of macroeconomic factors.

Bitcoin halving events align with recurring shifts in cryptocurrency market behavior. Fabuš et al. (2024) report that Bitcoin prices peak 12, 15, and 17 months after halving events, with these rebounds accompanied by heightened volatility and speculative activity. Meynkhard (2019) shows that following the 2012 and 2016 halvings, prices surged by 9200% and 2910%, respectively, after an approximate five- month lag. Chan et al. (2023) note that volatility regime shifts occur in low- and high-volatility conditions rather than coinciding directly with halving stages, and Phiri (2022) describes a trend of diminishing market efficiency with successive halving cycles. In addition, El Mahdy (2021) observes a significant negative reaction in the U.S. capital market, and Jiménez et al. (2024) identify positive volatility transmission from forex markets to Bitcoin. These studies indicate that Bitcoin halvings are linked to cyclical patterns in price dynamics and market effciency, although the timing and strength of effects vary across analyses. Concerning cross-market effects, one study notes a negative reaction in U.S. capital markets, whereas another finds Bitcoin price movements largely independent of

traditional asset trends (El Mahdy, 2021). The literature thus documents key facets of Bitcoin halving cycles yet remains fragmented in its integrated examination of these cyclical phenomena (Chan et al., 2023). A theoretical analysis proposes that built- in halving mechanisms - characteristic of Bitcoin's design - may also prompt adjustments in miner rewards in other cryptocurrencies. Although detailed market responses and statistical evidence exist solely for Bitcoin, the theoretical framework implies that halving cyclicity may not be unique to Bitcoin but could extend to other digital currencies with similar protocols (Courtois, 2014).

Based on the above data the paper adopts two research hypotheses that are verified based on the methodology proposed by the authors:

- **H1**: The cryptocurrency market is characterized by cyclicality from Bitcoin halvings.
- **H2**: Halving cyclicality is not exclusive to Bitcoin.

The article consists of six sections. Section 1 is an introduction that covers the research's economic context, aim, and hypotheses. Section 2 reviews previous research works that fit into the issue of the cryptocurrency market cyclicity. Section 3 describes the authors' research methodology. Section 4 contains a presentation of the results of the conducted research. Section 5 presents conclusions, discusses the results obtained by other researchers, and indicates the research's limitations and further directions for future analyses. The last section includes information on the article's funding sources.

## 2. Cryptocurrency Market Cyclicality – A Literature Review

At the outset, it is worth drawing attention to the streams of research addressing the issue of cryptocurrencies. Bibliometric analysis is a popularly used quantitative method for assessing the development and dynamics of research in a given area. Merediz-Solà, I. and Bariviera, F.A. (2019), in their work covering data from 2012 to January 2019, stated that literature studies on cryptocurrencies mainly concern economic and IT issues. The authors emphasized that Bitcoin is fundamental to the market and literature. The latest bibliometric studies on Bitcoin were conducted by Wang, G. and Hausken, K. (2024). For this work, the authors created a data set for 2013-2022 containing 3837 publications published in 1024 scientific journals. The study results indicate a steady increase in the number of publications from 2013 to 2017 and an outburst in the number of publications from 2017 to 2019 (from 63 to 591). This trend continued after 2019, with the number of publications reaching 1032 in 2022. The same trend of changes, indicating an increasing interest in Bitcoin in the academic community, was also identified for the number of citations. The analysis showed that the literature is particularly keen to consider the economic and financial aspects of Bitcoin. The published works cover various aspects of Bitcoin, including price dynamics, market efficiency, market volatility, the relationship between Bitcoin and traditional financial markets, the role of Bitcoin as

an alternative investment asset, regulatory challenges related to Bitcoin adoption, and implications for monetary policy. Based on the bibliometric analysis, the authors divided the Bitcoin research into three stages, i.e., conceptualization and foundations of Bitcoin (2012-2016), cryptocurrencies and market efficiency (2007-2018), and technical analysis, big data, data privacy, and Bitcoin's links to financial markets (2019-2020).

Cagli, E.C. (2019) analyzed the phenomenon of the price explosion in Bitcoin and seven altcoins: Ethereum, Ripple, Litecoin, Stellar, Nem, Dash, and Monero. The research covered the daily prices of these cryptocurrencies from September 2015 to January 2018. The analysis results showed that, except for Nem, all cryptocurrencies from the studied sample showed a price explosion. This means that the prices of these cryptocurrencies are experiencing sharp increases, which may indicate the presence of speculative bubbles. It was also found that there are statistically significant bilateral relationships between the following pairs of cryptocurrencies: Bitcoin - Dash, Ethereum - Litecoin, Ethereum - Dash, Ethereum - Monero, and Ripple - Stellar. These results suggest that price changes of one cryptocurrency can affect the price changes of another, which thus emphasizes the strong connections between these assets.

The subject of the survey by Gül (2022) was the analysis of the relationships between the prices of selected cryptocurrencies in the period from January 21, 2020, to April 19, 2022. The work included seven cryptocurrencies selected based on the market capitalization criterion, which were Binance Coin (BNB), Bitcoin (BTC), Cardano (ADA), Dogecoin (DOGE), Ethereum (ETH), Polkadot (DOT), and Ripple (XRP). Cryptocurrencies representing a wide market range were selected for the analysis, from the oldest and most well-known cryptocurrency, Bitcoin, to more modern and specific projects like Cardano. The results of the study indicated a strong correlation between the cryptocurrencies studied. Only Ripple (XRP) was characterized by a low correlation with the other cryptocurrencies. The study also showed that the cryptocurrencies studied influence each other in the long and short term.

Gerlach, J. C., Demos, G., and Sornette, D. (2019) focused on analyzing Bitcoin price cycles and attempting to assess their predictability. For this purpose, they conducted a detailed analysis of the dynamics of Bitcoin prices against the U.S. dollar from January 2012 to February 2018. The automatic bubble detection method allowed for classifying price time series into periods of uninterrupted market growth and periods of continuous market decline. The authors identified three prominent bubbles and ten additional smaller bubbles that interrupted the Bitcoin price dynamics in the analyzed period. The main socio-economic factors responsible for the increase in Bitcoin prices were skepticism toward the traditional banking system, growing investment demand in China, and technical progress in the field of cryptocurrency mining itself. Despite its high volatility, Bitcoin showed the ability to quickly rebound after price declines, which, according to the authors, may suggest a future increase in its value. The study results also showed that the prices of many other cryptocurrencies are strongly correlated with the price of Bitcoin, which makes its analysis crucial for understanding the cryptocurrency market as a whole.

The results of a study conducted by Hayes, A. S. (2017) indicated the importance of production costs in shaping the value of cryptocurrencies. The author analyzed 66 most commonly used cryptocurrencies to determine the main factors influencing their value. It turned out that the three main factors driving their value are the level of competition in the network of producers, the rate of unit production, and the difficulty of the algorithm used to mine them. These factors come down to the emergence of relative differences in the costs of producing one digital currency concerning another. The work indicated that the increasing efficiency of cryptocurrency mining caused by technological progress reduces production costs and thus affects the price decline. The study's author also pointed out the block reward halving phenomenon as an essential factor determining the value of cryptocurrencies. Reducing the block reward leads to an immediate increase in the costs of producing cryptocurrencies, which may affect their price.

Masiak, C., Block, J.H., Masiak, T., Neuenkirch, M., and Pielen, K.N. (2018) conducted a study of the interactions between the market cycles of Initial Coin Offerings (ICOs) and the prices of Bitcoin and Ethereum, with a special focus on the influence of these variables on each other. The study covering 2014-2022 showed the occurrence of bullish and bearish price cycles of ICOs. The results also demonstrated that shocks in the prices of Bitcoin and Ethereum have a significant and positive effect on the volume of ICOs, with the impact of Bitcoin shocks being shorter than that of Ethereum shocks. It was also noted that higher ICO volumes cause lower prices of Bitcoin and Ethereum. The conclusions also indicated that innovations in Bitcoin and Ethereum positively affect future ICOs. Interestingly, however, innovations in ICOs are seen as drivers for changes in cryptocurrencies, not vice versa. The authors also concluded that Bitcoin, the leading cryptocurrency, influences Ethereum prices, but not the other way around, thus confirming its status as a benchmark in the cryptocurrency market.

Saad, M., Choi, J., Nyang, D., Kim, J., and Mohaisen, A. (2019) also addressed the explanation of Bitcoin and Ethereum's changing price and market trends. A Bayesian neural network was used along with other linear and nonlinear models to explain the volatility of Bitcoin's price. The authors analyzed the activity of users of the network of a given cryptocurrency from June 2015 to April 2017. Then, they identified the key features of cryptocurrencies that affect their prices, which included the hash rate used in cryptocurrency mining, reflecting the speed at which a computer can perform calculations, the number of users, the transaction rate, and the total number of a given cryptocurrency. Using machine learning methods, a model was built to predict the prices of Bitcoin and Ethereum and what is worth emphasizing based on features other than their past prices. As the authors claimed, the proposed model ensures accuracy of up to 99% in predicting the price of both cryptocurrencies.

In their article, Tanwar, S., Patel, N.P., Patel, S.N., Patel, J.R., Sharma, G., and Davidson, I.E. (2021) proposed a hybrid deep-learning model for predicting cryptocurrency prices. The authors focused on Litecoin (LTC) and Zcash (ZEC), considering interactions with Bitcoin as the base currency. The research was conducted for empirical data from August 24, 2016,

to May 26, 2021. What is particularly important is that the analysis of the relationships between cryptocurrencies revealed a significant impact of Bitcoin price changes on Litecoin and Zcash forecasts. These results thus emphasize the importance of interactions between different cryptocurrencies in the context of the possibility of formulating market forecasts.

Wheatley, S., Sornette, D., Huber, T., Reppen, M., and Gantner, R.N. (2019) also worked on speculative bubbles and price crashes of Bitcoin. The authors claimed that the existence of a relationship between the value of Bitcoin, its adoption, and the online activity of network users (searches, tweets, etc.) is entirely natural. They also pointed to macroeconomic variables that may determine the attractiveness of the cryptocurrency, e.g., in the context of treating Bitcoin as a hedge against the collapse of sovereign monetary systems. The analysis, conducted on empirical data from January 1, 2012, to January 26, 2018, allowed them to identify four different Bitcoin bubbles characterized by their high overvaluation. The LPPLS (Log-Periodic Power Law Singularity) model used in the study provided an ex-ante warning of market instability, indicating a probable time frame for a crash consistent with actual corrections. The conclusions regarding the impact of Bitcoin price changes on other cryptocurrencies are crucial. It was found that short-term price movements of different cryptocurrencies can be caused by Bitcoin price corrections, regardless of their valuations.

Che, M.N.X., Che, N., Copestake, A., Furceri, D., and Terracciano, T. (2023) analyzed the price movements of cryptocurrencies and their relationship with stock markets. The authors assumed that cryptocurrency markets have become more integrated and synchronized with the stock cycle. They also added that cryptoasset prices are strongly correlated. They pointed to Bitcoin as an example, whose average correlation with other cryptocurrencies is 52%. On this basis, the authors also assumed the existence of a common crypto factor that moves in line with the price movements of cryptoassets. The results confirmed that although crypto assets differ significantly in their construction and value proposition, their prices essentially move in the same direction. They also indicated that a single cryptographic factor could explain 80% of their price volatility, and since 2020, it has notably correlated with the technology stock market and small companies. These results also confirm the earlier observations of Iyer, T. (2022), who found a growing correlation between Bitcoin and the American S&P 500 stock index precisely since 2020. This phenomenon results from the increasing presence of institutional investors in the cryptocurrency market, which makes the risk profile of an individual investor in the stock market and the cryptocurrency market increasingly similar.

The issue of the formation of speculative bubbles in the Bitcoin and Ethereum markets and the importance of halving in forming price cycles was taken up by M'bakob, G.B. (2024). This author noted at the beginning of his work that the analysis of speculative bubbles in the cryptocurrency market requires considering the market dominance of Bitcoin. This dominance is measured by the ratio of Bitcoin's market capitalization to the market capitalization of all other cryptocurrencies. In 2023, Bitcoin's dominance exceeded 52.17%, indicating its significant impact on a majority market share. This means that any event responsible for the

formation of Bitcoin's price, such as halving, will probably impact all other cryptocurrencies. The results of the conducted research confirmed that the largest fluctuations in the prices of Bitcoin and Ethereum follow a four-year pattern, which can be characterized as a series of cyclical speculative bubbles. In the case of Bitcoin, bubbles were identified in 2013, 2017, and 2021. Halving analysis showed a significant correlation with the price cycles of the studied cryptocurrencies. The Bitcoin price peak occurs on average about a year after halving, which indicates a close relationship between halving and the breakout of the following currency peak. As the authors claimed, the halving phenomenon is also associated with additional lengthening of the price cycles of Bitcoin and Ethereum, and economic arguments can explain its existence. First, halving the reward for miners mining Bitcoin has a key impact on creating new coins. On the other hand, reducing supply contributes to creating an environment conducive to the growth of Bitcoin prices, thus encouraging the formation of speculative bubbles. Second, expectations of an increase in Bitcoin prices after halving may encourage investors to enter the market, also contributing to the formation of bubbles. Moving on, as investors experience subsequent price increases following each halving, they become increasingly confident in Bitcoin's long-term value, fueling speculative cycles.

Taskinsoy 's (2021) research also showed the cyclical nature of Bitcoin prices. This study indicated that Bitcoin's high valuations are related to its halving dates, as each resulted in a bubble within one year and a crash within the next few months. The behavior of Bitcoin prices after its halvings in 2012, 2016, and 2020 confirms this.

According to Chan, J.Y.L., Phoong, S.W., Phoong, S.Y., Cheng, W.K., and Chen, Y.L. (2023), the Bitcoin halving cycle suggests that its price movements follow specific sequences and are independent of the prices of other assets. Therefore, the implication of the above is the possibility of considering Bitcoin in the context of a haven investment. The authors also drew attention to the growing institutional and industrial adoption of Bitcoin and the outflow of capital from the gold market to the Bitcoin market in 2021. The mentioned authors' work aimed to examine the volatility of Bitcoin and determine its properties as a safe haven. The empirical data covered the period from October 2017 to February 2021, thanks to which it was possible to analyze Bitcoin prices before and after the stock market sell-off caused by the outbreak of the COVID-19 pandemic. The results indicated, among other things, that the Bitcoin halving cycle is not correlated with the stock market, which is why investors should not treat Bitcoin as a safe haven investment. The authors emphasized the need for further research into the properties of Bitcoin, bearing in mind that further adoption of the currency could affect the traditional halving cycle.

While the previously discussed works focused mainly on the supply effect of Bitcoin halving, i.e., speculation and price dynamics, Lashkaripour, M. (2024) considered not only the supply effect but also the security effect in his research. The reduction of the block reward reduces the profitability of cryptocurrency mining and thus forces miners to suspend operations. Limitations in Bitcoin's creation capabilities weaken the network's security, leading to

a decline in its price and undermining transaction utility. Studies have shown that the security effect is more visible in the short term. According to the authors, Bitcoin halvings cause an adverse price reaction, reduce price volatility and increase transaction fees.

The impact of Bitcoin halving on the cryptoasset market and the benefits and limitations resulting from this event are collectively presented in the work by Singla, A., Singla, M., and Gupta, M. (2023). The benefits of Bitcoin halving are considered from the perspective of supply constraints, market sentiment, and technical mining capabilities. Halving contributes to a decrease in the rate of introduction of new bitcoins into circulation and, therefore, may be a fundamental factor supporting the long-term value of Bitcoin. Events related to Bitcoin halving have a profound impact on market sentiment. The reduction in Bitcoin supply and increasing demand may create positive market sentiment in the months preceding and following the halving. These may, in turn, attract new investors and lead to a further increase in the price of Bitcoin. Considering the technological factor, it is noted that although halving events may pose a challenge for miners due to reduced rewards for new blocks, they can also encourage the use of more efficient mining technologies and sustainable practices. In the long term, developing mining technologies may create a more environmentally friendly mining ecosystem. However, the authors also noted the adverse effects of Bitcoin halving, including short-term price fluctuations and the mining centralization risk. Although the Bitcoin market is known for its high volatility, Bitcoin halving events often amplify short-term price fluctuations. This is due to, among other things, the increased involvement of traders in speculative activities. Reducing the rewards for mining another Bitcoin may also affect the profitability of smaller miners, potentially leading to increased centralization of mining activities. Larger mining companies with access to broader and more profitable resources may gain a competitive advantage, thus creating challenges to the decentralized nature of the network. The paper finally noted that the Bitcoin halving phenomenon is not isolated from the broader economic and regulatory context. This means that macroeconomic trends and regulatory or technological changes may overshadow the effects of the events that accompany the Bitcoin halving.

Based on the conducted literature analysis, it was decided to join the research trend on the cyclicality of cryptocurrencies, verify their relevance in the context of changing market conditions, and propose our research approach, allowing for explaining the timeliness of cryptocurrency peaks and troughs based on bitcoin halvings and attempting to find analogous patterns resulting from the halving of a lesser-known cryptocurrency, which is Litecoin. The small number of studies related to the behavior of cryptocurrency prices other than Bitcoin within its halving cycles and the lack of studies on potential cycles resulting from halvings of other cryptocurrencies constitute a research gap worth filling.

## 3. Research Methodology

The implementation of the objectives adopted in the article required the use of a multi-stage research procedure, the essence of which is the analysis of the cyclicality of the cryptocurrency market by determining the impact of classic Bitcoin cycles on altcoin prices and determining the "halving" cyclicality of other cryptocurrencies.

The study was conducted according to a procedure consisting of the following stages:

1. Determining the average number of days between Bitcoin halvings, which was taken as the average cycle length.
2. Determining the start and end dates of individual Bitcoin cycles, taking the halving date as the middle of the cycle.
3. Determining temporary highs and lows for the cryptocurrencies selected for research.
4. Establishing the dependence level of cryptocurrency prices between cycles.
5. Establishing the dependence level between altcoin prices and the Bitcoin price in individual Bitcoin cycles.
6. Determining the forecasts of cryptocurrency prices within the fourth Bitcoin cycle.
7. Determining and analyzing Litecoin's current cycles.
8. Comparing Bitcoin and Litecoin cycles.

The study was conducted based on data from August 16, 2014, to August 31, 2024. The starting date is the estimated beginning of the second Bitcoin cycle. The end date is the end of the entire month before starting work on the article. The research period includes the second, third, and part of the fourth Bitcoin cycle. The first cycle was deliberately omitted because, on the one hand, cryptocurrencies were not very popular and relatively difficult to access at that time. On the other hand, most altcoins, especially those currently characterized by high capitalization, did not yet exist, which would significantly limit the research sample (Majewska-Bielecka, Grzelczak, 2021). The study used daily closing prices of cryptocurrencies expressed in dollars from the website (Stooq.pl, 2024). First of all, any gaps were filled in based on the closing prices from (CoinGecko, 2024) website, and in the absence of a daily price for a given day, the price from the previous day was used. For the study, a forecast of cryptocurrency prices was prepared for the period from September 1, 2024, to March 13, 2026, i.e., from the end of the period from which the data came to the potential end of the fourth Bitcoin cycle, assuming the current cyclicality is maintained. The length of a single Bitcoin cycle was estimated at 1387 days.

The study examined Bitcoin prices and five altcoins with the largest capitalization expressed in dollars as of August 31, 2024, which simultaneously existed on August 16, 2014. The capitalization of individual cryptocurrencies was taken from www.coingecko.com. These were Ripple, Dogecoin, Litecoin, Monero, and Stellar. Classic Bitcoin cycles were used for the analyses, as they are characterized by a fixed length, allowing for the comparability of data between cycles, which is necessary for performing calculations.

The dependence level of cryptocurrency prices between cycles and between altcoin prices and Bitcoin prices in individual cycles was determined using the Spearman rank correlation coefficient. Tests of normality of the distribution of the studied variables preceded the selection of the correlation coefficient. The following tests were used: Shapiro-Wilk and Kolmogorov-Smirnov with Lilliefors correction, assuming a significance level of 5%. In the case of both tests, the hypotheses about the normality of distributions were rejected for all analyzed cryptocurrencies. The graphs of normality of distributions of individual cryptocurrencies are presented in Figure 1.

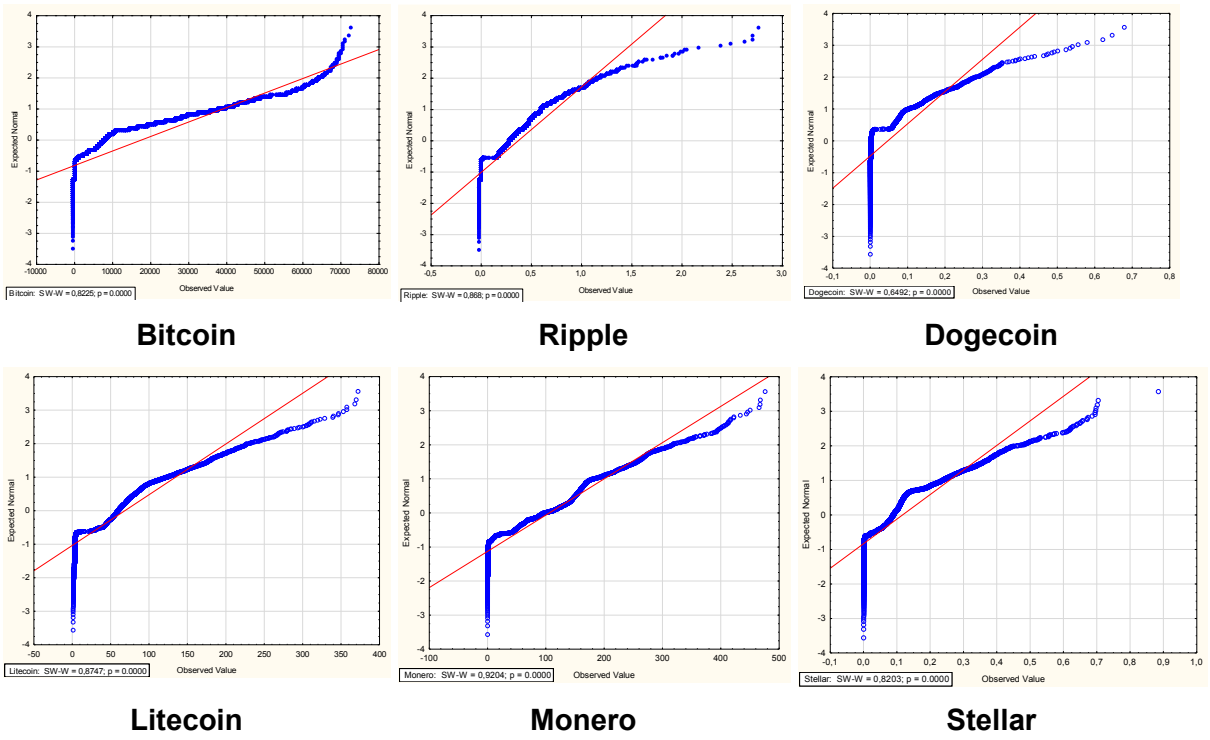



**Figure 1.** Normality charts of selected cryptocurrencies.

Source: own study.

Cryptocurrency price forecasts were made employing the Forecast Sheet tool with the ETS algorithm using exponential smoothing, available in Microsoft Excel. A confidence level of 95% was adopted, which is a commonly known compromise between the interval width and the forecast certainty (Kallogjeri, Francis, Piccirillo, 2019). The advantages of the exponential smoothing algorithm include the ability to detect clear trends and strong seasonality (Hema et al., 2025). The limitations include: lack of adaptation to sudden changes and poor ability to detect significant anomalies such as sudden price jumps caused by fundamental events (Akyildirim et al., 2022).

Of the five analyzed altcoins, Dogecoin, Litecoin, and Monero are characterized by a proof-of-work consensus mechanism, while Ripple and Stellar are proof-of-stake cryptocurrencies (Gans, 2023). Only Litecoin has a halving mechanism that occurs every 840,000 blocks among the proof-of-work cryptocurrencies, so the last part of the study checked Litecoin's cyclicality based on its halvings and compared the obtained results with Bitcoin's cyclicality.

## 4. Research Results

Halving, the process of reducing by half the current reward for miners for mining a single block and aimed at controlling the supply of the cryptocurrency, occurs approximately every four years in the case of Bitcoin. However, the number of days between individual halvings is not fixed and has so far ranged from 1319 to 1439 days. To apply the classic concept of cycles based on their fixed length in further analyses, the average length of the Bitcoin cycle was calculated at 1387 days. Based on the halving dates and average cycle length, individual cycles' start and end dates were determined (see Table 2).

**Table 2.**
*Parameters of individual Bitcoin cycles*

| Cycles | Start of a cycle | Halving day | End of a cycle |
|---|---|---|---|
| Cycle 1 | 01/05/2011 | 11/28/2012 | 10/22/2014 |
| Cycle 2 | 08/16/2014 | 07/09/2016 | 06/02/2018 |
| Cycle 3 | 06/18/2018 | 05/11/2020 | 04/04/2022 |
| Cycle 4 | 05/27/2022 | 04/19/2024 | 03/13/2026 |

Source: own study.

In Table 2, Cycle 1 is marked in orange, which was excluded from further analysis due to the low popular appeal and difficult accessibility of cryptocurrencies and the fact that most of the currently existing altcoins did not exist at that time. It is also worth noting that in the first cycle, market liquidity was very low, meaning that Bitcoin prices were more susceptible to manipulation and rapid changes. In later cycles, the development of technology, the growth of the number of users and acceptance by financial institutions had a significant impact on its cyclicality, so analyses omitting this period seem more reliable. In the next part of the study, the peaks and troughs occurring in the classic Bitcoin cycle were determined for cycles that have been completed. In the case of cycle four, the trough has potentially already been determined, but until the cycle ends, the price may fall lower and determine a new trough. Such a situation could occur if the previous cyclicality had not been maintained. Table 3 presents the temporality of individual peaks and troughs of the examined cryptocurrencies.

**Table 3.**
*Timeline of the examined cryptocurrencies' highs and lows in the full Bitcoin cycle with the Bitcoin price variation*

| Crypto-currency | Cycle 2 – low (variation from Bitcoin) | Cycle 3 – low (variation from Bitcoin) | Low – mean (variation from Bitcoin) | Cycle 2 – high (variation from Bitcoin) | Cycle 3 – high (variation from Bitcoin) | High – mean (variation from Bitcoin) |
|---|---|---|---|---|---|---|
| Bitcoin | 152nd day | 181st day | **167th day** | 1219th day | 1241st day | **1230th day** |
| Ripple | 248th day (+96 days) | 638th day (+457 days) | **443rd day (+276 days)** | 1241st day (+22 days) | 1032nd day (-209 days) | **1137th day (-93 days)** |
| Dogecoin | 263rd day (+111 days) | 638th day (+457 days) | **451st day (+284 days)** | 1241st day (+22 days) | 1055th day (-186 days) | **1148th day (-82 days)** |

Cont. table 3.

| | | | | | | |
|---|---|---|---|---|---|---|
| Litecoin | 152nd day (0 days) | 179th day (-2 days) | **166th day (-1 day)** | 1221st day (+2 days) | 1058th day (-183 days) | **1140th day (-90 days)** |
| Monero | 186th day (+34 days) | 638th day (+457 days) | **412th day (+245 days)** | 1223rd day (+4 days) | 1057th day (-184 days) | **1140th day (-90 days)** |
| Stellar | 201st day (+49 days) | 638th day (+457 days) | **420th day (+253 days)** | 1237th day (+18 days) | 1059th day (-182 days) | **1148th day (-82 days)** |

Altcoin low lags against Bitcoin | Altcoins and Bitcoin lows co-occur | Altcoin low accelerates against Bitcoin

Source: own study.

In the first and second Bitcoin cycles, the altcoin lows came later than the Bitcoin lows (except for Litecoin). At the same time, it can be observed that the altcoin lows came much later in the third cycle than in the second cycle. In predicting the lows, Bitcoin can be considered a leading indicator, as its price rises faster than the altcoin prices.

Considering the timeline of the highs, it can be observed that in the second cycle, the highs on altcoins occurred slightly later than on Bitcoin. In contrast, in the third cycle, this relationship was not maintained. It is worth noting here that a relatively specific course characterized the third cycle of Bitcoin. A double top formation known from technical analysis could be observed in the third cycle on the Bitcoin chart (Murphy, Madej, Kalinauskas, 1995). The first peak was formed on the 1033rd day of the cycle (63,460.86 USD), while after another 208 days, the price formed a second peak at 67,305.13 USD. Figure 2 shows the double top on Bitcoin visible in the third cycle.




**Figure 2.** Double top in Bitcoin's third cycle.

Source: own study.

Table 4 considers the timeline of the highs and lows of the studied cryptocurrencies in the full Bitcoin cycle after correction to include the first Bitcoin top in the third cycle.

**Table 4.**
*Adjusted timeline of highs and lows of the studied cryptocurrencies in the full Bitcoin cycle with the variation from the Bitcoin price*

| Crypto-currency | Cycle 2 – low (variation from Bitcoin) | Cycle 3 – low (variation from Bitcoin) | Low – mean (variation from Bitcoin) | Cycle 2 – high (variation from Bitcoin) | Cycle 3 – first BTC high (variation from Bitcoin) | High – mean (variation from Bitcoin) |
|---|---|---|---|---|---|---|
| Bitcoin | 152nd day | 181st day | **167th day** | 1219th day | 1033ed day | **1126th day** |
| Ripple | 248th day (+96 days) | 638th day (+457 days) | **443ed day (+276 days)** | 1241st day (+22 days) | 1032nd day (-1 day) | **1137th day (+11 days)** |
| Dogecoin | 263rd day (+111 days) | 638th day (+457 days) | **451st day (+284 days)** | 1241st day (+22 days) | 1055th day (+22 days) | **1148th day (+22 days)** |
| Litecoin | 152nd day (0 days) | 179th day (-2 days) | **166th day (-1 day)** | 1221st day (+2 days) | 1058th day (+25 days) | **1140th day (+14 days)** |
| Monero | 186th day (+34 days) | 638th day (+457 days) | **412th day (+245 days)** | 1223ed day (+4 days) | 1057th day (+24 days) | **1140th day (+14 days)** |
| Stellar | 201st day (+49 days) | 638th day (+457 days) | **420th day (+253 days)** | 1237th day (+18 days) | 1059th day (+26 days) | **1148th day (+22 days)** |

Altcoin low lags against Bitcoin | Altcoins and Bitcoin lows co-occur | Altcoin low accelerates against Bitcoin

Source: own study.

Considering the corrected data, it can be concluded that even in the case of peaks, Bitcoin can serve as a leading indicator of the altcoin price. It is also worth noting that the number of days between the highs of the Bitcoin price and the highs of the altcoin prices is much lower than in the case of analogous lows. At the same time, it can be observed that the number of days between bottoms and peaks has decreased significantly when comparing the second and third cycles.

Then, Spearman rank correlations were calculated between cryptocurrency prices in individual Bitcoin cycles (see Figure 3).

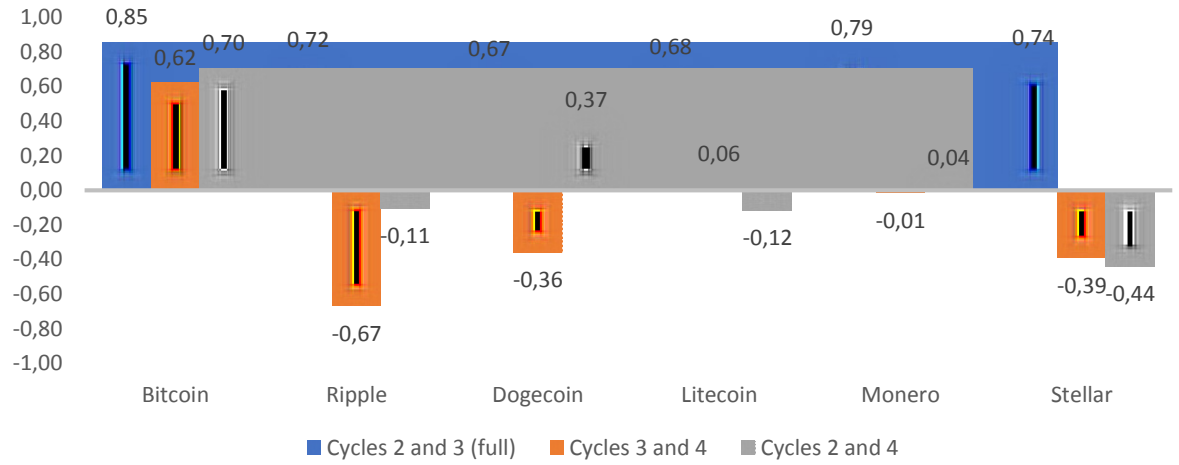



**Figure 3.** Cryptocurrency price correlations between cycles across Bitcoin cycles.

Source: own study.

The correlations between the prices in the second and third cycles are worth noting because only these cycles have been completed, while the fourth cycle should end in 2026. For the indicated cross-section, the correlation was significant in four cases (for Bitcoin, Ripple, Monero, and Stellar) and moderate in two (for Dogecoin and Litecoin). The correlation values between the third and fourth cycles and the second and fourth cycles in most cases (66.67%) turned out to be small at most. Still, if the current cyclicality is maintained, they should increase significantly in the later phase of the fourth cycle.

In the next step of the research procedure, correlations between altcoin prices and the Bitcoin price in individual Bitcoin cycles were calculated (see Figure 4).

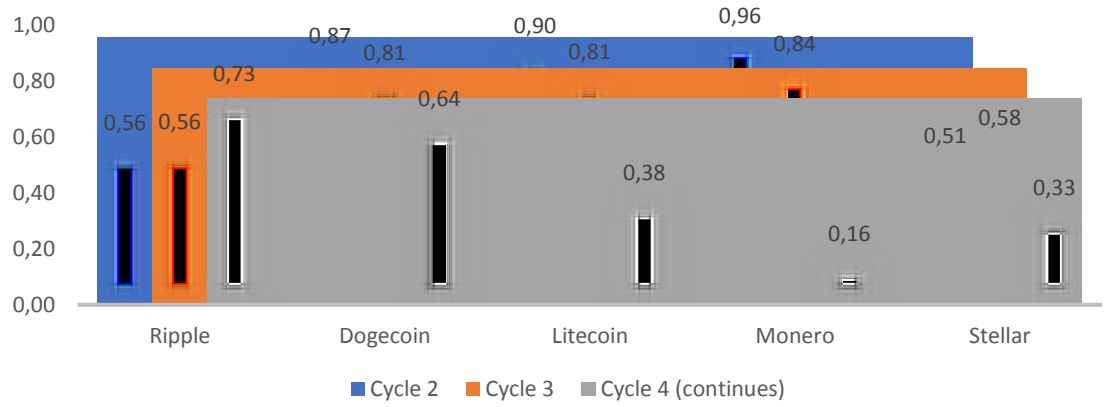



**Figure 4.** Correlations of altcoin prices with Bitcoin prices within Bitcoin cycles.
Source: own study.

In the cycles completed so far (the second and third), the correlations between the Bitcoin and altcoin prices were strong in two cases (Litecoin and Monero – Cycle 2), significant in four (Dogecoin – Cycles 2 and 3, Litecoin and Monero – Cycle 3) and moderate in four cases (Ripple and Stellar – Cycles 2 and 3). This indicates a statistically significant connection between the Bitcoin price and the prices of the analyzed altcoins and that the cyclicality persists over time. Only in the case of the fourth cycle were the correlation values lower on average, which should change if the current cyclicality is maintained.

The next step of the research procedure was to prepare price forecasts of the analyzed cryptocurrencies for the period from September 1, 2024, to March 13, 2026, i.e., for the rest of the fourth cycle. The Forecast Sheet with the ETS algorithm using exponential smoothing was used to prepare the forecasts. From the point of view of further analysis, it seems essential that the used algorithm indicated the possibility of double tops at a similar level in the fourth cycle – identical to the third cycle. The first of the peaks would be USD 83,619.66, and the second higher at USD 91,105.79. The timeliness of the analyzed cryptocurrencies, considering the forecasts for the fourth cycle, is presented in Table 5.

**Table 5.**
*Adjusted timeline of highs and lows of the studied cryptocurrencies in the full Bitcoin cycle with the variation from the Bitcoin price with Cycle 4 forecast*

| Crypto-currency | Cycle 2 – low (variation from Bitcoin) | Cycle 3 – low (variation from Bitcoin) | Cycle 4 – forecasted low (variation from Bitcoin) | Cycle 2 – high (variation from Bitcoin) | Cycle 3 – first BTC high (variation from Bitcoin) | Cycle 4 – forecasted highs (variation from Bitcoin) |
|---|---|---|---|---|---|---|
| Bitcoin | 152nd day | 181 day | 179 day | 1219 day | 1033 day | I top: 981st day<br>II top: 1169th day |
| Ripple | 248th day (+96 days) | 638th day (+457 days) | 23ed day (-156 days) | 1241st day (+22 days) | 1032nd day (-1 days) | 1174th day (+193 days)<br>1174th day (+5 days) |
| Dogecoin | 263ed day (+111 days) | 638th day (+457 days) | 23ed day (-156 days) | 1241st day (+22 days) | 1055th day (+22 days) | 1003ed day (+22 days)<br>1003ed day (-166 days) |
| Litecoin | 152nd day (0 days) | 179th day (-2 days) | 18th day (-161 days) | 1221st day (+2 days) | 1058th day (+25 days) | 1155th day (+174 days)<br>1155th day (-14 days) |
| Monero | 186th day (+34 days) | 638th day (+457 days) | 23ed day (-156 days) | 1223ed day (+4 days) | 1057th day (+24 days) | 1156th dzień (+175 dni)<br>1156th day (-13 days) |
| Stellar | 201st day (+49 days) | 638th day (+457 days) | 219th day (+40 days) | 1237th day (+18 days) | 1059th day (+26 days) | 1170th day (+189 days)<br>1170th day (+1 day) |

Altcoin low lags against Bitcoin | Altcoins and Bitcoin lows co-occur | Altcoin low accelerates against Bitcoin

Source: own study.

When analyzing the obtained forecasts of Bitcoin and altcoin prices for the fourth cycle, it is worth noting that, unlike the second and third cycles, the bottoms on altcoins in most cases (for Ripple, Dogecoin, Litecoin, and Monero) occurred much earlier than for Bitcoin. Only the lowest value of the Stellar price occurred 40 days after the bottom in the Bitcoin price. The forecasted peaks for three out of five analyzed altcoins should be formed earlier than the second Bitcoin peak. However, assuming an alternative scenario, considering only the first peak, Bitcoin would remain a leading indicator for all altcoins whose price was forecasted.

The next part of the study was to check whether halving cycles are a specific feature of Bitcoin or also occur in other cryptocurrencies. For this purpose, the halving cyclicity of Litecoin was examined. To compare individual cycles, we started by standardizing their lengths – as in the case of Bitcoin. To achieve comparability of data, the average cycle length was determined, which was rounded to 1450 days. Based on the halving dates and average cycle length, individual cycles' start and end dates were determined (see Table 6).

**Table 6.**
*Parameters of individual Litecoin cycles*

| Cycle | Start of a cycle | Halving Day | End of a cycle |
|---|---|---|---|
| Cycle 1 | 08/30/2013 | 08/25/2015 | 08/19/2017 |
| Cycle 2 | 08/10/2017 | 08/05/2019 | 07/30/2021 |
| Cycle 3 | 08/07/2021 | 08/02/2023 | 07/27/2025 |

Source: own study.

So far, Litecoin has had three cycles, the last of which is scheduled to end on July 27, 2025. Figure 5 presents the Litecoin price in the individual cycles.

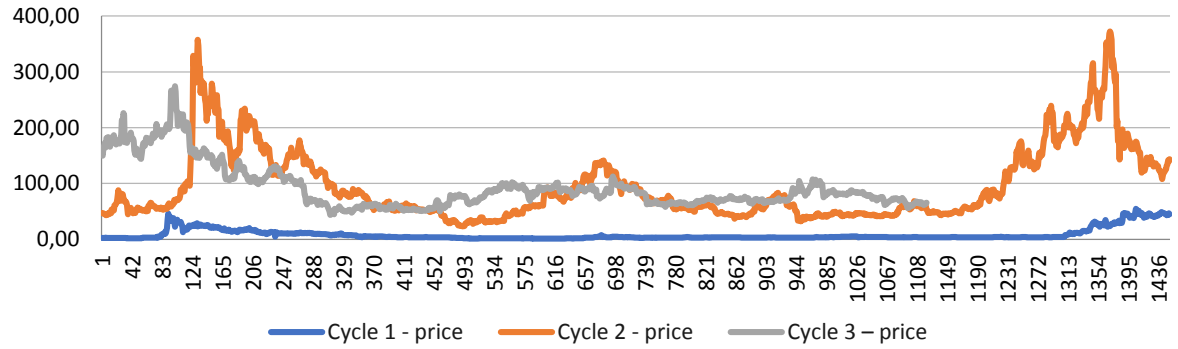



**Figure 5.** Litecoin price in individual cycles.

Source: own study.

The Litecoin cycle graph resembles a U-pattern with clearly formed tops in their initial and final phases. Spearman rank correlation coefficients were calculated between individual cycles to examine the strength of the relationship between the price in the Litecoin cycle. The value of the correlation coefficient between the first and third cycles was 0.60, between the second and third cycles 0.24, and between the first and third cycles 0.07. The strongest correlation is, therefore, between Litecoin prices in two completed cycles.

Table 7 presents a comparison of Bitcoin and Litecoin cycles.

**Table 7.**
*Comparison of Bitcoin and Litecoin cycles*

| Comparison criterion | Bitcoin Cycles | Litecoin Cycles |
|---|---|---|
| Current cycle count | 4 | 3 |
| Average cycle length | 1387 | 1450 |
| Average price correlation between cycles | 0.73 | 0.30 |
| Planned last halving event | The year 2141 | The year 2142 |
| Maximum cryptocurrency resources | 21 000 000 | 84 000 000 |
| Cycle progress | The upward trend lasts about a year and ends with a new high on the chart, followed by a downward trend lasting about a year and ending with a new low. Then, Bitcoin's price consolidates for about two years. | The chart resembles a U-pattern. Two distinctive tops:<br>- first between 91st and 131st day<br>- second between 1370 and 1405 day |

Source: own study.

In the case of Bitcoin, there have been more cycles, as many as four, while in the case of Litecoin, only three cycles have been recorded. Classic Litecoin cycles are 63 days longer than Bitcoin cycles. The average correlation between the rates of the cycles in the case of Bitcoin is significant (0.73), while in the case of Litecoin, it is small (0.30). The dates of the last halving and, thus, the potential end of the cyclicality of Bitcoin and Litecoin are similar. The Bitcoin cycle progression is characterized by annual phases: growth and decline, followed by a two-year consolidation. In turn, the shape of the Litecoin cycle resembles a U-pattern with clearly formed peaks at the beginning and end of the cycle.

## 5. Conclusions and Discussion

The research that was conducted allowed us to draw the following conclusions.

- C1: The classic Bitcoin cycles concept remains relevant, highlighted by the significant correlations in Bitcoin prices across its cycles.
- C2: The Bitcoin price may be a leading indicator in forecasting the lows and highs in altcoin prices, as indicated by a statistically significant correlation between the prices of Bitcoin and altcoins and the timeliness of the highs and lows. However, the altcoin peaks may occur after the first Bitcoin peak but before the second one.
- C3: The cyclical nature of cryptocurrency halvings is not unique to Bitcoin, as evidenced by the correlations between rates in Litecoin cycles. Still, it is weaker than in the case of Bitcoin.

Based on the obtained results, the hypotheses that the cryptocurrency market is characterized by cyclicality resulting from Bitcoin halvings and that halving cyclicality is not exclusive to Bitcoin have been positively verified.

The research results allowed us to draw three main conclusions. First, the concept of classic Bitcoin cycles remains relevant, as confirmed by the high correlation of Bitcoin prices across individual cycles (C1). This means that Bitcoin, despite changing market conditions, is still subject to similar cyclical mechanisms that allow for the prediction of its rises and falls.

Second, the Bitcoin price can be a leading indicator in forecasting the troughs and peaks of altcoin prices. The significant correlation between Bitcoin and altcoin prices and the analysis of the temporality of tops and bottoms indicate that movements in the Bitcoin market can signal future changes in the altcoin market. Therefore, these results are consistent with the findings obtained by other authors and presented in the literature review. However, it is worth noting that altcoin peaks can occur after the first Bitcoin high but before its second high (C2), which requires considering this specific phenomenon in forecasts.

The research also allowed us to formulate an innovative conclusion regarding halving, which, as it turned out, is not a phenomenon reserved exclusively for Bitcoin. Although the correlations between Litecoin and Bitcoin cycles indicate certain similarities, the halving cyclicality in the case of Litecoin is less pronounced and weaker than in the case of Bitcoin (C3). This may indicate differences in the dynamics and characteristics of both markets, which should be considered when analyzing and forecasting their future movements.

Based on the obtained results, the hypotheses that the cryptocurrency market is characterized by cyclicality resulting from Bitcoin halvings and that halving cyclicality is not exclusively Bitcoin's domain were positively verified. The research conclusions highlight the significance of cyclical patterns in cryptocurrency market analysis. They also point out the complexity of this phenomenon and underscore the necessity for further investigation in future studies, which we are committed to pursuing.

## 6. Limitation of the research

The limitation of the conducted research was undoubtedly the amount of available data. The cryptocurrency market is very young, less than a dozen years old. Most currently popular projects have been listed for only a few years, which is why the most significant projects in terms of capitalization that existed at the beginning of the second Bitcoin cycle at the time of launching this study were ranked from 7th to 36th in terms of capitalization. This situation will change over time, especially concerning currently existing cryptocurrencies, which can get through subsequent cycles, systematically making up their market position during periods of a bull market. The presented study is worth repeating in subsequent Bitcoin cycles, which the authors of this article would like to undertake. Halving cycles of other cryptocurrencies also seem worth investigating, especially in a few or a dozen years, when the amount of available data will be much greater, which may help find patterns similar to those known in the case of Bitcoin.

## Acknowledgements

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Regionalna Inicjatywa Doskonałości

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# PERCEPTION OF WORKPLACE CHANGES BY GENERATION Z REPRESENTATIVES

Piotr ROMAŃSKI[1*], Wiesław ŁUKASIŃSKI[2]

[1] Cracow University of Economics; piotr.m.romanski@gmail.com, ORCID: 0009-0009-0084-0994
[2] Cracow University of Economics, Department, Department of Process Management;
wieslaw.lukasinski@uek.krakow.pl, ORCID: 0000-0002-8757-0190
* Correspondence author

**Purpose:** The aim of the article is to identify the expectations of surveyed representatives of Generation Z regarding changes in the work execution process and the ways work will be performed in the coming years.
**Design/methodology/approach**: Following a literature review on the subject, directions of change in the work execution process were identified. A survey was then conducted among representatives of Generation Z in Poland. This made it possible to understand the values and expectations of Generation Z in the context of changes in the work process, including modern work trends and digital technologies.
**Findings:** The study revealed that Generation Z highly values flexible forms of work. The most desired work models are hybrid work (82.3%) and flexible working hours (75.16%). Remote work (44.72%) and a four-day workweek (45.34%) are also popular, indicating a strong desire to achieve a work-life balance. Preferences for working in international teams (34.78%) and business travel (37.58%) reflect a desire to gain global professional experience. Freelance work (22.98%) and project-based work (22.05%) are less preferred, suggesting concerns about job stability and financial security. The least preferred form of work is traditional office work (13.66%).
**Research limitations/implications**: The main limitation of the study is the use of an online survey, which may lead to capturing the expectations of only those respondents who are more technologically advanced.
**Practical implications:** The study points to important trends that companies should consider when designing workplaces. Businesses should offer flexible work options, such as hybrid models and flexible hours, to attract and retain Generation Z employees. Additionally, it is important to utilize technologies that support remote work execution.
**Social implications:** The study results may contribute to improving employees' work-life balance and increasing flexibility in how work is performed. They may also drive changes in the structure of work itself.
**Originality/value:** The paper provides insights into Generation Z's preferences, helping companies, HR professionals, and decision-makers adapt to the evolving expectations of younger workers.
**Keywords:** Generation Z, Future of Work, Hybrid Work, Flexibility, Remote Work.
**Category of the paper:** Human Resource Management, Organizational Behavior.

## 1. Introduction

In the context of ongoing transformations driven by digitalization, automation, and the increasing need to reconcile professional and personal life, the vision of the future of work is gaining significance (Jaworska, 2014, p. 10; Szymański, 2017, p. 93). The perspectives of Generation Z, which is currently entering the labor market, play a particularly crucial role in shaping contemporary work models. This cohort, comprising individuals born after 1995, is characterized by high mobility, flexibility, and proficiency in utilizing the Internet, emerging technologies, and digital applications. They demonstrate a strong preference for remote and hybrid work arrangements, perceiving geographical and cultural boundaries as relatively insignificant barriers (Kukla, Nowacka, 2019a). Similar to preceding generations, they prioritize health, autonomy, and interpersonal relationships. Moreover, they exhibit a strong inclination towards rapid career development and job satisfaction, often displaying a readiness to change their place of employment or residence when necessary (Kołodziejczyk, 2021, p. 7; Hysa, 2016, p. 390). As their presence in the labor market becomes increasingly pronounced, they pose both challenges and opportunities for employers and human resource professionals.

The growing prevalence of remote and hybrid work models, as well as flexible working hours, imposes new demands on employers in terms of workforce management and operational efficiency. Organizations must refine their employment strategies to align with these evolving trends. A comprehensive understanding of the expectations of Generation Z is essential for the development of effective human resource policies, which hold significant implications not only for the labor market but also for broader socio-economic well-being.

The primary objective of this study is to examine the expectations of Generation Z regarding transformations in work processes and employment structures in the coming years. The research seeks to validate the following hypotheses:

- Remote and hybrid work arrangements constitute the predominant employment models anticipated by Generation Z representatives.
- Flexible working hours represent a fundamental aspect of their employment expectations.

The study aims to address key research questions, namely: What are the specific expectations of Generation Z regarding work execution? What changes are most preferred by this cohort, and which employment models align most closely with their professional aspirations?

To achieve these research objectives and provide empirical insights, a systematic literature review was conducted, complemented by a survey-based study and a subsequent analysis of the collected data. The findings contribute to the formulation of recommendations that may serve as strategic guidelines for organizations in designing employment policies that cater to the

evolving workforce landscape. The originality of the presented material lies in the analysis of Generation Z representatives' expectations regarding the future of work. Attention is given to their preferences for work flexibility, including remote and hybrid work, as well as their approach to technology and well-being in the workplace.

## 2. Literature Review

The labor market is undergoing significant transformations due to technological advancements and socio-political factors. The success of organizations operating within a knowledge-based economy primarily depends on their competitiveness. One of the key trends shaping the future of work is the increasing prevalence of remote and hybrid work models (Kawecka-Endler, 2014, p. 124; Lubrańska, Musialik, 2024, p. 52). The COVID-19 pandemic accelerated this phenomenon, and an increasing number of employees now embrace these employment forms due to their flexibility and the ability to balance professional and personal responsibilities. The growing significance of remote work is also a consequence of rapid technological progress, the expansion of the service sector, and the implementation of legal regulations that standardize remote work practices (Muster, 2022, p. 33; Krzysztofek, 2015, pp. 19-20). According to the report Living, working and COVID-19 by the European Foundation for the Improvement of Living and Working Conditions, remote work and telework are expected to become dominant forms of employment (Eurofound, 2020; Kawa, Grewiński, 2020, p. 4).

Changes in work models also result from labor market fluctuations and uncertainty. Globalization, digitalization, and increasing competition among companies and employees necessitate adaptation to evolving conditions (Majewski, Leja, 2023, p. 43). In the context of a knowledge-based economy, human capital, knowledge, and innovative technologies are of paramount importance (Mizerska, 2023). These factors determine the development potential of both individuals and entire organizations. The digital economy significantly influences the future labor market, with digital competencies playing a crucial role. The ability to critically and responsibly utilize new technologies has become a fundamental prerequisite for professional success. Digitalization compels employees to continuously develop their skills, acquire new knowledge, and adapt to changing conditions (Gasz, 2025, p. 45). Additionally, employment forms such as civil-law contracts, self-employment, and gig work are becoming increasingly common (Grewiński, Kawa, 2021, pp. 5–6).

A notable trend in the evolving labor market is the rise of coworking spaces and the so-called digital nomad work model. A growing number of professionals perform their job duties flexibly, utilizing dedicated workspaces such as cafés, parks, coworking centers, and even public transportation (Sęczkowska, 2019, p. 12; Wiśniewski, 2014, p. 80). This approach offers

greater freedom and flexibility, attributes particularly valued by Generation Z (Budniak, Grzybowski, Olszewski, 2017, p. 52).

Workplace flexibility entails the ability to choose working hours, a factor that significantly enhances job satisfaction (Mockałło, Barańska, 2022, p. 10). Organizations are increasingly adapting their management models to accommodate employee expectations. Many companies implement flexible working hours, allowing employees to tailor their schedules to their individual needs. Such solutions not only improve work-life balance but may also contribute to increased productivity. Technological advancements facilitate the virtualization of work, enabling remote access to corporate resources, applications, and data (Grzeganek-Więcek, Szopa, Więcek, 2014, p. 80).

In this context, a particularly important issue is employees' mental well-being, which gains special significance especially in remote and hybrid work models. Mental well-being at work can be understood as a subjective sense of satisfaction with one's job, positive attitudes toward professional duties, as well as a sense of balance between work and private life (Tabor, 2022, pp. 47-55). According to Ryff's definition, mental well-being encompasses six dimensions, among which the most relevant in the context of remote work are: a sense of autonomy, control over working time, a sense of purpose in work, and interpersonal relationships (Karaś, 2019, pp. 17-18).

Remote and hybrid work models significantly influence employees' mental well-being. Within these models, the organization of work and the way collaboration is managed play a crucial role in shaping employee experiences. Remote and hybrid work structures involve various forms of task organization and interaction, such as flexible working hours, the possibility to choose one's work location, and different collaboration approaches—both synchronous and asynchronous. Synchronous collaboration, based on real-time interactions, can be associated with time pressure and increased stress, whereas asynchronous collaboration, allowing flexibility and self-management of time, fosters greater control over work, which can contribute to improving employees' mental well-being. Preferences regarding work organization, including the choice between these models, can impact the sense of work-life balance, stress levels, and the quality of interpersonal relationships in the workplace (Muster, 2022, pp. 29-44).

The emergence of Generation Z in the labor market presents new challenges for contemporary organizations. Upcoming changes must be addressed effectively to ensure efficient human resource management. For many business leaders, this necessitates a reassessment of existing strategies. Recruitment processes, talent utilization, motivation, and employee evaluation methods are evolving (Dolot, 2018, pp. 45-46; Messyasz, 2021, pp. 103-106). As the expectations of younger generations shift, employers must adapt their human resource strategies accordingly (Gajda, 2019, p. 96). Generation Z seeks not only competitive salaries but also an inspiring work environment, respect, opportunities for personal development, and the ability to leverage their potential (Ławińska, Korombel, 2023, p. 13).

They demonstrate a stronger inclination toward informal learning, highlighting their adaptability and eagerness to acquire new skills (Oxford Economics, 2021). Some organizations have begun employing Generation Z consultants, altering communication strategies and career development planning in response to these changes (Dorsey, Villa, 2023, p. 23).

As a new workforce segment, Generation Z introduces distinct values and expectations regarding employment. This generation has grown up in a digital world and is unfamiliar with a reality devoid of the Internet, smartphones, and social media. As a result, they possess unique technological competencies and exhibit a strong propensity for utilizing modern work tools (Chomątowska, Żarczyńska-Dobiesz, 2016, p. 63). Generation Z is characterized by pragmatism, creativity, and a drive for independence (Piotrowska, 2022, p. 5). They expect flexible working conditions, work-life balance, and rapid career development opportunities. Their entrepreneurial mindset enables them to generate innovative ideas and collaborate on solving global challenges. They also recognize the positive impact of automation and new work models on professional experiences (Wawrzonek, 2023, p. 87).

The future of work will be shaped by rapid technological advancements, the expansion of the knowledge economy, and the evolving expectations of younger generations (Tomaszewska, 2020, pp. 163-165; Tworóg, Mieczkowski, 2019, pp. 20-24). As a new professional group, Generation Z is setting new standards and values that organizations must acknowledge to remain competitive in the talent market. Key factors for success will include flexibility, adaptability, and investment in digital competencies, which are expected to become fundamental tools for professional activities in the coming decades (van Laar, van Deursen, van Dijk, de Haan, 2020).

## 3. Methodology

To achieve the research objective, an online survey method was employed, enabling the collection of opinions from representatives of Generation Z. The study was conducted between October and December 2024. Respondents answered questions developed based on a review of the relevant literature. For the purposes of this study, Generation Z was defined as individuals born after 1995. The sample selection was purposive. A total of 322 individuals participated in the survey, all of whom met the age criteria. Among the respondents, 190 were men (59%), 130 were women (40.4%), and 2 individuals (0.6%) chose not to disclose their gender.

Regarding educational and professional activity, 140 participants (43.5%) were students, 178 individuals (55.3%) combined work and studies, and 4 respondents (1.2%) focused exclusively on professional work. This sample structure provided diverse insights into the expectations of Generation Z, encompassing both those still pursuing education and those already engaged in the labor market.

The criteria included in the research questionnaire were based on a review of the existing literature. By analyzing the obtained results, it is possible to verify the extent to which the discussed variables reflect the actual preferences of the respondents and how significant they are for their perception of the future of work.

## 4. Results

To determine anticipated directions of change, respondents were asked about their opinions on the future of work models. Participants could select up to five responses, which facilitated the identification of the most significant trends likely to shape organizational operations in the coming years. The obtained results are presented in the chart below.

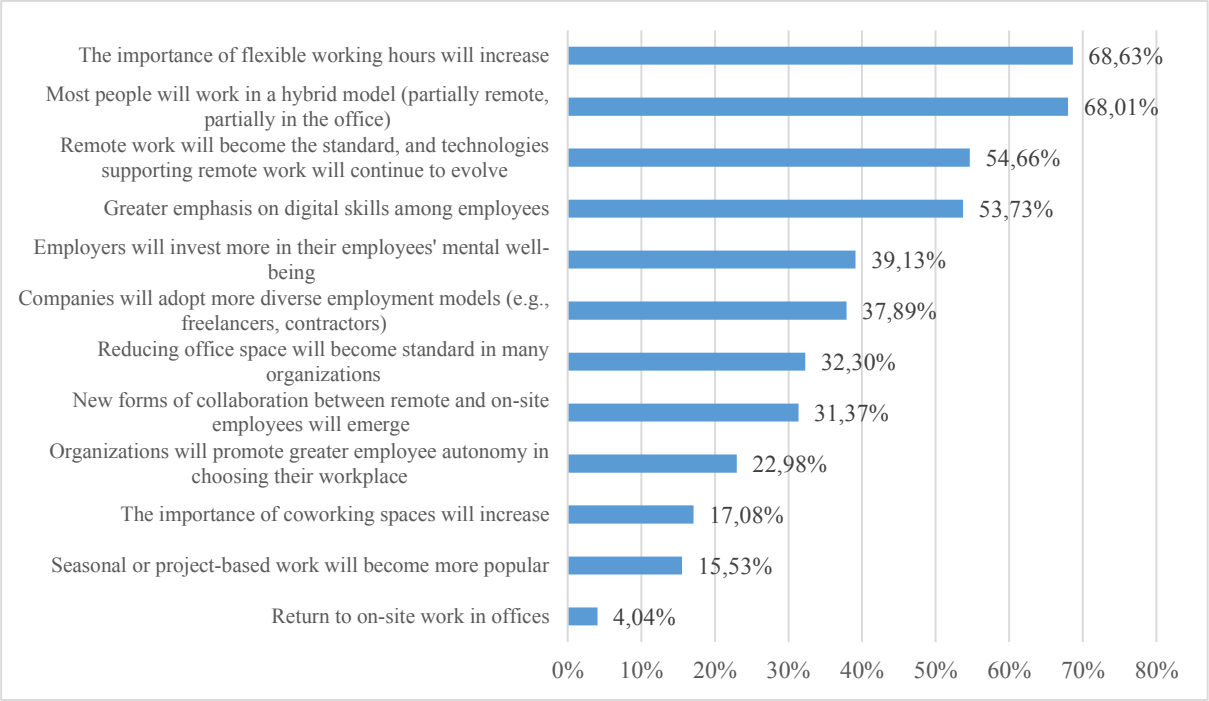



**Figure 1.** Perception of Work Model Changes from the Perspective of Respondents.

Source: Own elaboration based on survey research.

Survey results indicate that the future of the labor market will be dominated by flexible employment forms and new technologies supporting remote work. The most frequently mentioned trends are the increasing importance of flexible working hours (68.63%) and the hybrid work model (68.01%), confirming that employees expect greater freedom in organizing their work time and location. Remote work as a standard (54.66%) and the development of technologies supporting this model indicate long-term changes in how professional duties are performed. Along with this, there will be a growing emphasis on digital skills (53.73%), suggesting an increasing need to adapt to new tools and communication methods. Representatives of Generation Z expect organizations to place a greater emphasis on employee

well-being (39.13%) and implement more diverse employment models (37.89%), which may mean a higher number of freelancers and contractors. At the same time, reducing office space (32.30%) and the development of new forms of collaboration between remote and on-site employees (31.37%) indicate the gradual evolution of traditional offices.

Less popular but still significant predictions include employee autonomy in choosing their workplace (22.98%) and the growing role of coworking spaces (17.08%). Meanwhile, a return to fully on-site work (4.04%) was indicated as unlikely, proving that the traditional office-based work model is losing relevance.

In the opinion of Generation Z representatives, the future of work will be based on flexibility, hybrid and remote work, digital skills development, and greater support for employee well-being. The traditional on-site work model is expected to give way to modern solutions better suited to employees' needs. Respondents also assessed the significance of various changes for the future labor market using a five-point scale (where "1" meant insignificant and "5" meant crucial). The results are presented in Table 1.

**Table 1.**
*Changes in Work Organization According to Generation Z Representatives*

| Parameter | Arithmetic Mean | | | Coefficient of Variation (%) | | |
|---|---|---|---|---|---|---|
| | A | W | M | A | W | M |
| Increasing emphasis on digital skills | 4,18 | 4,24 | 4,13 | 18,96% | 20,97% | 19,58% |
| Remote work will become the standard | 4,08 | 4,29 | 3,93 | 22,64% | 20,60% | 23,56% |
| Most people will work in a hybrid model | 4,08 | 4,22 | 3,99 | 21,12% | 19,39% | 22,03% |
| Growing importance of flexible working hours | 3,99 | 4,03 | 3,97 | 20,63% | 22,05% | 19,73% |
| Employers will invest in employee well-being | 3,93 | 4,08 | 3,82 | 24,64% | 20,05% | 26,18% |
| Companies will adopt more diverse employment models | 3,72 | 3,85 | 3,64 | 25,19% | 20,68% | 25,55% |
| New forms of collaboration will emerge | 3,70 | 3,73 | 3,67 | 22,10% | 21,32% | 22,73% |
| Return to full on-site work in offices | 2,64 | 2,49 | 2,74 | 40,79% | 45,03% | 37,85% |
| Organizations will promote greater autonomy | 3,59 | 3,60 | 3,58 | 22,63% | 31,18% | 22,48% |
| Growing importance of coworking spaces | 3,53 | 3,75 | 3,37 | 26,83% | 29,96% | 28,83% |
| Reducing office space will become standard | 3,50 | 3,61 | 3,42 | 29,68% | 25,13% | 31,02% |
| Seasonal or project-based work will become more popular | 3,25 | 3,37 | 3,17 | 30,73% | 26,38% | 32,19% |

Legend: W – Women, M – Men, A – All.

Source: Own study based on survey research.

Analysis of differences between the responses of women and men reveals certain distinctions in the perception of the future of work. The survey results highlight several key changes shaping the future of work. Forecasts related to remote work (mean 4.08) suggest that it will become a standard. Moreover, a coefficient of variation of 22.64% indicates a fairly consistent belief among respondents that this form of work will dominate the future. Women (mean 4.29) show a stronger belief in remote work becoming the norm compared to men (mean 3.93), which may stem from their greater need for flexibility in work organization. A similar result (4.08) was obtained in the case of the hybrid work model, indicating the belief that this model will also become standard. In this case, the coefficient of variation is 21.12%,

and women (mean 4.22) are again more inclined to view the hybrid model as the future norm, while men (mean 3.99) show slightly less conviction.

On the other hand, the results concerning a return to on-site office work (mean 2.64) point to lower conviction among respondents regarding a return to the traditional work model. A coefficient of variation of 40.79% shows that opinions on this matter are more varied, and results differ by gender. A noticeable gender gap is due to lower support for on-site work among women (mean 2.49), who show a greater preference for flexibility, compared to men (mean 2.74), who seem slightly more open to returning to the office. While some people express the belief that we will return to offices, the overall trend points to a stronger preference for remote or hybrid work.

In the context of flexible working hours, the mean of 3.99 suggests that time flexibility will gain importance. Women (mean 4.03) indicate slightly higher importance for flexible working hours than men (mean 3.97), which may reflect a greater need for work-life balance among women. A low coefficient of variation (20.63%) indicates high agreement among respondents, suggesting that flexibility will become an essential element of work organization. Similarly, the growing importance of new forms of collaboration (mean 3.70) is also evident. Women (mean 3.73) indicate slightly stronger belief in the future of such collaborative forms than men (mean 3.67), with a coefficient of variation of 22.10%, suggesting a relatively consistent belief that such collaboration will continue to develop.

The results concerning the increasing emphasis on digital skills point to a clear trend of development. A mean of 4.18 and a low coefficient of variation (18.96%) confirm that the majority of respondents recognize digital skills as crucial for the future of work. The high average suggests that almost all respondents are convinced of the growing importance of digital competencies, which form the foundation for adapting to new technologies and maintaining competitiveness in the labor market. However, women (mean 4.24) perceive the development of digital skills as more essential in the future, while men (mean 4.13) show slightly less certainty regarding this direction.

The results of the study indicate a strong belief among Generation Z respondents in the growth of remote and hybrid work, with less support for a return to exclusively on-site work. The increasing importance of flexible working hours, new forms of collaboration, and digital skills forms the foundation for the future of work, pointing to growing organizational adaptation to dynamic changes in employee preferences and technological demands. In the conducted survey, representatives of Generation Z also indicated their preferences regarding the most attractive forms of work. Participants were allowed to choose up to five work formats they considered most aligned with their expectations. The results are presented in figure 2, illustrating the popularity of different work models.

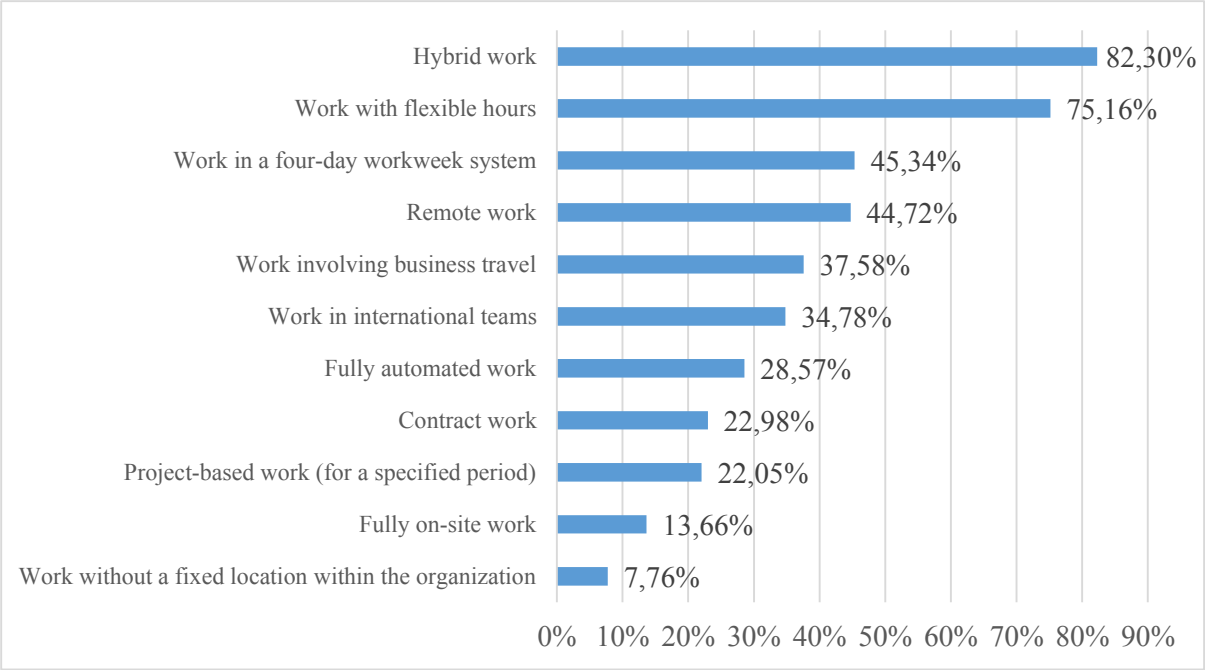



**Figure 2.** Preferred Work Forms According to Generation Z Representatives.
Source: Own study based on survey research.

Surveyed representatives of Generation Z primarily prefer flexibility in work organization. The most desired work models are hybrid work (82.3% of responses) and flexible working hours (75.16%), indicating a strong demand for the ability to adjust working hours to personal needs. Remote work (44.72%) and the four-day workweek (45.34%) are also highly popular, suggesting that work-life balance and efficiency gained through a shorter workweek are crucial. The opportunity to work in international teams (34.78%) and its connection to business travel (37.58%) are significant for respondents, possibly due to the desire to gain professional experience in an international environment.

Less popular work models include technology-driven automated work (28.57%), contract work (22.98%), and project-based work (22.05%). This may be due to concerns about job security and financial stability associated with these employment forms. The least interest is in fully office-based work (13.66%) and work without a fixed location within the organization (7.76%), confirming the trend of moving away from the traditional office model in favor of more flexible solutions.

The survey results show that Generation Z prefers work models that offer flexibility, remote work opportunities, and a balance between professional and personal life. Traditional office work is losing significance, while flexible working hours and the ability to choose a workplace are becoming essential.

Summarizing the research results, several significant trends can be identified that may shape the future of the labor market. Most notably, respondents most frequently chose the hybrid work model (82.3%) and flexible working hours (75.16%). In addition, remote work and a shorter workweek also attracted considerable interest, indicating preferences related to achieving work-

life balance. Less popular, though still noteworthy, are forms of employment such as freelance or project-based work, which may be associated with concerns about job stability. The traditional office-based model generated the least interest, which may suggest a growing preference for flexible organizational solutions.

At the same time, the results concerning digital skills, remote work, and new forms of collaboration point to long-term changes in the organization of work. These findings highlight the importance of technology and the need to tailor work formats to the individual needs of employees—particularly in the context of Generation Z. Forecasts related to on-site work indicate that the traditional office model is losing relevance, while preferences for remote and hybrid work are gaining momentum.

## 5. Discussion

The conducted research captured key preferences and expectations of Generation Z regarding work execution. The results align in many aspects with previous studies and findings from other authors, although some differences and new trends are noticeable. The study clearly indicates that Generation Z prefers flexible work arrangements, particularly hybrid and remote work. The results confirm that the most significant factors are flexible working hours (68.63%) and the hybrid model (68.01%). Similar trends were observed in a PwC study, where 77% of respondents preferred the hybrid model as the desired future solution (PwC, 2021). Piotrowicz also highlights dominant preferences among both employees and managers for hybrid work, emphasizing the need to maintain team integration in office spaces (Piotrowicz, 2023, pp. 83-84). Similar conclusions can be drawn from Deloitte's research, where nearly half of respondents (49.6%) preferred working from various locations while maintaining flexibility in working hours. Meanwhile, in the same Deloitte study, only 10% of respondents favored the traditional office model, which aligns with the low attractiveness ratings of fully office-based work in this study (average score of 2.64) (Deloitte, 2021).

This trend is further confirmed by the Ernst & Young Work Reimagined Employee Survey, in which 88% of employees stated they would strongly demand flexibility in terms of work time and location. At the same time, Ernst & Young found that 84% of employers recognize this need, though 35% still plan to reinstate full office work post-pandemic. This indicates a discrepancy between employee preferences and employer expectations, which may lead to future labor market tensions. The present study confirms that Generation Z clearly expects flexibility to be a permanent feature of work organization (Ernst & Young, 2021).

Further evidence of the consistency of these findings with previous research comes from Waszkiewicz (2022, pp. 50-51), who emphasizes that among Generation Z, the hybrid model dominates, even if one might intuitively expect greater popularity for fully remote work.

Notably, men in Generation Z more frequently express a need for higher levels of remote work, which was not directly verified in this study. However, the sample structure (59% men) may have influenced the strong preference for hybrid and flexible work.

It is also worth noting that compared to studies conducted before the COVID-19 pandemic by Bartkowiak and Krugiełka, a significant shift in attitudes is evident. At that time, young respondents showed reluctance toward flexible employment forms, preferring stable and traditional job models (Bartkowiak, Krugiełka, 2013, pp. 46-47). In contrast, in the current study, not only remote work but also flexibility in work time organization was rated as an essential element of the future job market (average score of 4.00). It is likely that the COVID-19 pandemic and accelerated digital transformation significantly influenced these changing attitudes, as highlighted by Dolot (2020, pp. 35-43) and PwC (2021).

The expectation of increased emphasis on digital skills also plays a significant role in this study (average score of 4.18). This result aligns with PwC's research, which shows that 57% of respondents see new technologies more as an opportunity than a threat (PwC, 2021). Similarly, Dolot's studies emphasize that digital skills and knowledge of remote work tools are becoming essential for adapting to new market conditions (Dolot, 2020, pp. 42-43).

Additionally, this study highlights the growing importance of employee well-being (39.13% of responses, average score of 3.93). Although not the highest-rated factor, its significance aligns with broader trends observed in the literature (Dolot, 2020, pp. 40-41; Piotrowicz, 2023, p. 82).

Moreover, the relatively low rating of a full return to office-based work (average score of 2.64) aligns with PwC and Waszkiewicz's studies, which indicate that support for this model is marginal, especially among younger age groups (PwC, 2021; Waszkiewicz, 2022, pp. 48-50). At the same time, Waszkiewicz's research reveals that Generation Z does not seek fully remote work but rather prefers a hybrid model, a finding corroborated by the present study (Waszkiewicz, 2022, p. 52).

## 6. Conclusions

The future of the labor market is evolving towards greater flexibility and digitalization, which is particularly reflected in the expectations of Generation Z. The most significant trends include the growing importance of hybrid and remote work, flexible working hours, and the use of modern technologies supporting these employment models. Simultaneously, there is an increasing emphasis on digital skill development and the ability to adapt to dynamic changes in the work environment. Generation Z particularly values work-life balance, which is evident in their preference for flexible employment forms and a shorter workweek. The traditional office-based work model is losing significance, being replaced by more modern and individualized solutions.

Based on the research findings, it is recommended that organizations and policymakers take action to align work strategies with the expectations of Generation Z. It is essential to invest in the development of employees' digital skills, enabling them to effectively use modern technologies in their daily work. Furthermore, implementing hybrid work policies and flexible working hours could significantly increase satisfaction and engagement among younger employees. Organizations should also focus on promoting employee well-being by offering appropriate tools and support to help maintain a healthy work-life balance.

However, this study had some limitations. It relied on an online survey, which may affect the sample structure and representativeness, as respondents were actively using the internet, potentially not reflecting the full Generation Z population. The use of this research method may have excluded younger individuals who do not use digital technologies, which could limit the ability to generalize the results to the entire Generation Z population. Additionally, the study only included individuals born after 1995, which might have influenced the results concerning differences between younger and older members of this group. Future research should employ qualitative methods, such as in-depth interviews or focus groups, to better understand young workers' motivations and values. It is also recommended to use a broader sampling method to increase representativeness and the ability to generalize the results to the entire Generation Z population. Expanding the analysis to compare different generations in the labor market could also help determine how Generation Z's preferences differ from older workforce groups. Further studies could also focus on long-term trends, examining how work expectations evolve as Generation Z gains professional experience.

Overall, the study results indicate that the future labor market will prioritize flexibility, technology, and employee-centered solutions. The conducted research captured key preferences and expectations of Generation Z. The recommended actions may be a key element in the process of adapting organizations to the challenges posed by the new demands of Generation Z.

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# ENTREPRENEURIAL ORIENTATION IN POLISH NON-PROFIT ORGANIZATIONS: BALANCING INNOVATION AND MISSION-DRIVEN PERFORMANCE

Joanna SCHMIDT

Poznań University of Economics and Business; joanna.schmidt@ue.poznan.pl, ORCID: 0000-0002-7593-5738

**Purpose**: This study examines the role of Entrepreneurial Orientation (EO) in Polish non-profit organizations (NPOs), focusing on how EO is implemented within a mission-driven framework, its impact on financial and social performance, and the organizational mechanisms mediating this relationship.
**Design/methodology/approach**: The study adopts a qualitative multiple-case-study approach, analyzing data from ten NPOs operating in the Greater Poland region (Poland). Data collection involved semi-structured interviews, observations, document analysis, and was supported by questionnaire with open-ended questions. Thematic coding was employed to identify patterns in EO adoption and its performance implications.
**Findings**: The findings reveal that EO in NPOs is primarily externally induced, driven by donor expectations, funding environments, and institutional pressures rather than proactive strategic intent. EO exhibits a stronger positive impact on social performance (e.g., mission achievement, stakeholder engagement) than financial performance. Additionally, mission alignment and professionalization emerge as critical mediators, enhancing EO's effectiveness in achieving social outcomes while mitigating financial instability.
**Research implications**: This study contributes to EO theory by challenging traditional assumptions that EO is an inherent strategic posture. Instead, it conceptualizes EO in NPOs as an adaptive response to external pressures. The findings also extend research on institutional constraints by identifying key organizational mechanisms that shape EO effectiveness in mission-driven contexts.
**Practical implications**: The study highlights the need for NPO managers to integrate EO with mission-driven strategies, strengthen governance and professionalization, and develop hybrid funding models. Policymakers and funders should consider providing more flexible financial support structures to encourage sustainable entrepreneurial initiatives in the non-profit sector.
**Originality/value**: This study provides new insights into EO in NPOs, particularly in a post-transition economy. By differentiating EO's impact on financial and social performance and identifying organizational mechanisms that enhance EO effectiveness, it advances both theoretical and practical understanding of entrepreneurial behavior in non-profits.
**Keywords:** Entrepreneurial Orientation, Non-Profit Organizations, Social Performance, Financial Performance, Mission Alignment.
**Category of the paper:** research paper.

## 1. Introduction

In recent years, the role of entrepreneurial activity within non-profit organizations (NPOs) has gained increasing scholarly and practical attention (Saebi et al., 2019; Nicolas et al., 2018). Entrepreneurial Orientation (EO), a concept traditionally associated with for-profit enterprises, has been recognized as a crucial factor in shaping the strategic behavior of NPOs, particularly in environments characterized by resource constraints and institutional complexity (Alarifi et al., 2019; Erpf et al., 2019). Social enterprises and other mission-driven organizations increasingly adopt entrepreneurial practices to enhance financial sustainability, service delivery, and social impact (Saebi et al., 2019). Despite this growing interest, the understanding of how EO functions within the non-profit sector, particularly in transition economies such as Poland, remains underexplored (Morris, 2011; Wronka-Pośpiech, 2015; Porzak, Sagan, 2013).

Existing research has primarily examined EO in the context of commercial enterprises, emphasizing its positive relationship with organizational performance (Rauch et al., 2009). However, studies on EO in the non-profit and social enterprise sector suggest that its impact may be contingent on various external and internal factors (Morris et al., 2011; Lumpkin et al., 2013). While institutional factors can shape the broader environment in which NPOs operate, the specific mechanisms through which EO influences performance in mission-driven organizations require further examination. Understanding the extent to which EO contributes to financial and social performance in NPOs, and identifying key organizational mechanisms that mediate this relationship, remains a critical research area.

To address these gaps, this study explores the following research questions:

1. How do Polish NPOs implement Entrepreneurial Orientation (EO) within a mission-driven framework?
2. To what extent does EO influence financial and social performance in Polish NPOs?
3. What organizational mechanisms shape the EO-performance relationship in non-profit settings?

This study aims to contribute to the literature by examining the ways in which EO is implemented in Polish NPOs and its effects on financial and social performance. Additionally, it investigates how certain organizational mechanisms interact with EO to influence performance outcomes.

The paper is structured as follows: The next section provides a theoretical framework, discussing the concept of EO in the non-profit sector and key factors influencing its implementation and impact. This is followed by a description of the research methodology, including the data collection and analysis approach. The findings section presents the results of the study, highlighting key relationships between EO, organizational mechanisms, and performance. Finally, the discussion and conclusion sections reflect on the theoretical and practical implications of the findings, offering recommendations for future research and policy development.

## 2. Theoretical Framework

Entrepreneurial Orientation (EO) has been widely studied in the context of for-profit organizations, with substantial evidence supporting its positive impact on firm performance (Rauch et al., 2009; Wiklund, Shepherd, 2003). However, its application to non-profit organizations (NPOs) remains relatively underexplored. Given the dual mission of NPOs - balancing financial sustainability with social impact (McMullin, Skelcher, 2018) - the role of EO in this sector may differ from its function in traditional business enterprises. This section outlines the theoretical foundations of EO in NPOs, its expected impact on organizational performance, and the key mechanisms that shape this relationship.

EO is typically defined as a strategic posture characterized by three to five dimensions: innovativeness, proactiveness, risk-taking, and, in some models, autonomy and competitive aggressiveness (Covin, Slevin, 1989; Lumpkin, Dess, 1996; Morris et al., 2011). In the non-profit sector, EO manifests through efforts to develop innovative services, anticipate and respond proactively to stakeholder needs, and engage in calculated risks to enhance social and financial performance (Morris et al., 2011).

Studies suggest that EO can drive both financial and social performance in NPOs (Alarifi et al., 2019; Schmidt et al., 2015). Financial performance refers to an organization's ability to secure and efficiently manage funding, generate revenue through social enterprise activities, and maintain long-term sustainability (Chen, Hsu, 2011). Research indicates that EO fosters financial performance by encouraging innovation in fundraising, diversification of income sources, and entrepreneurial strategies for sustainability (Morris et al., 2011).

Social performance reflects an NPO's effectiveness in achieving its mission, creating social value, and generating meaningful impact for its beneficiaries (Ebrahim, Rangan, 2014). EO enhances social performance by promoting innovative service delivery models, expanding outreach efforts, and strengthening stakeholder engagement (Pearce et al., 2010). However, the extent of these benefits may depend on the internal and external conditions under which EO is exercised.

NPOs operate under dual institutional pressures - they must maintain financial viability while fulfilling their social mission (Austin et al., 2006). Unlike private firms, where EO typically leads to competitive advantage and profitability, NPOs often face resource scarcity, donor dependency, and regulatory constraints, which influence how entrepreneurial strategies are implemented (Foster et al., 2009).

While EO is generally associated with financial growth and competitive advantage in business settings (Rauch et al., 2009), its impact on NPOs is less straightforward. Research suggests that EO may influence performance through two distinct pathways: financial and social performance. As for financial performance some studies argue that EO can improve financial sustainability by diversifying revenue sources, attracting donors, and fostering

financial independence (Saebi et al., 2019). However, empirical findings remain mixed, with some studies indicating that EO does not necessarily translate into higher financial performance in non-profits (Austin et al., 2006). A more consistent finding is that EO enhances an NPO's ability to achieve its social mission by increasing outreach, improving service delivery, and strengthening stakeholder engagement (Saebi et al., 2019; Ebrahim, Rangan, 2014). Social entrepreneurship research suggests that EO helps NPOs develop innovative solutions to social problems, but financial outcomes remain secondary (Desa, Basu, 2013). This dual nature of performance raises the question of which organizational mechanisms mediate the EO-performance relationship in NPOs.

Several studies suggest that NPOs can leverage EO to enhance their adaptability and resilience. For example Desa & Basu (2013) noticed that innovativeness in NPOs is often externally driven by funding requirements rather than intrinsic motivation to create new solutions. What is more, proactiveness in NPOs tends to be short-term and reactive, as many organizations respond to funding cycles rather than develop long-term strategic initiatives (Doherty et al., 2014). Also, risk-taking is often low due to accountability to donors and the need to minimize uncertainty (Morris et al., 2011). However, existing studies provide limited empirical evidence on how EO influences NPO performance, particularly in the context of post-transition economies like Poland.

The relationship between EO and performance in NPOs is not direct; it is shaped by several key organizational and institutional mechanisms including internal and external organizational factor and strategic adaptation mechanisms.

Internal organizational factors are factors such as leadership style, governance structures, and resource availability mediate the EO-performance link. Strong leadership support and mission alignment enhance the effectiveness of EO strategies, while resource constraints may limit their impact (Lumpkin et al., 2013; Morris et al., 2011). While not the primary focus of this study, external institutional factors such as regulatory frameworks, public funding policies, and societal expectations can either facilitate or constrain EO in NPOs. For example, rigid funding structures may limit risk-taking, while supportive policies may encourage innovative solutions (Stephan et al., 2015). NPOs may also develop adaptive strategies, such as cross-sector partnerships or hybrid business models, to maximize the benefits of EO while navigating institutional constraints (McMullin, Skelcher, 2018).

Existing research highlights two key organizational factors that influence how EO impacts NPO performance: mission alignment and professionalism and strategic management. First, organizations that integrate EO while maintaining strong mission focus are more likely to achieve sustainable social impact (Saebi et al., 2019). Conversely, excessive commercial orientation can lead to mission drift, weakening an NPO's credibility (Foster et al., 2009). Second, higher levels of formalization, governance, and managerial competence can enhance EO's effectiveness in NPOs (Austin et al., 2006). Studies show that professionalized NPOs are

better at balancing entrepreneurial risk-taking with accountability requirements (Gmür, Löffel, 2019).

The conceptual framework guiding this study assumes that EO dimensions (innovativeness, proactiveness, risk-taking) affect specific performance outcome (financial performance or social performance) with certain meditating mechanism. The specific framework is presented in the table 1 below.

**Table 1.**
*Conceptual framework*

| EO Dimension | Mediating Mechanism | Performance Outcome |
|---|---|---|
| Innovativeness | Mission alignment | Enhanced social performance |
| Proactiveness | Professionalism | Strengthened social performance |
| Risk-taking | Governance structures | Uncertain financial impact |

Source: own research.

The theoretical foundation of this study suggests that EO is a critical driver of both financial and social performance in NPOs. However, its effectiveness is contingent on internal organizational dynamics and broader institutional conditions. Understanding these moderating factors allows for a more nuanced interpretation of how EO functions in mission-driven organizations.

This framework provides the foundation for the subsequent empirical analysis, which examines how EO is implemented in Polish NPOs and its impact on performance, considering both organizational and institutional influences.

## 3. Method: research design, data collection and analysis

This study employs a qualitative, multiple-case-study approach to explore how Entrepreneurial Orientation (EO) manifests in Polish non-profit organizations (NPOs) and how it influences financial and social performance. The case study method is well-suited for investigating complex, context-dependent organizational phenomena (Yin, 2014) and is particularly appropriate given the limited research on EO in the non-profit sector.

A multiple-case-study design allows for cross-case comparison and the identification of common patterns while accounting for organizational diversity (Eisenhardt, 1989). This approach is particularly relevant in post-transition economies such as Poland, where NPOs operate under evolving institutional conditions.

The study examines 10 non-profit organizations operating in the Greater Poland region. The Greater Poland region was chosen due to its well-developed and diverse NPO ecosystem, which includes both urban and rural organizations, varying in scale and mission. The region also reflects national trends in the Polish non-profit sector in terms of funding structures and institutional conditions. While the findings may not be directly transferable to all regions,

they offer valuable insights into NPO behavior in post-transition economies, and the regional focus enhances contextual depth without undermining theoretical transferability.

Cases were selected using purposive sampling based on the following criteria:

1. Operational stability – The organization has been continuously active for at least 3 years, ensuring sufficient historical data.
2. Organizational structure – The NPO has a defined management team and strategic objectives, allowing for meaningful analysis of EO-related practices.
3. Sectoral diversity – The sample includes NPOs from various fields (social services, education, advocacy, cultural organizations) to capture different EO manifestations.
4. Engagement in entrepreneurial activities – The organization has demonstrated at least some degree of innovative, proactive, or risk-taking behavior, ensuring the relevance of EO analysis.

This selection strategy ensures a heterogeneous yet comparable sample that allows for meaningful exploration of EO-performance relationships across different NPO contexts. The number of ten cases was determined based on the principle of theoretical saturation (Eisenhardt, 1989), which ensures sufficient variation across cases to capture key patterns and mechanisms related to EO. The sample is not statistically representative but analytically robust, aligning with qualitative case study logic aimed at theory building rather than generalization to a population. This approach is commonly accepted in organizational and management studies when examining under-researched or complex phenomena such as EO in non-profit settings.

Data collection was conducted between June and September 2018 using a triangulated approach to enhance validity and reliability. The study employed semi-structured interviews, observations, and document analysis. Semi-structured interviews were conducted with managerial staff representatives (executive directors, program managers, board members), but also organization members, employees, volunteers. A minimum of two interviews were conducted in each organization. Each interview lasted 45-90 minutes and explored, among others, strategic decision-making processes, perceptions of risk-taking, innovativeness, and proactiveness, financial and social performance metrics (with managerial staff) and overall performance and organizational behaviors related to EO dimensions (with other engaged in organizations' activity). The interviews were conducted as a part of the visit in the organizations which consisted also of observations and handing over document for further analysis or reviewing documents and making notes if making a copy or transferring them were impossible. Document analysis included review of strategic plans, financial reports, grant applications, and annual statements to validate interview findings. Each organization also filled in a detailed questionnaire with open-ended questions regarding organizations activity, structure, team management, cooperation with other entities, financial situation and provided services. A comprehensive report was compiled for each organization, integrating all collected data sources. By integrating multiple data sources, the study ensures robustness and credibility in identifying EO patterns and their relationship with performance.

Data were analyzed using qualitative coding and cross-case comparison, following Miles & Huberman's (1994) framework for thematic analysis. First, transcribed interviews, questionnaire responses, and organizational documents were systematically coded. EO-related behaviors were classified into three primary categories: innovativeness (development of new programs, services, or funding models), proactiveness (strategic planning, long-term vision, and stakeholder engagement), and risk-taking (willingness to invest in uncertain projects or diversify funding).

Then, performance outcomes were analyzed along two dimensions: financial performance (revenue sources, financial stability, and ability to attract funding) and social performance (goal achievement, community impact, and stakeholder engagement).

A comparative case analysis was conducted to identify common patterns and variations across organizations. Particular attention was given to organizational mechanisms mediating EO-performance relationships (e.g., mission alignment, professionalism) and differences between high vs. low EO organizations in terms of financial and social outcomes. Findings were validated through member checking (confirming interpretations with interviewees) and triangulation across data sources.

The studied organizations varied in terms of sector, size, and level of professionalization. The sample included foundations and associations operating in areas such as education, cultural activities, workforce activation, healthcare, and sports. Some organizations exhibited a high degree of professionalization, while others maintained stronger ties to grassroots initiatives. Several cases experienced periods of crisis linked to organizational restructuring, funding challenges, or mission drift. These variations allowed for an in-depth examination of EO and its relationship to organizational performance within different operational contexts.

The data used in this study were collected in 2018, which may raise concerns regarding its timeliness related to contemporary context (like policy shifts, economic conditions or COVID-19 pandemic). However, the relevance of the findings remains strong due to several factors. This include: structural stability of the sector which means that fundamental characteristics of Polish NPOs and their regulatory environment have remained relatively stable over time; limited availability of updated data because conducting large-scale, sector-wide qualitative studies on EO in NPOs is rare, making this dataset one of the few comprehensive sources available; longitudinal relevance – the study examines organizational developmental patterns and strategic behaviors, which remain valid even if specific operational details evolve; and comparability with prior research as using this dataset allows for comparisons with existing literature on EO and non-profits, contributing to the broader academic discourse. While external conditions such as policy shifts or economic trends may have evolved, core mechanisms of EO - governance models, strategic decision-making, and financial sustainability - exhibit long-term stability. To account for potential changes, findings are interpreted in the context of broader sectoral trends rather than specific operational details, and future research could explore post-pandemic developments in NPO entrepreneurial orientation.

This methodological approach allows for a robust examination of EO in Polish NPOs, integrating qualitative insights through a multiple-case-study design. Despite some limitations, the findings contribute to a better understanding of how EO influences performance in mission-driven organizations and provide a foundation for future research in this field.

## 4. Results

Analysis of the 10 non-profit organizations revealed varying levels of EO adoption, influenced by external pressures, organizational capacity, and leadership strategies. The findings highlight key differences in how innovativeness, proactiveness, and risk-taking are expressed within the non-profit sector. To protect the anonymity of the studied organizations, their names are not disclosed. Instead, they are labeled with letters from A to J throughout the analysis.

Most organizations demonstrated moderate levels of innovativeness, primarily in response to external funding requirements rather than internal strategic intent. Innovations were generally incremental, such as adapting existing programs or modifying service delivery models, rather than radical transformations. For example organization A secured a corporate partnership to launch a works of art loaned from the Foundation, a novel initiative in its sector.

Low-to-moderate levels of proactiveness were observed, with most organizations engaging in short-term, reactive planning rather than long-term strategic positioning. Few organizations actively sought partnerships or diversified revenue sources beyond traditional grants. Organization C, for instance, engaged in scenario planning and early adoption of EU funding opportunities, setting it apart from others.

Risk-taking was limited, largely due to donor accountability and financial constraints. Most organizations displayed risk aversion in financial decision-making (e.g., reluctance to launch self-financing initiatives), while some engaged in calculated programmatic risk (e.g., piloting new service models). Organizations with higher professionalization and diversified funding sources exhibited greater risk-taking behaviors. A good illustration here would be organization I which experimented with a social enterprise model and not-for-profit company, while others remained cautious due to uncertainty. These findings align with prior research suggesting that EO in NPOs is often externally driven rather than a core strategic priority (Desa, Basu, 2013).

The analysis explored how EO influences financial and social performance, revealing distinct patterns in each domain. First, EO alone does not directly drive financial sustainability; rather, its impact depends on complementary strategic financial management practices. Organizations with higher EO (more innovative, proactive) were not necessarily more financially sustainable, like organization F, which, despite high EO – implementing innovative

solution in social work area, with proactive behavior of staff, and high level of risk-taking, struggled with financial instability due to reliance on project-based funding. Key insight in this domain appeared that EO alone is insufficient for financial sustainability unless coupled with strategic financial management.

Second, a strong positive relationship was found between EO and social performance (goal achievement, stakeholder engagement). Organizations with higher EO exhibited greater program outreach, community engagement, and service effectiveness. Organization C, which integrated EO with mission alignment, expanded its social services by 30% in two years, is a good example of this link. Main conclusion of EO and social performance relation analysis was that EO in NPOs primarily enhances social value creation rather than financial gain (Saebi, et al., 2019; Austin et al., 2006).

Findings indicate mission alignment and professionalization and strategic management are important factors that shape the impact of EO on performance

High EO organizations with strong mission alignment successfully balanced innovation with social impact. Organizations that pursued EO without aligning it with their mission faced internal resistance and stakeholder distrust. For example organization H successfully integrated EO into its mission-driven model, building professional and well-integrated hospice centers, while Organization B experienced mission drift. Organization B introduced, after finding promising niche, revenue-generating activities (running educational institutions), while financially promising, conflicted with its core mission, leading to tension among staff and beneficiaries (especially in local communities). As a conclusion it can be said that mission-driven entrepreneurship strengthens EO effectiveness (Saebi et al., 2019).

As mentioned above, another as mediating factor was professionalization and strategic management. Organizations with higher levels of professionalization (formal governance, strategic planning) were better at leveraging EO for both social and financial gains, while informally structured NPOs struggled to sustain entrepreneurial initiatives. For instance organization I used performance measurement tools to enhance EO effectiveness, whereas Organization J lacked structured planning. Organizational capacity therefore can be seen as a critical determinant of EO success in NPOs (Austin et al., 2006).

The case study analysis revealed three broad EO-performance patterns among the studied NPOs:

- Organizations with high EO and strong mission alignment achieve a strong social impact (e.g. Organizations C, H and I).
- Organizations with a medium level of EO and moderate professionalization demonstrate a mixed results in financial and social performance, as observed in Organizations A, B, D, E, and F.
- Organizations with low EO and weak strategic management exhibit limited performance outcomes, as seen in Organizations G, and J.

These findings highlight the importance of internal organizational mechanisms in shaping the EO-performance link. While EO enhances social impact, financial sustainability requires complementary strategic management practices. This analysis provides the basis for the discussion of implications and future research directions.

## 5. Discussion & Implications

This study investigated the relationship between Entrepreneurial Orientation (EO) and performance in Polish non-profit organizations (NPOs), focusing on three key research questions: (1) how EO is implemented within a mission-driven framework, (2) the extent to which EO influences financial and social performance, and (3) the organizational mechanisms that mediate the EO-performance relationship. The findings contribute to the growing body of research on EO in non-profits by demonstrating that EO in NPOs is primarily driven by external pressures rather than intrinsic strategic intent. Unlike for-profit firms, where EO is linked to profit maximization and competitive advantage, the findings suggest that EO in NPOs functions as a mechanism to enhance mission fulfillment and social impact, with financial benefits remaining uncertain.

The study indicates that EO adoption in Polish NPOs is largely a response to external funding and institutional constraints rather than a proactive strategic orientation. This aligns with prior research suggesting that NPOs engage in entrepreneurial behaviors primarily to meet donor expectations, policy requirements, and competitive grant conditions (Desa, Basu, 2013). This study extends the literature by illustrating how EO in post-transition economies like Poland is shaped by a unique set of institutional challenges, including fluctuating funding availability, regulatory constraints, and donor-driven priorities. Unlike in more established non-profit sectors, where EO may stem from strategic agency, Polish NPOs engage in entrepreneurial behaviors as a necessity to navigate unstable financial and policy environments, often at the cost of strategic autonomy. These findings challenge traditional EO theories, which assume that entrepreneurial behavior stems from proactive decision-making rather than external survival mechanisms (Rauch et al., 2009).

The results provide empirical evidence that EO in NPOs is more strongly linked to social performance than financial outcomes. Organizations with higher EO levels reported greater mission achievement, stakeholder engagement, and service outreach, reinforcing prior studies that highlight EO's role in social innovation (Austin et al., 2006; Saebi et al., 2019). However, the findings also indicate that EO did not directly contribute to financial sustainability. Even highly entrepreneurial organizations faced financial instability, suggesting that EO alone does not guarantee financial sustainability. However, organizations that coupled EO with strong governance and diversified funding strategies were better positioned to mitigate

financial risks. This indicates that EO's financial impact is contingent on the presence of complementary resource management mechanisms rather than being an independent driver of financial success (Foster et al., 2009). This distinction between social and financial performance adds nuance to existing EO research, which has traditionally assumed that EO contributes equally to both dimensions.

A key contribution of this study is the identification of mission alignment and professionalization as critical mediators of the EO-performance relationship. The findings suggest that NPOs that successfully integrate EO with their core mission experience stronger social performance. This supports prior research showing that mission-driven entrepreneurship enhances stakeholder trust and prevents mission drift (Morris et al., 2011). However, organizations that adopt EO purely as a means of financial survival often face internal resistance from staff and volunteers, limiting their effectiveness. This highlights a tension between entrepreneurial strategies and mission-driven values, a challenge that remains underexplored in EO literature.

Professionalization emerges as a critical moderator in the EO-performance relationship. Specifically, organizations with well-developed governance structures, strategic foresight, and leadership capacity were better positioned to translate EO into social innovation and long-term sustainability. These findings suggest that professionalization is not merely a supporting factor but a necessity for the successful implementation of EO, particularly in environments where institutional funding mechanisms are unstable. These findings align with prior research emphasizing the role of managerial competence and strategic capacity in translating EO into performance outcome (Doherty et al., 2014; Saebi et al., 2019). However, this study further reveals that low professionalization can act as a barrier to EO success, particularly in environments where institutional funding mechanisms are weak.

This study makes three key theoretical contributions to EO research and non-profit management. First, this study reframes EO in NPOs as a contextually driven adaptation rather than a deliberately chosen strategic orientation (Covin, Slevin, 1989; Rauch et al., 2009). Unlike for-profit firms, where EO is a proactive pursuit of competitive advantage, NPOs exhibit entrepreneurial behaviors primarily as a means of organizational survival and mission fulfillment in response to external funding pressures and institutional constraints. While EO in for-profit firms is often a deliberate strategic choice, in NPOs, it emerges primarily as a response to external pressures. This challenges traditional EO frameworks that assume organizations proactively pursue entrepreneurship as part of their long-term vision (Morris et al., 2011). Second, the study differentiates the impact of EO on social versus financial performance. While prior research acknowledges EO's role in social innovation, this study provides empirical evidence that EO does not automatically lead to financial sustainability. Instead, financial stability requires additional governance and revenue diversification mechanisms, which EO alone cannot provide. Third, the study identifies organizational mechanisms that shape EO effectiveness in NPOs, demonstrating that mission alignment and

professionalism moderate the EO-performance link (Austin et al., 2006; Foster et al., 2009). These findings extend research on institutional constraints in non-profits, emphasizing that EO's effectiveness depends not only on strategic intent but also on internal capacity-building.

The findings have several practical implications for non-profit managers. First, entrepreneurial initiatives should be aligned with the organization's social mission to prevent internal resistance and stakeholder disengagement. NPO leaders must communicate the strategic value of EO to employees and donors to maintain coherence and trust. Second, strengthening governance and professionalization can enhance EO effectiveness by providing the managerial capacity to execute innovation, proactiveness, and risk-taking responsibly. Investing in leadership development, strategic planning, and performance measurement can help NPOs leverage EO without financial instability. Third, EO alone does not guarantee financial sustainability, highlighting the need for hybrid funding models. NPOs should diversify revenue streams, such as earned income, partnerships, and philanthropic investments, to mitigate risk. Additionally, policymakers and funders should support entrepreneurial NPOs through hybrid financing mechanisms such as outcome-based grants, innovation vouchers, and social impact bonds. These tools can provide financial flexibility while encouraging innovation. Moreover, regulatory reforms that allow NPOs to diversify income sources - such as facilitating earned income activities and simplifying the process for establishing social enterprises - could further strengthen the sector's entrepreneurial capacity. Encouraging multi-year funding agreements rather than short-term project-based grants would also reduce administrative burden and enhance strategic planning opportunities.

## 6. Conclusion & Future Research

This study examined how Entrepreneurial Orientation (EO) manifests in Polish non-profit organizations (NPOs) and its impact on financial and social performance. The findings challenge traditional EO theories by demonstrating that, in NPOs, EO functions as an adaptive strategy rather than an inherent strategic posture.

In summary, the study provides three main contributions. Empirically, it offers rich, qualitative insights into how EO manifests in Polish NPOs and affects both financial and social performance. Theoretically, it reframes EO as a context-dependent, externally driven phenomenon and distinguishes its differentiated impact on dual performance dimensions. Practically, it delivers actionable recommendations for NPO leaders and external stakeholders, including aligning EO with mission, professionalizing management, and implementing hybrid and flexible funding structures. This consolidated framework bridges research and practice while addressing the unique challenges of NPOs in post-transition economies.

The key findings indicate that EO in NPOs is externally induced rather than proactively pursued, driven primarily by donor expectations, competitive funding environments, and institutional pressures. Additionally, EO has a stronger impact on social performance than financial performance, suggesting that entrepreneurial activities enhance mission achievement and stakeholder engagement but do not necessarily lead to financial sustainability. Furthermore, mission alignment and professionalism moderate the EO-performance relationship, with organizations that integrate EO into their core mission and employ structured governance benefiting the most. These findings refine EO theory by demonstrating that entrepreneurial strategies in NPOs are not universally beneficial but are highly context-dependent. Their effectiveness hinges on organizational mechanisms such as mission alignment and professionalization, which mediate EO's impact on both social and financial performance. For non-profit managers, the study underscores the need to balance EO with mission-driven strategies, strengthen professionalization, and adopt hybrid funding models to maximize the benefits of entrepreneurial initiatives.

While the study provides valuable insights, several limitations must be acknowledged. First, the use of retrospective data may affect the accuracy of reported experiences. Second, potential response bias due to self-reported data. Third, the time gap between data collection and publication requires cautious interpretation of findings.

Also, while this study provides important insights, several avenues for future research remain. First, longitudinal studies are needed to examine how EO influences NPOs over time, particularly in response to policy changes and funding cycles. Second, comparative research across institutional contexts would provide valuable insights into how policy frameworks, donor structures, and socio-economic conditions affect EO adoption. Third, mixed-method approaches combining quantitative and qualitative data could be used to test the causal mechanisms between EO, mission alignment, and financial/social performance. Future research could also investigate the interplay between leadership styles, organizational culture, and staff engagement in EO implementation. Given that professionalization enhances EO effectiveness, understanding how leadership fosters or inhibits entrepreneurial behaviors within NPOs could provide deeper insights into the internal drivers of EO. Finally, with the growing use of technology and digital platforms in non-profits, further investigation into how digital transformation can enhance entrepreneurial behaviors and performance would be beneficial. Addressing these gaps would contribute to a more comprehensive understanding of EO in NPOs and offer actionable insights for both researchers and practitioners.

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# EVALUATION OF SELECTED INSTRUMENTS, CONCEPTS, TECHNIQUES, METHODS, TOOLS AND PRINCIPLES OF QUALITY MANAGEMENT IN THE CONTEXT OF THEIR USE IN THE CONDITIONS OF INDUSTRY 4.0

Damian SKÓRNÓG[1*], Paulina MAJOR-KALINOWSKA[2]

[1] Silesian University of Technology, Organization and Management Department, Economics and Informatics Institute; damian.skornog@polsl.pl, ORCID: 0000-0001-6357-4261
[2] Silesian University of Technology, Organization and Management Department, Department of Management; paulina.major-kalinowska@polsl.pl, ORCID: 0000-0002-8281-642X
* Correspondence author

**Purpose:** The purpose of the publication is to evaluate the effectiveness of selected instruments, concepts, methods, techniques, tools and principles of quality management in the context of their use in the conditions of Industry 4.0, based on the opinions of experts representing the scientific and industrial community.
**Design/methodology/approach:** The research used quantitative expert analysis. Thirty-three experts participated, of which 26 were selected for the final analysis (13 representing industry and 13 the scientific community). The selection of experts was based on a competence factor, taking into account self-assessment of familiarity with the subject matter and the quality of argumentation. Forty-two quality management tools and methods were evaluated using descriptive statistics and Spearman rank correlation analysis.
**Findings:** The results of the survey indicate that industrial practitioners and researchers differ in their preferences for the tools they use - the former focus on practical and implementation solutions, while the latter focus on analytical and conceptual tools. Despite these differences, a number of tools highly rated by both groups were also identified. Spearman correlation analysis revealed strong relationships between some methods (e.g., Scatter Diagram and Workflow, QFD and Gantt chart), suggesting the possibility of their complementary use. The results confirm the need to integrate quality management tools in an Industry 4.0 environment.
**Research limitations/implications:** The selection of experts, based on recommendations and self-assessment, carries a risk of subjectivity despite objective criteria. The analysis covered only 42 tools, not fully reflecting the diversity of quality management methods. The absence of strong correlations may stem from the adopted methodology and the complexity of the studied relationships. Future research should involve a broader, more diverse sample, consider industry specifics, and analyze a wider range of tools.

**Originality/value:** The publication provides a detailed analysis of the evaluation of the effectiveness of quality management tools under the conditions of Industry 4.0 and indicates the relationship between them. The results of the study can provide a basis for building integrated quality management systems adapted to the challenges of digital transformation.
**Keywords:** quality management, Industry 4.0, expert analysis, quality tools, Spearman rank correlation, digitization, innovation implementation.
**Category of the paper:** Research paper.

## Introduction

Quality management in an enterprise, to be effective, should be characterized by the expediency and comprehensiveness of the methods, tools and principles used (Mroczko, 2012, p. 259). There are many publications in the literature on instruments, concepts, methods, tools, techniques and principles of quality management to support quality improvement in organizations. Dynamic changes resulting from the advancing Fourth Industrial Revolution, have an impact on the operation of enterprises in various areas of their activities (Janke et al., 2023; Kuzior, 2022; Saniuk, Saniuk, 2018; Spałek, 2020; Wolniak, 2023), in this area of quality management (Czyż-Gwiazda, 2024; Fadilasari et al., 2024). Therefore, it was decided in this article to check which of the selected instruments, concepts, techniques, methods, tools and principles of quality management are the most highly rated by experts from the scientific field and industry in the context of their use in the conditions of Industry 4.0. The results of the study indicate strong links between specific tools that are not widely described in the context of Industry 4.0 in the literature. In addition, differences in preferences between the academic and industrial environments were identified, and attention was drawn to the relationships between individual tools.

## Literature review

The authors, by means of a literature review, identified 42 instruments, concepts, methods, tools, techniques and principles of quality management, and then sorted them according to the way they were used, using the grouping of methods proposed by Luczak and Matuszak-Flejszman, and then subjected them to further research, which is described in the empirical part of the article (Łuczak, Matuszak-Flejszman, 2007).

In the literature there are many divisions of instruments, concepts, methods, tools, techniques and principles of quality management. In order to organize the definitions in this article, the terms will be used according to the following understanding. Instruments is the broadest concept, encompassing concepts, methods and techniques (Jankowiak, 2008).

Concepts are holistic approaches involving management, within which lower levels of methods and techniques can be identified (Lichtarski, 2001). A technique is a procedure or course of action that covers specific narrow problem domains (Mazur, 2023). Methods are a specially ordered set of tools aimed at effectively achieving the intended purpose for which the method was developed (Hamrol, 2013, p. 363). Quality management tools are used to collect and process data that relates to various aspects of quality management in a company and are used to solve problems and make strategic and operational decisions (Hamrol, 2013, p. 284). The principles reflect the approach of the enterprise and its employees to quality issues in the broadest sense. The principles of quality management should be universal, transparent and known in ogranizaji employees at every level (Hamrol, 2013, p. 363).

The tools, methods and instruments of quality management can be grouped due to the methods of idea creation and planning, used for checking and control, used at the stage of evaluation of activities, used at the stage of implementation (Łuczak, Matuszak-Flejszman, 2007). Table 1. presents sets of grouped selected instruments, concepts, techniques, methods, tools and principles of quality management developed on the basis of analysis of pre-subject literature, used for creation of ideas and planning, checking and control, evaluation of activities and used at the stage of implementation.

**Table 1.**
*Groups of selected instruments, concepts, techniques, methods, tools and principles of quality management*

| Method group | Instruments, concepts, techniques, methods, tools and principles of quality management |
|---|---|
| Methods for creating ideas and planning | ABCD Suzuki |
| | Benchmarking |
| | Business Process Reengineering (BPR) |
| | Brainstorming |
| | DMAIC (Define, Measure, Analyze, Improve, Control) |
| | Tree Diagram |
| | Fishbone Diagram |
| | Arrow Diagram |
| | Interrelationship Diagram |
| | Flowchart Diagram SIPOC (Supplier, Input, Process, Output, Customer) |
| | Failure Mode and Effects Analysis (FMEA) |
| | Multivoting |
| | Hoshin Kanri |
| | Value Stream Mapping (VSM) |
| | SMART method |
| | DMADV (Define, Measure, Analyze, Design, and Verify) |
| | Quality Function Deployment (QFD) |
| | Theory of Constrains (TOC) |
| | Gantt chart |
| Methods used for checking and controlling | 5PPJ - Five-Step Quality Improvement Process |
| | 5S Practics |
| | Balanced Score Card (BSC) |
| | Matrix Diagram |
| | Pareto chart |
| | Why-Why Diagram |
| | Servqual |

Cont. table 1.

| | |
|---|---|
| Methods used at the stage of evaluation of activities | 5 WHY |
| | Scatter Diagram |
| | Gemba |
| | Is-Is Not Matrix |
| | Analytical Hierarchy Process (AHP) |
| | Poka-Yoke |
| | Total Quality Management (TQM) |
| Methods used at the implementation stage | Checksheet |
| | Contingency Diagram |
| | Workflow |
| | Kanban |
| | Measurement System Analysis (MSA) |
| | SMED |
| | Statistical Process Control (SPC) |
| | TPM |
| | Run Chart |

Source: own elaboration based on: (Adamek, 2020; Arabian-Hoseynabadi et al., 2010; Dąbrowski, 2020; Drzewiecka, Stachowiak, 2014; Duplaga, 2009; Ekoanindiyo, 2014; Fortz, Thorup, 2002; Gołębiowski, 2011; Jabłoński, Jabłoński, 2011; Jolayemi, 2008; Karaszewski, 2001; Komańda, 2015; Krasiński, 2013; Król et al., 2013; Kruczek, Żebrucki, 2012; Krzemień, Wolniak, 2002; Kwintowski, 2012; Łuczak, Matuszak-Flejszman, 2007; Major, Stefanów, 2008; Malska, 2018; Michalak, 2016; Michlowicz, Świątoniowski, 2011; Obora, 2011; Otręba, Knop, 2019; Pacana et al., 2019; Randhawa, Ahuja, 2017; Rogowska, 2023; Sobczuk et al., 2021; Szczęsna, Klimecka-Tatar, 2017; Szkiel, 2023; Szydełko, Kołodziejczuk, 2016; Wawak, 2006; Wojciechowska, 2006; Wolniak, 2003; Wolniak, Sułkowski, 2018a, 2018b; Woźniak, 2008; Zwolenik, Pacana, 2019).

The presented classification highlights the diversity of quality management instruments, concepts, techniques, methods, tools and principles, and organizes them according to their main application stages. Such systematization is crucial for understanding their potential use in quality management under the conditions of Industry 4.0. In the next part of the study, an empirical analysis will be conducted to evaluate the effectiveness of these selected solutions based on expert opinions.

## Methods

The purpose of the research is to evaluate selected instruments, concepts, techniques, methods, tools and principles of quality management in the context of their use in the conditions of Industry 4.0. 33 people participated in the research with experts. Expert competence was assessed on the basis of a self-assessment questionnaire, evaluating the competence coefficient (Kk) of the respondents, which is the arithmetic mean of the familiarity coefficient (Kz) and the argumentation coefficient (Ka) (Męczyńska, 2001).

$$Kk = \frac{Kz + Ka}{2} \tag{1}$$

The familiarity index (Kz) is used to determine the degree to which an expert's knowledge is consistent with the essence of the issue being analyzed. The highest values of this indicator are attributed to experts with narrow specialization. The evaluation of the expert's familiarity coefficient Kz is shown in Table 2. Its value for each expert is determined by multiplying the obtained rating from the questionnaire by a factor of 0.1.The analysis will include experts who have demonstrated sufficient knowledge of the problem, regardless of their practical involvement in solving it, i.e. achieved a Kz value of at least 0.5 (Wolniak, Sułkowski, 2018a).

**Table 2.**
*Expert knowledge factor rating Kz*

| Numerical value of the assessment of the expert's knowledge of the problem | The expert's degree of familiarity with the problem |
|---|---|
| 0 | The expert does not know the problem |
| 1-3 | The expert has limited knowledge of the problem, but it lies within his/her area of interest |
| 4-6 | The expert has satisfactory knowledge of the problem, but does not participate in its practical solution |
| 7-9 | The expert is well acquainted with the problem and participates in its practical solution |
| 10 | The problem falls within the narrow specialisation of the expert |

Source: own elaboration based on: (Wolniak, Sułkowski, 2018a).

The argumentation coefficient (Ka) is used to assess the quality of the argumentation used by the expert. The highest value is assigned to judgments based on personal experience, while the lowest value is assigned to general generalizations and intuitive opinions. This indicator is calculated by adding up the scores obtained in each category of argumentation. Experts whose argumentation is at least at an average level, corresponding to both the theoretical analysis carried out and their practical experience, i.e. Ka ≥ 0.5, will be qualified for the analysis, as shown in Table 3 (Wolniak, Sułkowski, 2018a).

**Table 3.**
*Expert knowledge factor rating Ka*

| Argumentation | | | Source of Argumentation |
|---|---|---|---|
| High | Medium | Low | |
| 0,3 | 0,2 | 0,1 | Expert's theoretical analysis |
| 0,5 | 0,35 | 0,2 | Expert's practical experience |
| 0,05 | 0,05 | 0,05 | Generalization of works by native authors |
| 0,05 | 0,05 | 0,05 | Generalization of works by foreign authors |
| 0,1 | 0,1 | 0,1 | Expert's intuition |

Source: own elaboration based on: (Wolniak, Sułkowski, 2018a).

When the minimum values of the Kz and Ka coefficients are set at 0.5 and 0.55, respectively, the qualification threshold for the competence coefficient (Kk) is determined as the average of these values. This means that an expert can be qualified for the survey if his competence coefficient is at least (0.5 + 0.55) / 2 = 0.53. Based on the Kk coefficient, 26 experts were selected, consisting of 13 respondents from industries, and 13 representing the scientific community. Those taking part in the survey were selected on the basis of recommendations.

The questions in the questionnaire made it possible to assess the phenomena studied and the relationships between them. The analysis of the results of the research concerns selected parts of the questionnaire:

- metric (5 questions, 5 variables);
- self-assessment questionnaire (2 questions, 2 variables);
- specific questions (42 questions, 42 variables).

The analysis of the obtained results was carried out using descriptive statistics, focusing on the evaluation of the frequency of responses and their percentage distribution among respondents. Particular emphasis was placed on comparing the responses of two groups of experts - representatives of the scientific community and representatives of industrial sectors - which made it possible to identify differences and similarities in the perception of the evaluated tools, methods and principles of quality management in the conditions of Industry 4.0.

The analysis of the obtained results was carried out using descriptive statistics, focusing on evaluations of the effectiveness of selected instruments, methods, techniques, tools and principles of quality management in the context of their application in the conditions of Industry 4.0. Particular emphasis was placed on interpreting the percentage distributions of responses and comparing the opinions of two groups of experts: representatives of the scientific community and practitioners from industries.

The research approach used makes it possible to capture differences and similarities in the assessments of experts representing different environments, and to identify those solutions that received the highest scores in terms of operational and strategic effectiveness in the era of digitization. In addition, Spearman's rank correlation analysis made it possible to identify strong correlations between the selected tools, which may suggest their complementarity or the possibility of simultaneous use in practice.

## Results

The results presented in this section of the study reflect the opinions of two separate groups of experts: practitioners from the industrial sector and representatives of the scientific community. The respondents evaluated the effectiveness of selected tools, methods and principles of quality management in the context of their usefulness in the conditions of Industry 4.0 on the basis of the answers given to 42 specific questions. Table 4 shows the evaluation of selected instruments, techniques, methods, tools and principles of quality management in the context of their use in the conditions of Industry 4.0 with the assigned average ratings of the respondent groups.

**Table 4.**
*Evaluation of selected quality management instruments, techniques, methods, tools and principles in the context of their use in Industry 4.0 conditions with assigned average ratings of respondent groups*

| Method group | Instruments, concepts, techniques, methods, tools and principles of quality management | Symbol | Industry (average) | Average for the group (Industry) | Scientists (average) | Average for the group (Scientists) |
|---|---|---|---|---|---|---|
| Methods for creating ideas and planning (G1) | ABCD Suzuki | P1 | 3,54 | 3,74 | 3,69 | 3,83 |
| | Benchmarking | P2 | 3,69 | | 3,69 | |
| | Business Process Reengineering (BPR) | P3 | 3,62 | | 3,69 | |
| | Brainstorming | P4 | 3,31 | | 3,31 | |
| | DMAIC (Define, Measure, Analyze, Improve, Control) | P5 | 3,46 | | 3,62 | |
| | Tree Diagram | P6 | 3,85 | | 3,92 | |
| | Fishbone Diagram | P7 | 4,31 | | 4,08 | |
| | Arrow Diagram | P8 | 3,62 | | 3,77 | |
| | Interrelationship Diagram | P9 | 3,46 | | 3,92 | |
| | Flowchart Diagram SIPOC (Supplier, Input, Process, Output, Customer) | P10 | 3,38 | | 3,85 | |
| | Failure Mode and Effects Analysis (FMEA) | P11 | 3,69 | | 3,77 | |
| | Multivoting | P12 | 3,77 | | 3,92 | |
| | Hoshin Kanri | P13 | 3,69 | | 3,69 | |
| | Value Stream Mapping (VSM) | P14 | 4,38 | | 4,46 | |
| | SMART method | P15 | 3,92 | | 4,15 | |
| | DMADV (Define, Measure, Analyze, Design, and Verify) | P16 | 3,69 | | 3,77 | |
| | Quality Function Deployment (QFD) | P17 | 4,23 | | 4,00 | |
| | Theory of Constrains (TOC) | P18 | 3,69 | | 3,62 | |
| | Gantt chart | P19 | 3,69 | | 3,92 | |
| Methods used for checking and controlling (G2) | 5PPJ - Five-Step Quality Improvement Process | P20 | 3,85 | 3,75 | 3,92 | 3,85 |
| | 5S Practics | P21 | 4,38 | | 3,92 | |
| | Balanced Score Card (BSC) | P22 | 3,62 | | 3,85 | |
| | Matrix Diagram | P23 | 3,54 | | 3,85 | |
| | Pareto chart | P24 | 4,00 | | 3,62 | |
| | Why-Why Diagram | P25 | 3,46 | | 3,85 | |
| | Servqual | P26 | 3,38 | | 3,92 | |
| Methods used at the stage of evaluation of activities (G3) | 5 WHY | P27 | 4,00 | 3,68 | 4,00 | 3,88 |
| | Scatter Diagram | P28 | 3,46 | | 3,85 | |
| | Gemba | P29 | 3,31 | | 3,77 | |
| | Is-Is Not Matrix | P30 | 3,46 | | 3,69 | |
| | Analytical Hierarchy Process (AHP) | P31 | 3,62 | | 3,69 | |
| | Poka-Yoke | P32 | 4,15 | | 4,00 | |
| | Total Quality Management (TQM) | P33 | 3,77 | | 4,15 | |

Cont. table 4.

| | | | | | | |
|---|---|---|---|---|---|---|
| Methods used at the implementation stage (G4) | Checksheet | P34 | 3,92 | 3,67 | 3,69 | 3,78 |
| | Contingency Diagram | P35 | 3,31 | | 3,69 | |
| | Workflow | P36 | 3,54 | | 3,85 | |
| | Kanban | P37 | 3,69 | | 3,92 | |
| | Measurement System Analysis (MSA) | P38 | 3,77 | | 3,77 | |
| | SMED | P39 | 3,85 | | 3,62 | |
| | Statistical Process Control (SPC) | P40 | 3,54 | | 3,54 | |
| | TPM | P41 | 3,92 | | 4,00 | |
| | Run Chart | P42 | 3,46 | | 3,92 | |

Source: own elaboration.

Figure 1 shows the average rating of experts for groups of quality management methods.

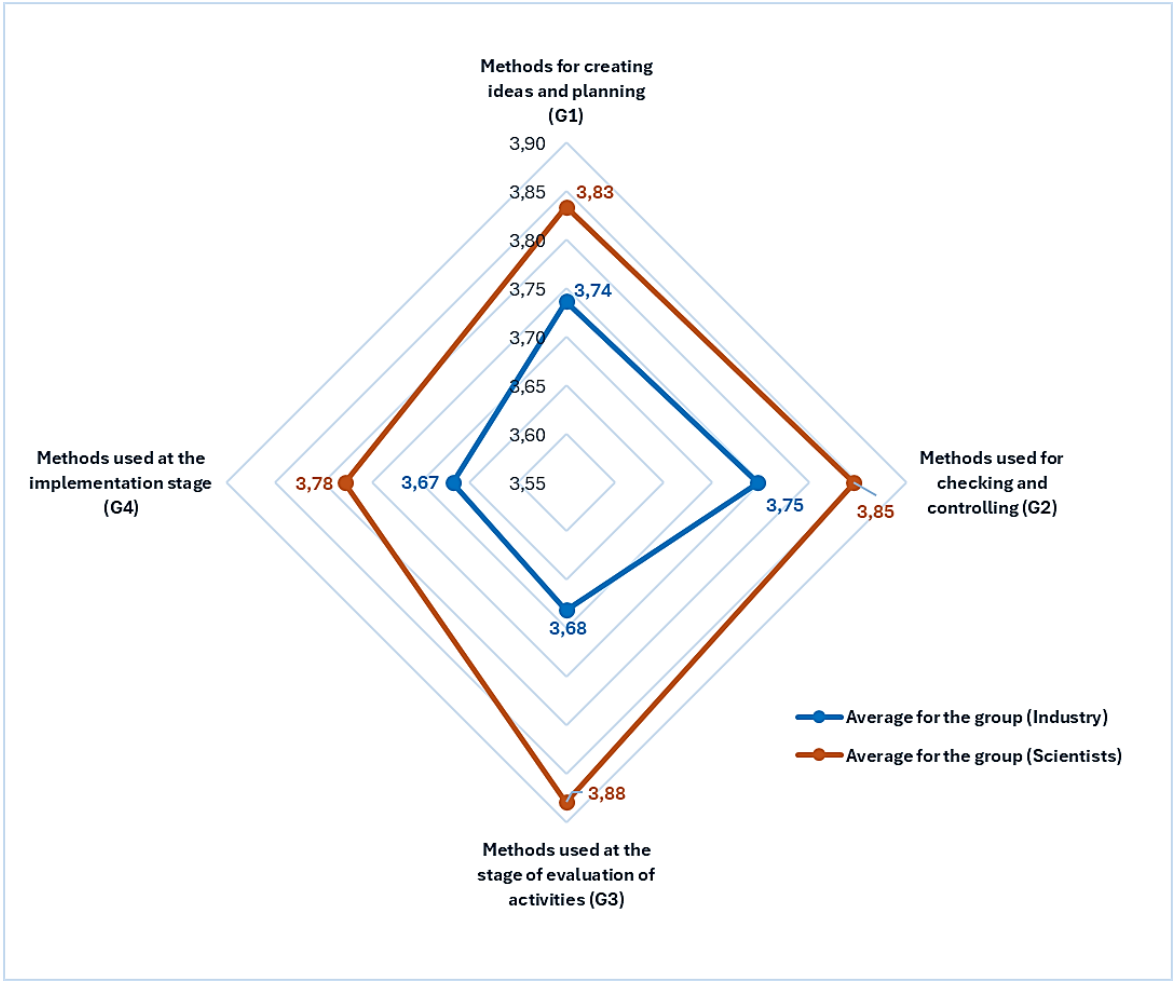



**Figure 1.** Average expert rating with regard to quality management groups.

Source: own elaboration.

Methods used for checking and controlling (G2) (3.75) and Methods for creating ideas and planning (G1) (3.74) were rated highest by industry experts. Next were Methods used at the stage of evaluation of activities (G3) (3.68) and Methods used at the implementation stage (G4) (3.67), which received lower ratings among this group of respondents. Based on the evaluations of industry experts, it can be concluded that they prefer practical tools that directly support daily process control and quick corrective actions.

In the Scientists group, the highest score was given to Methods used at the stage of evaluation of activities (G3) (3.88), which has great potential for analyzing process efficiency and supporting data-driven decision-making. Next in order were Methods used for checking and controlling (G2) (3.85), Methods for creating ideas and planning (G1) (3.83), and Methods used at the implementation stage (G4) (3.78). Ratings in all four groups are higher in the group of experts from the scientific world than among industry representatives.

From the difference in average ratings between the groups, it appears that academics focus more on the conceptual and systemic potential of the tools, while practitioners are more likely to be guided by their actual usefulness under time, personnel and financial constraints.

In addition, the distribution of evaluations indicates relatively small differences between the various groups of methods in both one group and the other. Thus, all four areas are important to respondents for effective quality management under Industry 4.0 conditions, and the differences are due more to the context of application than to the characteristics of the tools themselves.

Another analysis involved conducting a Spearman rank correlation analysis to determine the strength and direction of the relationship between the variables studied. The correlation coefficient indicates whether a relationship exists and the nature of the relationship. The sign of the coefficient indicates the direction of the relationship: a positive value indicates a positive dependence (an increase in one variable is associated with an increase in the other), while a negative value indicates a negative dependence (an increase in one variable is associated with a decrease in the other). The absolute value of the coefficient, on the other hand, determines the strength of the relationship. Spearman's correlation coefficient takes values between -1 and 1, where (Kulawiecka, 2016):

- 1 means positive correlation, a functional relationship,
- -1 means negative correlation, a functional relationship,
- 0 means no correlation, that is, no relationship between two variables.

The study adopted a scale with a correlation coefficient of:

- Less than |0.2| means no relationship between the studied characteristics,
- |0.2 - 0.4| means a low relationship between the studied characteristics,
- |0.4 - 0.7| means a moderate relationship between the studied characteristics,
- |0.7 - 0.9| means a significant relationship between the studied characteristics,
- Above |0.9| means a very strong relationship between the studied characteristics.

During the course of the study, 1764 pairs of variables were identified. After eliminating diagonal pairs, the number decreased to 1722. The frequency distribution of variable pairs in the correlation groups is shown in Figure 2.

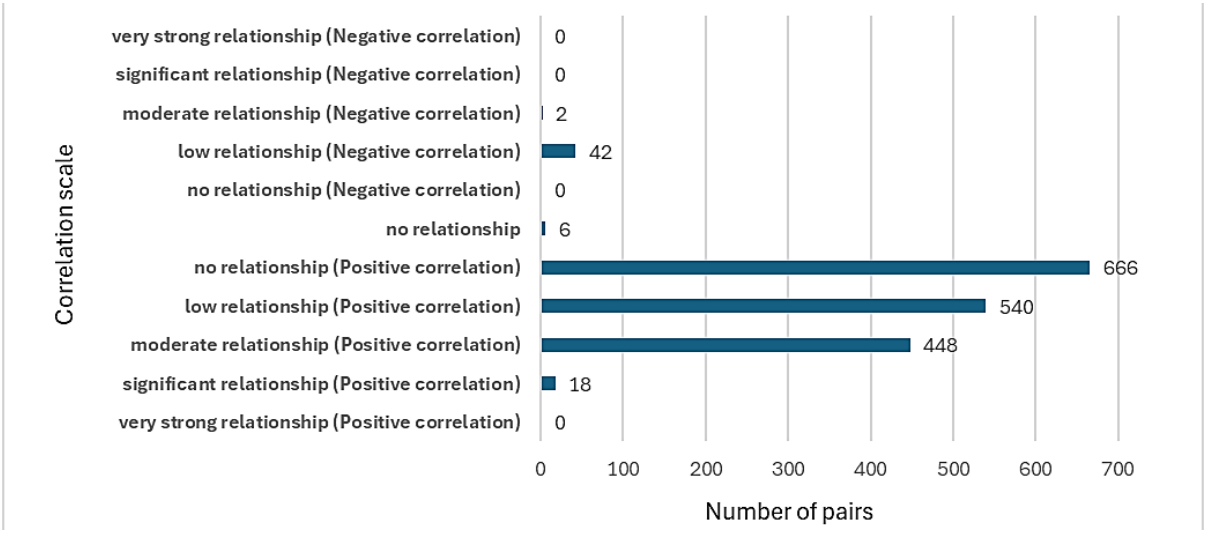



**Figure 2.** Frequency distribution of pairs of variables in correlation groups.

Source: own elaboration.

Figure 2 shows the frequency of pairs of variables by categories of strength and direction of correlation. The dominant category is pairs showing no significant positive correlation (n = 666), as well as pairs with low (n = 540) and moderate (n = 448) positive correlation. Negative correlations were far less frequent, mostly of low strength (n = 42), while moderate and stronger correlations were marginal (total n = 2). Both very strong positive and negative correlations were not observed. The results indicate a clear predominance of weak and moderate positive correlations and an overall low frequency of strong correlations between variables.

Due to the number of variables analyzed, only those characteristics for which the absolute value of the correlation coefficient exceeded 0.7 were selected for further analysis. Table 5 presents a summary of pairs of quality management tools and methods, assigned to the four thematic groups (G1-G4), between which a strong Spearman's rank correlation was observed, exceeding the value of 0.7. Such a result indicates a significant relationship between the variables studied - this means that these tools can be used simultaneously, complement each other or play a similar role in the analysis and improvement of processes.

**Table 5.**

*A summary of pairs, assigned to the four subject groups (G1-G4), between which a strong Spearman rank correlation was observed, exceeding the value of 0.7*

| Variable 1 | Group | Variable 2 | Group | Correlation |
|---|---|---|---|---|
| P28 (Scatter Diagram) | G3 | P36 (Workflow) | G4 | 0,88 |
| P17 (QFD) | G1 | P19 (Gantt chart) | G1 | 0,81 |
| P31 (AHP) | G3 | P38 (MSA) | G4 | 0,80 |
| P10 (SIPOC) | G1 | P19 (Gantt chart) | G1 | 0,77 |
| P19 (Gantt chart) | G1 | P24 (Pareto chart) | G2 | 0,77 |
| P10 (SIPOC) | G1 | P11 (FMEA) | G1 | 0,73 |
| P16 (DMADV) | G1 | P38 (MSA) | G4 | 0,73 |
| P17 (QFD) | G1 | P26 (Servqual) | G2 | 0,71 |
| P32 (Poka-Yoke) | G3 | P39 (SMED) | G4 | 0,71 |

Source: own elaboration.

The strongest correlation (0.88) was observed between P28 (Scatter Diagram), belonging to G3 (Methods used at the stage of evaluation of activities), and P36 (Workflow) from G4 (Methods used at the implementation stage). Such a high correlation suggests a close relationship between cause-effect analysis and process flow design. The implication is that organizations using analytical tools to assess the quality of processes often implement them simultaneously with tools to improve the flow of those processes.

An equally high correlation (0.81) occurred between P17 (QFD - Quality Function Deployment) and P19 (Gantt chart), both from the G1 group (Methods for creating ideas and planning). Such a relationship indicates that quality planning according to customer requirements and scheduling of project activities are complementary. In business practice, these two tools can be used together when implementing new solutions, especially in project management-oriented organizations.

A correlation of 0.80 appeared between P31 (AHP - Analytical Hierarchy Process) from G3 and P38 (MSA - Measurement System Analysis) from G4. This indicates a correlation between tools for making decisions based on established priorities and tools for ensuring the reliability of the measurement system. This means that organizations that care about the quality of measurement data are also more likely to use methods for systematically selecting and evaluating decision options.

Also at the same level of correlation (0.77) are P10 (SIPOC) and P19 (Gantt chart), both belonging to the G1 group. Such a combination indicates that overall process mapping and planning their time execution are closely related and are the foundation of effective quality project management.

A link also appears between P19 (Gantt chart, G1) and P24 (Pareto chart, G2 - Methods used for checking and controlling), where the correlation coefficient was 0.77. Effective project planning often goes hand in hand with the analysis of quality problems in terms of their impact on the bottom line, facilitating the allocation of resources to the most critical areas requiring improvement.

Significant correlations also appear between tools assigned to different groups. For example, P16 (DMADV, G1) and P38 (MSA, G4) reached a correlation of 0.73, indicating a link between the design of new solutions under the Six Sigma approach and the quality control of measurement systems necessary for accurate validation of results.

A similar value (0.73) was reached by the pair of P10 (SIPOC, G1) and P11 (FMEA, G1), which may confirm that detailed process planning and analysis of potential risks are often applied simultaneously, especially at the process design or improvement stage.

On the other hand, a correlation of 0.71 occurred between P17 (QFD, G1) and P26 (Servqual, G2), which can be interpreted as a link between designing the quality of a product or service according to customer expectations and measuring satisfaction with the realization of those expectations in practice.

A pair of P32 (Poka-Yoke, G3) and P39 (SMED, G4) ranked on the same level. Both tools are part of lean management practices and serve to reduce waste - one by eliminating errors, the other by reducing changeover times. Their joint use may be due to their focus on process optimization in manufacturing environments.

Analyzing the membership of the tools in each group, it can be seen that many strong correlations occur within the G1 (planning) group. This indicates a high degree of integration of tools used at the quality planning stage. At the same time, there is a tendency for high correlations to co-occur between tools from the G3 (evaluation) and G4 (implementation) groups, which may suggest that accurate analysis of quality data and decision-making are closely linked to the processes of implementing improvements. The identified links indicate the need to use quality tools in a complementary manner, not only within a single phase, but also between the planning, analysis, control and implementation phases. In industrial practice, this may imply the need for a more integrated approach to quality management in an Industry 4.0 environment.

## Summary

The survey made it possible to assess the effectiveness of selected instruments, methods, tools and principles of quality management in the context of their application in the conditions of Industry 4.0. Analysis of the responses of 26 experts representing industrial (13 experts) and academic (13 experts) environments provided valuable information on preferences and differences in the perception of the effectiveness of individual solutions. Despite some differences in approach, it is the practitioners who focus mainly on tools that support ongoing control and implementation, while academics show more interest in analytical and conceptual solutions. A number of common elements were also identified, which demonstrate the versatility of some tools in the context of the challenges of Industry 4.0.

The use of Spearman rank correlation analysis made it possible to identify the most effective solutions and to capture correlations between them. The observed strong correlations between some tools suggest their complementarity and potential for synergistic use as part of a comprehensive approach to quality management. An example is the very strong correlation (0.88) between the Scatter Diagram tool, used to analyze cause-and-effect relationships, and the Workflow tool, used to model process flows. This correlation suggests that organizations using an analytical approach to quality assessment often implement solutions in parallel to visualize and optimize the flow of activities. An equally significant correlation (0.81) emerged between QFD (Quality Function Deployment) and the Gantt chart - planning tools that together support the design of products in line with customer expectations and the effective management of implementation time. Such strong correlations confirm the need for systemic

integration of quality management tools, especially in environments characterized by high levels of complexity and dynamic operations.

The conducted research provided new information on the effectiveness and interrelationships of selected instruments, concepts, methods, techniques, tools, and principles of quality management in the context of their application in Industry 4.0. While other studies focused mainly on the evaluation of individual tools in isolated conditions (e.g. Hamrol, 2013; Wolniak, Sułkowski, 2018a), this study combined the assessment of the effectiveness of tools with an analysis of the correlations between them, taking into account the perspectives of both industrial practitioners and representatives of the scientific community.The findings also confirm that effective quality management in the era of digitization cannot be limited to the use of single methods, but requires a thoughtful selection of tools tailored to the specifics of a given process stage and organizational context, which is in line with the path of quality in digital maturity developed by Patricia Hume (Hume, 2024). Industry 4.0, through its assumptions about automation, IT integration, the Internet of Things or data analytics, creates new opportunities, but also forces a revision of existing approaches. Quality management tools should therefore not only be effective, but also flexible, interoperable and ready to work with modern technologies, as evidenced by studies conducted by other researchers (Fadilasari et al., 2024).

However, the survey is not free of limitations. The selection of experts based on recommendations and self-assessments of competence introduces the risk of subjectivity, despite the application of rigorous criteria. In addition, the analysis included only 42 selected tools, which does not exhaust the full spectrum of quality management methods available in the literature and practice. The lack of strong negative correlations and very strong positive correlations (above 0.9) may also suggest that the tools studied operate largely independently or that their relationships are too complex to be fully captured by the methodology adopted. Another limitation is the lack of consideration of industry specificity or organizational context, which may have influenced the differences in scores between groups.

Prospects for future research could include conducting quantitative surveys targeting academics as well as managers and executives from the industrial sector. An in-depth analysis of the context in which the tools are used, such as through case studies in specific companies implementing Industry 4.0, is worth considering. Additional research could also focus on the dynamics of the relationship between tools over time, and the integration of new technologies (e.g., artificial intelligence) with traditional quality management approaches. Expanding the analysis to include less researched tools or new approaches could further enrich the findings and contribute to a better understanding of their role in improving organizations in an era of digital transformation.

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# PRICE DISCOVERY IN SINGLE-STOCK FUTURES: EVIDENCE FROM THE WARSAW STOCK EXCHANGE

Milena SULIGA

AGH University of Krakow; msuliga@agh.edu.pl, ORCID: 0000-0001-5719-5679

**Purpose:** The aim of the research is to assess the role of single-stock futures in the price discovery process on the Warsaw Stock Exchange**.** The paper seeks to determine whether the futures market contributes significantly to price discovery or if the spot market remains dominant.
**Design/methodology/approach**: The study employs a two-dimensional vector error correction model (VECM) to describe the dynamics of the relationship between cointegrated spot and futures prices. The analysis is conducted for single stock futures with the highest multiplier (1000) and for underlying stocks. Based on the model, both short-term and long-term causal relationships are analysed and the relative contribution of the spot and futures markets to price discovery is determined for each of the eight pairs of analysed assets separately.
**Findings:** The findings indicate that, on the WSE, the spot market generally plays a dominant role in the price discovery process, with an average contribution of 72.03%, compared to 27.97% for the single-stock futures market. Short- and long-term Granger causality tests confirmed that, in most cases, stock prices lead futures prices. This suggests that high leverage alone does not guarantee a strong price discovery role of futures.
**Research limitations/implications**: The research focuses on only eight single-stock futures classes, with the highest contract multiplier, which may not fully represent the broader market. Future research could expand the analysis by incorporating derivatives with lower multipliers as well as making a combined analysis of the prices of stocks, single-stock futures, and index futures.
**Practical implications:** The research highlights that, on the WSE, the spot market generally dominates the price discovery process. For investors in single-stock futures, this means that relying solely on futures market signals may not be sufficient for forecasting price movements. The study also indicates that high leverage does not guarantee a dominant role of futures in price discovery, which could influence trading strategies and risk management approaches. Economically, these findings can guide market participants in optimizing investment strategies and regulators in assessing the efficiency of the derivatives market.
**Originality/value:** The paper provides a detailed analysis of the price discovery role of single-stock futures on the WSE, an area with limited prior research. Unlike previous studies, it examines both short- and long-term causal relationships for selected high-multiplier futures contracts, offering new insights into market efficiency. The study is valuable for investors, traders, and regulators by clarifying the dominant role of the spot market and highlighting factors influencing futures market efficiency. It is particularly relevant for financial analysts,

policymakers, and market participants seeking to improve trading strategies and market oversight.
**Keywords:** price discovery, single-stock futures, Granger causality.
**Category of the paper:** Research paper.

## 1. Introduction

Every day, a vast amount of information flows into the stock market, significantly influencing trading behavior of investors and, consequently, the pricing of financial instruments. In a strong-form efficient market, all relevant information should be instantaneously reflected in asset prices (Fama, 1970). However, in markets exhibiting weak or semi-strong efficiency, the full absorption of new information into asset prices—referred to as price discovery—is a process that requires time.

Since financial futures serve as crucial hedging instruments for positions in the spot market, there are strong interdependencies between their prices and the prices of their underlying assets. As a result, the spot and futures markets influence each other. The arrival of new information triggers similar investor reactions in both markets, leading to comparable price movements in the underlying asset and its corresponding derivative. However, in the absence of strong informational efficiency, spot and futures price changes are not perfectly synchronized—one market absorbs new information more quickly than the other. A prior price change in either the underlying asset or its derivative thus signals an imminent adjustment in the other. Such relationships are commonly associated with Granger causality between spot and futures prices.

Examining the relationship between stock prices and their corresponding derivatives provides valuable insights for both investors and regulators overseeing market operations. First, such analyses help assess whether the futures market fulfills its price discovery function, thereby contributing to the efficiency of the spot market. Second, identifying systematic causal relationships between spot and futures prices enables the determination of which market plays a dominant role in the price discovery process. Consequently, observing price movements in the leading market can enhance investors' ability to forecast price changes in the other market, thereby facilitating the construction of more effective investment strategies.

Previous studies on mature, liquid markets indicate that the futures market typically plays a dominant role in price discovery (e.g., Alphonse, 2000; Covrig et al., 2004; Chou, Chung, 2006; Gaul, Theissen, 2008). One key factor contributing to the futures market's advantage in absorbing new information is the leverage effect. In futures contracts linked to large stock portfolios, even small changes in the underlying asset's price can lead to substantial fluctuations in the contract's value. This prompts futures investors to remain highly attentive and react immediately to significant market events. Additional characteristics of mature derivatives

markets that reinforce their dominance in price discovery include low transaction costs, the absence of short-sale restrictions and the substantial presence of institutional investors (Bohl et al., 2011).

On most global markets, stock index futures are the most liquid financial derivatives. Consequently, the majority of prior research on price discovery has focused on the relationship between major stock indices and their corresponding futures contracts. Considerably fewer studies have examined the role of single-stock futures (SSF) in the price discovery process. To the best of the author's knowledge, the only study investigating single-stock futures listed on the Warsaw Stock Exchange (WSE) was conducted by Mutlu and Arik (2015). Their analysis, which also covered the Indian, Korean, and Russian markets, provided only general insights into the Polish SSF market. Based on a sample of 20 SSF classes and their corresponding stocks, the authors found that, on average, the Polish SSF market contributed approximately 40% to price discovery, while the spot market accounted for around 60%.

The aim of this article is to conduct a more detailed investigation into the role of single-stock futures in the price discovery process on the Warsaw Stock Exchange. To achieve this, both long-term and short-term causal relationships were analysed for selected stocks and corresponding futures contracts. Based on these findings, the relative contributions of the spot and futures markets to price discovery were determined for each of analysed asset pairs separately. Conducting such an analysis for all available SSF classes (over 40) would require an extensive presentation. Therefore, the study focuses on derivatives with the highest contract multiplier (1,000), as their contribution to price discovery process is expected to be particularly significant (cf. Aggarwal, Thomas, 2011).

## 2. Literature Review

### 2.1. Studies from Foreign Markets

There are numerous studies analyzing the price discovery function of financial futures. The majority of these studies focus on index futures. Their findings indicate that in case of mature derivatives markets, significant new information is generally reflected more quickly in index futures prices than in the prices of the corresponding indices. Such conclusions have been drawn, among others, for markets in the United States (e.g., Hasbrouck, 2003; Chou, Chung, 2006), France (Alphonse, 2000), Germany (Gaul, Theissen, 2008), the United Kingdom (Brook et al., 2001) and Japan (Covrig et al., 2004).

For emerging markets, conclusions regarding the extent to which index futures contribute to price discovery are less consistent and vary depending on the market analysed, the research period and the frequency of the data used (e.g., Min, Najand, 1999; Roope, Zurbruegg, 2002; Yang et al., 2012; Fassas, Siriopoulos, 2018; Chen et al., 2019, 2021).

Far fewer studies have examined the price discovery function of single-stock futures (SSF), as these derivatives are considerably less popular than index futures in most global markets. With regard to the Indian market, Kumar and Tse (2009) analysed the role of SSF in price discovery using high-frequency data from 2004. Their findings suggest that transactions in the Indian spot market contributed significantly more to price discovery than SSF transactions, with estimated contributions of 72% and 28%, respectively. Aggarwal and Thomas (2011) also studied the Indian SSF market and found that the role of SSF in price discovery increases with its relative liquidity compared to the spot market. Fung and Tse (2008) examined SSF in Hong Kong from August 2001 to June 2003, estimating the average contribution of SSF to price discovery at approximately 33%. Similar conclusions were reached for the Australian market by Lien and Yang (2003), who attributed the dominance of the spot market in price discovery during their research period (from contract inception to June 1998) to low SSF trading volumes. Furthermore, Lien and Yang (2003) found that switching from cash settlement to physical delivery increased information flow from the spot to the futures market.

On the Thai market, Songyoo (2012) analysed KTB single-stock futures (KTB is the national bank of Thailand) and their role in price discovery. Unlike the previously mentioned studies on Australia, India, and Hong Kong, Songyoo (2012) found that SSFs prices generally led the corresponding prices of KTB stocks. Using 10-minute data from September 12, 2011, to November 14, 2011, the study concluded that analysed SSFs played a dominant role in price discovery during this period.

### 2.2. Previous Studies on Price Discovery on the Warsaw Stock Exchange

Research on the role of the derivatives market in the price discovery process on the Warsaw Stock Exchange is relatively limited. Bohl et al. (2011) applied a two-dimensional VECM error correction model to analyze the relationship between the WIG20 index closing prices and WIG20 futures prices during the first ten years of the derivatives market's operation (1998-2008). The primary objective of their analysis was to assess the impact of investor structure on the derivatives market's contribution to price discovery. Until 2004, the market was dominated by individual investors—presumably less informed—who accounted for approximately 75-80% of trading volume. The authors checked that, during this period, the derivatives market did not effectively fulfill its price discovery function. Their study found no evidence of information flows from the futures market to the spot market, and the average contribution of WIG20 futures to price discovery was only 16%.

Starting in 2004, regulatory changes allowing investment funds to trade in futures contracts led to a gradual increase in institutional investor participation in futures market. By 2008, institutional investors still remained a minority, accounting for about 47% of total futures market volume. However, this shift in market structure contributed to a rise in the conditional correlation between spot and futures prices and increased the average contribution of the futures market to price discovery to approximately 35%. The VECM estimation results also confirmed

the presence of bidirectional causality between the WIG20 index and corresponding futures contracts during 2004-2008, indicating that information was flowing in both directions.

Marcinkiewicz and Kompa (2013) also examined the causal relationship between the WIG20 index and corresponding futures. To identify both short- and long-term causality between spot and futures prices, they employed a vector autoregression (VAR) model and a two-dimensional VECM error correction model, depending on the properties of the analysed time series. Their analysis covered the period from July 1, 2008, to May 31, 2011, using both daily and intraday data (5-, 15-, and 30-minute intervals). Although they did not report full model estimation results, their study indicated that in the short term, Granger causality flowed from the futures market to the spot market, regardless of data frequency. For the highest-frequency data (5-minute intervals) throughout the sample period, as well as for 15-minute data from July 2008 to July 2009, bidirectional causality was observed.

In their discussion of long-term relationships, Marcinkiewicz and Kompa (2013) noted that in all four estimated VECM models, the error correction term was negative and statistically significant in the futures return equation. However, they incorrectly concluded that this implied long-term causality from the futures market to the spot market. In reality, their findings indicate that only futures prices responded to deviations from the long-term equilibrium relationship, meaning that the futures market adjusted to spot prices rather than leading them. This misinterpretation led them to overestimate the role of WIG20 futures in price discovery.

As mentioned earlier, the only study on single-stock futures role in price discovery on the WSE was conducted by Mutlu and Arik (2015). Their study covered four emerging markets—India, Korea, Poland, and Russia—using daily data from contract inception until August 15, 2014, and hourly data from April 1 to August 15, 2015. They modeled cointegrated spot and futures prices using a two-dimensional VECM. For the Polish market, the authors used a sample of 20 stock–futures pairs (stock quotes and quotes of futures on these stocks). Similar to Marcinkiewicz and Kompa (2013), the authors did not present the full estimation results of their models. Instead, based on results obtained for individual markets, they calculated and reported only the average relative shares of the futures and spot markets in price discovery, using formulas proposed by Eun and Sabherwal (2003). For the WSE, the share of the futures market in price discovery was found to be 40.22% for daily data and 38.15% for hourly data. These values indicate that, during the period under study, the spot market played a dominant role in price discovery on the WSE. The shares of the stock futures market in the price discovery process were similar in India and Korea. However, the Russian market exhibited a significantly different pattern, with stock futures accounting for as much as 77.18% of price discovery (based solely on daily data for this market). Mutlu and Arik (2015) attributed this difference to the fact that, among the four analysed markets, Russia was the only one where the trading volume of stock futures exceeded that of the underlying stocks.

To identify the factors significantly influencing the role of the futures market in price discovery, Mutlu and Arik (2015) additionally applied a multiple regression model. Their results confirmed the earlier observation that greater liquidity in the stock futures market relative to the spot market transfer to a higher contribution of futures to price discovery. Furthermore, their parameter estimation revealed a significant negative relationship between the turnover and market capitalization of the underlying stocks and the role of futures in price discovery. The study also confirmed the importance of the "age" of futures contracts: the longer a particular class of contracts had been listed on the market, the better it performed its price discovery function.

## 3. Data and Research Methodology

### 3.1. Data

This study utilizes daily closing stock prices of eight companies listed on the Warsaw Stock Exchange and the daily closing prices of corresponding single-stock futures. The list of companies and the characteristics of stocks and futures contracts are presented in Table 1. As mentioned earlier, only derivatives with the highest multiplier were included in the analysis, i.e., those where one contract represents one thousand shares of the company. This means that a 1-grosz change in the contract price translates to a change in its value of 10 PLN. The study covers the period from February 24, 2020, to the end of 2023. The beginning of the research period was set at the outbreak of the COVID-19[1] pandemic, as this marked a significant increase in investments in the derivatives market. The crisis triggered by the pandemic, characterized by sharp fluctuations in stock prices, attracted investors to futures markets as a tool for hedging open positions in the cash market. It is worth noting that in March 2020, the trading volume of single-stock futures on the WSE was nearly three times higher than in March of the previous year. Between 2020 and 2022, the annual trading volume of SSFs exceeded historical levels, only returning to pre-pandemic levels in 2023. Given this, it was assumed that from the onset of the COVID-19 pandemic, the role of SSFs in the price discovery process on the WSE may have increased significantly, making this period an appropriate focus for the study.

In Table 1, in addition to the full name and ticker symbol of each company, information is provided on the average closing price of both the stocks and the futures contracts during the period under study. Mutlu and Arik (2015) identified liquidity ratios of futures market relative

[1] Although the state of epidemic emergency in Poland was officially declared only on March 20, 2020, the impact of the global outbreak of COVID-19 on the Warsaw Stock Exchange became evident nearly a month earlier, on February 24. On that day, the WIG20 index recorded its first sharp decline, dropping by more than four percentage points, and continued its downward trend in the following days. For this reason, February 24, 2020, was chosen as the starting point of the study period.

to stock market and contract age as key factors influencing the role of derivatives in price discovery. Therefore, Table 1 also includes the launch dates of the respective futures contracts and the average relative trading volume, calculated as the ratio of the daily futures trading volume (multiplied by the contract multiplier of 1000) to the daily trading volume of the corresponding stocks. These details will help determine whether the analysed companies exhibit similar dependencies to those identified by Mutlu and Arik (2015).

**Table 1.**
*Characteristics of stocks and futures included in the study (24.02.2020 – 31.12.2023)*

| Name of the company | Ticker symbol of stocks | Average closing price of stocks (zł) | Ticker symbol of SSFs | Average closing price of SSFs (zł) | Launch date of SSFs | Average relative trading volume (%) |
|---|---|---|---|---|---|---|
| CI Games[2] | CIG | 2.24 | FCIG | 2.26 | 8.04.2019 | 1.11 |
| Enea | ENA | 7.46 | FENA | 7.53 | 3.12.2015 | 5.89 |
| Bank Millennium | MIL | 4.96 | FMIL | 4.98 | 3.12.2015 | 3.04 |
| Orange Polska | OPL | 6.99 | FOPL | 7.03 | 24.06.2013 | 4.76 |
| PGE Polska Grupa Energetyczna | PGE | 7.56 | FPGE | 7.55 | 22.03.2010 | 6.05 |
| Polimex Mostostal | PXM | 3.81 | FPXM | 3.87 | 20.03.2017 | 1.99 |
| Synthaverse | SVE | 7.24 | FSVE | 7.06 | 5.10.2020 | 3.17 |
| Tauron Polska Energia | TPE | 2.71 | FTPE | 2.73 | 20.12.2010 | 5.76 |

Source: own elaboration.

Since 2002, the expiration months for single stock futures (as well as index futures) on the WSE have followed a quarterly cycle: the three nearest months from the March cycle (March, June, September, and December). New contract series are introduced into trading nine months before expiration, which falls on the third Friday of the expiration month (or the preceding trading day in case of a public holiday). At any given time, three consecutive series of stock futures of the same class are available on the market, with the most liquid being the one closest to expiration. Consequently, the time series of daily closing prices for the single stock futures used in this study consists of the daily closing prices of the nearest-to-expiry contract series. Data from expiration days were omitted, as previous research by Suliga (2020, 2021, 2023) has shown that stock prices (and consequently, the prices of their corresponding futures contracts) tend to be distorted due to expiration-day effects. To conduct the study, closing prices of stocks $S_t$ and corresponding single-stock futures $F_t$ were logarithmized: $s_t = \ln(S_t)$, $f_t = \ln(F_t)$. Symbols $\Delta s_t = s_t - s_{t-1}$ and $\Delta f_t = f_t - f_{t-1}$ denote daily logarithmic returns of stocks and futures, respectively.

### 3.2. Methodology

According to financial theory, the fair price of a futures contract should be given by:

$$F_t = S_t e^{(r-d)(T-t)}, \tag{1}$$

[2] As of February 29, 2024, the Management Board of the Warsaw Stock Exchange indefinitely suspended the introduction of new series of futures contracts on CI GAMES stocks into trading.

where $r$ is the risk-free rate, $d$is the dividend yield, and $T-t$ is the time remaining until contract expiration. Arbitrage activity reinforces the relationship between spot and futures prices, ensuring that market prices of futures contracts do not significantly deviate from their theoretical values.

In econometric models, relationship described by equation (1) is often simplified by disregarding dividend yield, time to expiration, and time-varying returns, assuming instead that the time series of natural logarithms of prices $f_t$ and $s_t$ are cointegrated of order (1,1), with the cointegrating relation expressed as:

$$f_t = \beta_0 + \beta_1 s_t + ec_t. \tag{2}$$

This implies that while time series of $f_t$ and $s_t$ are non-stationary, their first differences $\Delta s_t, \Delta f_t$ are stationary, and a stationary linear combination exists $ec_t = f_t - \beta_0 - \beta_1 s_t$, known as the error correction term. The vector $[1, -\beta_0, -\beta_1]$ is referred to as the cointegrating vector.

The dynamics of the relationship between these cointegrated spot and futures prices can be modeled using a bivariate vector error correction model (VECM):

$$\Delta s_t = \mu_s + \alpha_s ec_{t-1} + \sum_{j=1}^{p} \gamma_{ss,j} \Delta s_{t-j} + \sum_{j=1}^{p} \gamma_{sf,j} \Delta f_{t-j} + \varepsilon_{s,t} \tag{3}$$

$$\Delta f_t = \mu_f + \alpha_f ec_{t-1} + \sum_{j=1}^{p} \gamma_{fs,j} \Delta s_{t-j} + \sum_{j=1}^{p} \gamma_{ff,j} \Delta f_{t-j} + \varepsilon_{f,t}. \tag{4}$$

In general, an $n$-dimensional VECM model can be expressed in matrix form as:

$$\Delta Y_t = \mu + \Pi Y_{t-1} + \sum_{j=1}^{p} \Pi_j \Delta Y_{t-j} + \varepsilon_t, \tag{5}$$

where Π is the error-correction matrix which captures the long-term equilibrium relationships, and $\Pi_j$ are coefficient matrices capturing short-term dynamics. The Johansen test (Johansen, 1991, 1992) is employed to determine the rank of cointegration (the number of cointegrating relations between $n$ variables). The test is based on two statistics:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1-\lambda_i), \tag{6}$$

$$\lambda_{max}(r) = -T \ln(1-\lambda_{r+1}), \tag{7}$$

where $\lambda_i$ are the eigenvalues of Π, ordered in ascending order. The $\lambda_{trace}(r)$ statistic tests the null hypothesis that the number of cointegrating vectors is at most $r$ against the alternative hypothesis that there are more of them. $\lambda_{max}(r)$ statistic tests the null hypothesis that there are exactly $r$ cointegrating vectors against the alternative hypothesis that the number of cointegrating vectors is equal to $r+1$.

For the bivariate VECM model used in this study, expressed by formulas (3) and (4), at most one cointegrating vector can exist. Thus, conducting the Johansen test aims to confirm whether stock and futures prices are indeed cointegrated of order (1,1).

Applying the VECM model to spot and futures prices enables an examination of both short-term and long-term causal relationships. The error correction terms $\alpha_s, \alpha_f$ in the equations (3) and (4) measure how prices adjust to deviations from the long-run equilibrium described by equation (2). If $\alpha_s$ is significantly different from zero, it indicates that stock prices respond to restore equilibrium, whereas a significant $\alpha_f$ suggests that futures prices adjust instead. If only one of these coefficients is significant, information flows in one direction, implying that, in a long-run aspect, either the spot or futures market leads in price discovery.

Short-term dependencies between stocks and futures prices are analysed using the estimated coefficients $\gamma_{sf,j}$ and $\gamma_{fs,j}$. Finally, $\gamma_{ss,j}$ ($\gamma_{ff,j}$) coefficients indicate the relationship between spot (futures) prices and their past values. The optimal lag order $j$ is determined using the Schwarz Bayesian Information Criterion (BIC).

Based on the estimated parameter values of the VECM model, the Granger causality test between spot and futures prices can be conducted. This causality may be observed in both long-term relationships (measured by coefficients $\alpha_s, \alpha_f$) and short-term dependencies (expressed by the lagged values of coefficients $\gamma_{sf,j}, \gamma_{fs,j}$). The analysis of Granger causality from spot prices to futures prices requires the verification of the following hypotheses:

$$H_{01}: \alpha_f = 0 \; and \; H_{02}: \gamma_{fs,1} = \gamma_{fs,2} = \cdots = \gamma_{fs,p} = 0. \tag{8}$$

Rejecting at least one of these hypotheses would indicate that spot prices are a Granger cause for futures prices, suggesting that the spot market plays a significant role in price discovery. Similarly, examining causality from futures prices to stock prices involves testing the validity of the following hypotheses:

$$H_{03}: \alpha_s = 0 \; and \; H_{04}: \gamma_{sf,1} = \gamma_{sf,2} = \cdots = \gamma_{sf,p} = 0. \tag{9}$$

Detecting bidirectional causality would signal that both the spot and futures markets contribute significantly to the price discovery process. To test hypotheses $H_{01}$ and $H_{03}$, it is sufficient to apply the significance $t$ −test for coefficients $\alpha_f, \alpha_s$ . This test can also be used for hypotheses $H_{02}$ and $H_{04}$ if the lag order is $p = 1$. In the case of $p > 1$, these hypotheses can be tested using the Wald restriction test (Witkowska et al., 2008, p. 146).

In addition to conducting the Granger causality test, to determine the average contribution of both markets to the price discovery process, measures based on the values of coefficients $\alpha_s, \alpha_f$ will be calculated. The measures proposed by Schwarz and Szakmary (1994) have been subsequently used in other studies on this topic (e.g., Bohl et al., 2011; Mutlu, Arik, 2015; Fassas, Siriopoulos, 2019):

$$\theta_f = \frac{|\alpha_s|}{|\alpha_s| + |\alpha_f|}, \tag{10}$$

$$\theta_s = 1 - \theta_f = \frac{|\alpha_f|}{|\alpha_s| + |\alpha_f|}. \tag{11}$$

If price discovery occurs exclusively in the spot market, only the futures market would react to disturbances from the long-term equilibrium relationship (2). Out of the two coefficients $\alpha_s, \alpha_f$, only the latter would be different from zero, leading to a value of $\theta_f = 0$. Conversely, if only $\alpha_s$ was nonzero, then $\theta_f$ would be equal to 1. The values of the coefficients defined by equations (10) and (11) thus indicate the average percentage contribution of each market to the price discovery process.

## 4. Empirical Results

In the first step of the study, the ADF test was used to examine the stationarity of time series for logarithmic stock and futures prices as well as logarithmic returns. The ADF test verifies the null hypothesis of a unit root (non-stationarity) against the alternative that the analysed series is stationary. The obtained test statistics are presented in Table 2. Assuming a significance level of 0.05, it was determined that all considered price series $s_t$ and $f_t$ are non-stationary, whereas logarithmic return series for stocks and indices are stationary. Thus, stock and futures prices are first-order integrated series (I(1)).

To check whether the price series are cointegrated of order (1,1), the Johansen test was conducted at a 0.05 significance level. The test statistics $\lambda_{trace}(r)$ and $\lambda_{max}(r)$ obtained for $r = 0$ i $r = 1$ respectively, as well as cointegrating vectors for each pair of instruments are presented in Table 3. These results confirm significant cointegration for each of the eight examined pairs, justifying the estimation of two-dimensional VECM models defined by equations (3) and (4).

**Table 2.**
*ADF test statistics for logarithmic prices and logarithmic returns of stocks and futures*

| company | $s_t$ | $f_t$ | $\Delta s_t$ | $\Delta f_t$ |
|---|---|---|---|---|
| CIG | -1.76 | -1.74 | -31.20*** | -31.90*** |
| ENA | -2.18 | -2.15 | -28.90*** | -28.51*** |
| MIL | -1.10 | -1.08 | -30.10*** | -30.00*** |
| OPL | -2.64* | -2.54 | -30.10*** | -28.90*** |
| PGE | -2.24 | -2.02 | -29.00*** | -29.50*** |
| PXM | -2.09 | -2.11 | -29.50*** | -28.50*** |
| SVE | -2.33 | -2.33 | -28.50*** | -28.50*** |
| TPE | -2.14 | -2.12 | -28.10*** | -27.80*** |

Note. Symbols: *** and * indicate statistical significance at 0.01 and 0.1 levels, respectively.

Source: own calculations.

**Table 3.**
*Johansen cointegration test results*

| Company | $\lambda_{trace}$ | | $\lambda_{max}$ | | Coordinates of cointegrating vector $[1, -\beta_0, -\beta_1]$ | |
|---|---|---|---|---|---|---|
| | $H_0: r = 0$ | $H_0: r \leq 1$ | $H_0: r = 0$ | $H_0: r = 1$ | $\beta_0$ | $\beta_1$ |
| CIG | 155,45*** | 4,22 | 151,23*** | 4,22 | 0,0007 | 1,0105*** |
| ENA | 232,57*** | 5,82 | 226,75*** | 5,82 | 0,0420*** | 0,9842*** |
| MIL | 345,18*** | 1,42 | 343,76*** | 1,42 | 0,0149*** | 0,9932*** |
| OPL | 133,78*** | 7,54* | 126,25*** | 7,54* | 0,0103*** | 0,9981*** |
| PGE | 29,91*** | 4,93 | 24,98*** | 4,93 | -0,1895*** | 1,0928*** |
| PXM | 269,96*** | 5,00 | 264,96*** | 5,00 | 0,0281*** | 0,9913*** |
| SVE | 71,59*** | 7,36 | 64,23*** | 7,36 | 0,0482*** | 0,9640*** |
| TPE | 153,93*** | 6,64 | 147,29*** | 6,64 | 0,0056*** | 1,0005*** |

Note. Symbols: *** and * indicate statistical significance at 0.01 and 0.1 levels, respectively.

Source: own calculations.

The estimated VECM model parameters are presented in Table 4. In each case, the Schwarz Bayesian information criterion indicated the optimal lag order selection $p = 1$.

**Table 4.**
*Estimated VECM model parameters*

| Company | Estimated values of parametres | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $\mu_s$ | $\alpha_s$ | $\gamma_{ss,1}$ | $\gamma_{sf,1}$ | $\mu_f$ | $\alpha_f$ | $\gamma_{ff,1}$ | $\gamma_{fs,1}$ |
| CIG | 0.001 | 0.174*** | 0.090* | -0.082 | 0.001 | -0.191*** | -0.156*** | 0.185*** |
| ENA | -0.005 | 0.139 | 0.037 | 0.059 | 0.019*** | -0.445*** | -0.068 | 0.170** |
| MIL | 0.002 | -0.089 | 0.144 | -0.133 | 0.013*** | -0.846*** | -0.084 | 0.095 |
| OPL | -0.001 | 0.127 | -0.002 | 0.047 | 0.002** | -0.226** | -0.193** | 0.282*** |
| PGE | 0.009** | 0.043* | 0.070 | 0.008 | -0.001 | -0.010 | -0.139** | 0.204*** |
| PXM | -0.003 | 0.124* | 0.124** | -0.057 | 0.015*** | -0.501*** | -0.047 | 0.189*** |
| SVE | -0.002 | 0.002 | 0.012 | -0.019 | 0.007*** | -0.180*** | -0.204*** | 0.268*** |
| TPE | 0.021 | 0.001 | -0.146 | 0.258* | -0.385*** | 0.003** | 0.020 | 0.097 |

Note. Symbols ***, **, * indicate significance at 0.01, 0.05, and 0.1 levels, respectively.

Source: own calculations.

The obtained values of coefficient $\gamma_{ss,1}$, relating to lagged changes in stock returns, are significantly different from zero (at 0.1 and 0.05 levels, respectively) only for two of the eight analysed companies. The positive values of these coefficients suggest that price trends in the stock quotes of CIG and PXM tend to persist over time. In contrast, the corresponding coefficients in the equations describing futures returns ($\gamma_{ff,1}$), except for one case, are negative, and four of them are significantly different from zero at the 0.05 level. This indicates that, unlike stock prices, at least some of futures prices exhibit a mean-reversion effect.

The analysis of coefficients $\gamma_{sf,1}$ and $\gamma_{fs,1}$allows for determining the nature of short-term dependencies between spot and futures prices. Since in each model, the lag order $p = 1$, verifying hypotheses $H_{02}$ and $H_{04}$ only requires assessing the significance of coefficients $\gamma_{sf,1}, \gamma_{fs,1}$. The values of $\gamma_{sf,1}$, presented in the left part of Table 4 are mostly not significantly different from zero. Only for TPE, a positive and significant coefficient at the 0.1 level was obtained, providing weak evidence that futures prices may be a Granger cause for stock prices in the short term. All estimated values of coefficient $\gamma_{fs,1}$, presented in the last column

of Table 4, are positive, and for six of them, significance tests confirm that they are different from zero at the 0.05 level. This indicates that for all companies except MIL and TPE, significant information flow from the spot market to the futures market was observed in the analysed period, meaning stock prices were a Granger cause for futures prices.

Considering the obtained values of coefficient $\alpha_s$, it should be stated that only in the case of CIG are there strong indications suggesting that significant stock price adjustments occur in response to long-term equilibrium disruptions between stock and futures prices, as described by equation (2). The coefficient $\alpha_s$ is positive, and its significance test confirms that it is different from zero at the 0.01 level. Among the remaining values of this coefficient, only those for PGE and PXM are significantly different from zero, but only at the 0.1 level. These results suggest potential long-term causal relationships from futures prices to stock prices for these two companies as well. For the remaining companies, the obtained values of coefficient $\alpha_s$ do not differ significantly from zero, indicating that their stock prices do not exhibit significant reactions to deviations from their long-term equilibrium with futures prices. This suggests that for ENA, MIL, OPL, SVE, and TPE, no significant long-term information flow from the futures market to the spot market was observed in the analysed period.

The obtained values of coefficient $\alpha_f$, presented in the right section of Table 4, are mostly negative (with the exception of TPE). Apart from the value obtained for PGE, they are significantly different from zero at the 0.05 or 0.01 level. This indicates that for seven out of the eight analysed companies, there is strong evidence of significant causality from the spot market to the futures market. When a long-term equilibrium disturbance occurs between stock prices and their corresponding futures prices, the price adjustment is primarily observed in the futures market. Generally, stock prices respond more quickly to new market information, while futures prices follow them.

The results described above indicate that long-term causality for most analysed companies flows from spot prices to futures prices. The exceptions in this context are CIG, PGE, and PXM. In the case of CIG and PXM, bidirectional causality is observed. However, for PXM, as previously mentioned, there is only weak evidence supporting the existence of causality from futures prices to spot prices. For PGE, there is no basis for determining causality from stock prices to futures prices; however, a causal relationship in the opposite direction may exist ($\alpha_f$ is not significantly different from zero, while $\alpha_s$ is significantly different from zero only at the 0.1 significance level).

It is also worth noting that, for most companies (7 out of 8), the obtained values of coefficient $\alpha_s$ are greater than zero, whereas coefficients $\alpha_f$ are less than zero. A positive $\alpha_s$ and a negative $\alpha_f$ align with the standard market reaction mechanisms to long-term equilibrium disturbances. A positive $ec_t$ value suggests that the futures price is overvalued relative to the spot price. As noted by Bohl et al. (2011), in such cases, arbitrageurs take short positions in the derivatives market and long positions in the spot market, leading to a decline in futures prices

and an increase in stock prices ($\Delta f_t < 0, \Delta s_t > 0$). Conversely, when $ec_t < 0$, meaning that stock prices are overvalued relative to futures prices, arbitrageurs take the opposite positions in both markets, resulting in rising futures prices and declining stock prices ($\Delta f_t > 0, \Delta s_t < 0$). In both cases, there is a negative relationship between futures price changes $\Delta f_t$ and $ec_t$ ($\alpha_f < 0$), and a positive relationship between stock price changes $\Delta s_t$ and $ec_t$ ($\alpha_s > 0$).

The detected Granger causal relationships between spot and futures prices are summarized in Table 5. The two columns in the left section of the table list long-term relationships flowing from the spot market to the futures market (column $s_t \dashrightarrow f_t$) and in the opposite direction (column $f_t \dashrightarrow s_t$). Each identified relationship is also marked with its level of significance. Similar information regarding short-term relationships (or their absence) is included in the right section of the table. This summary clearly shows that in both short- and long-term relationships, the spot market dominates the price discovery process, as the vast majority of detected causal relationships flow from spot prices to futures prices.

**Table 5.**

*Detected Granger causal relationships*

| Company | Long-term causality | | Short-term causality | |
|---|---|---|---|---|
| | $s_t \dashrightarrow f_t$ | $f_t \dashrightarrow s_t$ | $s_t \dashrightarrow f_t$ | $f_t \dashrightarrow s_t$ |
| CIG | CIG ⟶ FCIG*** | FCIG ⟶ CIG*** | CIG ⟶ FCIG*** | none |
| ENA | ENA ⟶ FENA*** | none | ENA ⟶ FENA** | none |
| MIL | MIL ⟶ FMIL*** | none | none | none |
| OPL | OPL ⟶ FOPL** | none | OPL ⟶ FOPL*** | none |
| PGE | none | FPGE ⟶ PGE* | PGE ⟶ FPGE*** | none |
| PXM | PXM ⟶ FPXM*** | FPXM ⟶ PXM* | PXM ⟶ FPXM*** | none |
| SVE | SVE ⟶ FSVE*** | none | SVE ⟶ FSVE*** | none |
| TPE | TPE ⟶ FTPE** | none | none | FTPE ⟶ TPE* |

Note. Symbols ***, *, and * indicate statistical significance at the 0.01, 0.05, and 0.1 levels, respectively.

Source: own calculations.

The above results are consistent with findings from other emerging markets. Similar conclusions, indicating the dominance of the spot market in the price discovery process, were reached by Lien and Yang (2003) in their analysis of the Australian market, Kumar and Tse (2009) in their study of the Indian market, and Fung and Tse (2008) regarding the Hong Kong market. Lien and Yang (2003) further associate the lack of information flow from the futures market to the spot market with the relatively low trading intensity of futures contracts compared to the stock market. They write that during the period under study daily average trading volume ratio of the individual stock to its futures varies from 150 to 2000 across the companies being analysed. The data presented in the last column of Table 1 indicate slightly higher, yet still very low, investor activity in the Polish SSF market compared to the corresponding stock market. The average relative daily trading volume ranges from 1.11% for CIG to 6.05% for PGE. This means that, on average, the daily trading volume of stocks is several dozen times higher than that of their corresponding single-stock futures, which, according to Mutlu and Arik (2015), may be a key factor contributing to the dominance of the

spot market in price discovery. Similar conclusions were also reached by Fung and Tse (2008) regarding the Hong Kong market who write, that it is very likely that SSF market would dominate the price discovery process if comparable trading volumes on both, spot and futures markets were reached. Also Aggarwal and Thomas (2011) in Indian market find that the SSF market dominates price discovery only for the highly liquid securities.

In the final step of the study, to determine the average contribution of the stock and futures markets to the price discovery process, the measures $\theta_s$ and $\theta_f$ defined by equations (10) and (11) were calculated for each of the eight analysed stock–futures pairs $(s_t, f_t)$. It should be noted that these measures rely solely on the values of $\alpha_s, \alpha_f$, and therefore reflect the contribution of each market to price discovery only in terms of adjusting deviations from the long-term equilibrium relationship between spot and futures prices. The obtained values of the measures are presented in Table 6.

**Table 6.**
*Contribution of stock and futures market to price discovery*

| Company | $\boldsymbol{\theta_s}$ (%) | $\boldsymbol{\theta_f}$ (%) |
|---|---|---|
| CIG | 52,30 | 47,70 |
| ENA | 76,19 | 23,81 |
| MIL | 90,50 | 9,50 |
| OPL | 63,93 | 36,07 |
| PGE | 19,14 | 80,86 |
| PXM | 80,20 | 19,80 |
| SVE | 99,16 | 0,84 |
| TPE | 94,81 | 5,19 |
| average | 72,03 | 27,97 |

Source: own calculations.

The highest values of $\theta_s$, exceeding 90%, were obtained for MIL, SVE, and TPE. This indicates that the price discovery process for these stocks and their corresponding futures contracts occurs almost exclusively in the spot market. For the remaining five companies, in four cases values of $\theta_s$ exceed 50%, also suggesting that the spot market dominates in price discovery. Therefore, despite all of the analysed derivatives represent one thousand shares of the company, the high leverage effect characterising these futures does not translate into a dominant role of futures market in price discovery.

The only company for which significantly different results were obtained is PGE. The value of the measure $\theta_s$ for this stock is only 19.14%, while $\theta_f$ is 80.86%. This means that PGE Polska Grupa Energetyczna is the only company for which the futures market plays the dominant role in price discovery. What distinguishes this company from the others? Returning to the data in Table 1, it can be observed that, although the daily trading volume of PGE stocks is, on average, approximately 16.5 times higher than that of its corresponding single-stock futures, PGE still has the highest average daily relative trading volume among all the companies included in the study. As previously mentioned, citing the results of studies conducted on other emerging markets (Lien, Yang, 2003; Fung, Tse, 2008; Aggarwal, Thomas, 2011; Mutlu, Arik, 2015),

this may be a key factor influencing the high contribution of the PGE futures market to price discovery.

Moreover, data in Table 1 indicate that PGE had also the highest average closing price of both stocks and futures and that SSFs on PGE stocks are the longest-listed stock futures among the eight analysed. Thus, PGE exhibits the characteristics that Mutlu and Arik (2015) identified as having a significant positive impact on the futures market's price discovery role. Additionally, it is worth noting that PGE was the only analysed company that was continuously included in the WIG20 index throughout the period under study. WIG20 futures are the most liquid instruments on the WSE derivatives market, which increases the chance for a significant participation of the futures market in the price discovery process in case of companies included in this index.

The average values of $\theta_s$ and $\theta_f$, presented in the last row of Table 6, suggest that, on average, the spot market played the dominant role in price discovery process for the analysed stocks and futures contracts. This conclusion aligns with the findings of Mutlu and Arik (2015) regarding the Polish market. It is also worth noting that Kumar and Tse (2009) obtained nearly identical values for the relative contribution of both markets to the price discovery process—72% for the stock market and 28% for the futures market—when analyzing the Indian market based on one-minute stock returns and their corresponding single-stock futures (SSF) contracts. A slightly higher contribution of the SSF market to price discovery (37%) was found by Fung and Tse (2008) in the Hong Kong market. These findings suggest that the Polish SSF market does not differ significantly in terms of its role in price discovery from other emerging markets that have been studied in this regard.

## 5. Summary and conclusions

The study presents the results of an analysis of the price discovery process on the Warsaw Stock Exchange, based on an examination of short- and long-term causal relationships between the stock prices of selected companies and the prices of their corresponding single-stock futures. Among the more than forty classes of SSFs available on the WSE derivatives market, the study included those with the highest multiplier (1000). This selection aimed to determine whether the strong leverage effect translates into a significant contribution of derivatives to price discovery in the market. The starting point of the study period was set at the outbreak of the COVID-19 pandemic. Given that a significant increase in stock futures trading volume was recorded during the pandemic compared to previous years, it was assumed that the outbreak of the pandemic could have led to a substantial increase in the share of the derivatives market in price discovery, thereby strengthening its price discovery function. Contrary to these

assumptions, obtained results do not confirm that the stock futures market had a significant contribution to the price discovery process during and after the pandemic

In general, the results are in line with the conclusions formulated for several other SSFs markets (e.g. Lien, Yang, 2003; Fung, Tse, 2008; Kumar, Tse, 2009) and with those phrased for the Polish single-stock futures market by Mutlu and Arik (2015). In both short- and long-term causal relationships, in most cases, spot prices are the Granger cause of futures prices (similar results, but referring to the WIG20 index and futures contracts on this index, were also obtained by Bohl et al. (2011) and Marcinkiewicz and Kompa (2013)). In the case of short-term relationships, a significant information flow from the spot market to the futures market was confirmed for six out of the eight analysed instrument pairs. As for causality in the opposite direction, weak indications suggesting the possible existence of such relationships were found only for the stocks of TPE and the futures contracts on these stocks. Also in long-term causal relationships the spot market was identified as the dominant one in price discovery. For seven out of the eight companies, it was confirmed that in moments of disruption to the long-term equilibrium relationship between stock and futures prices, price adjustments occur in the derivatives market. Only in the case of three companies was causality in the opposite direction also detected.

The calculated values of the measures of markets relative contribution to the price discovery process also indicate that, on average, the spot market plays a dominant role in this process. The share of the stock market amounted to 72.03%, compared to a 27.97% share of the futures market. Thus, in general, it can be stated that despite the strong leverage effect characterising the analysed classes of SSFs, the prices of their corresponding stocks exhibit a faster reaction to new market information, while futures prices follow them. The conducted study allows for the conclusion that a high multiplier does not guarantee that the futures market will take over the price discovery function from the stock market. As shown by Mutlu and Arik (2015), there are other significant factors influencing the extent of the derivatives market's participation in price discovery, whose importance may be much greater.

In the conducted study, the dominance of the futures market in price discovery was found only in the case of PGE, a company that, during the analysed period, was characterized by the highest average closing price of both stocks and futures, the highest average relative trading volume, and the longest-listed futures contracts on the market. All these characteristics were identified by Mutlu and Arik (2015) as factors that positively influence the proper fulfilment of the price discovery function by the futures market. Moreover, throughout the entire period under study, PGE was the only company among those analysed that was included in the WIG20 index. Futures contracts on WIG20 are the most liquid instrument on the Warsaw Stock Exchange derivatives market, thus the company's inclusion in the index may also contribute to an increased share of the derivatives market in the price discovery and, in this context, may be more significant than the strong leverage effect.

The conducted research yields several practical conclusions. Firstly, the findings indicate that, on average, single-stock futures market plays only a minor role in price discovery. This is a crucial insight for regulatory bodies overseeing both the spot and derivatives markets, suggesting that for the SSF market to fulfill its price discovery function effectively, further development is necessary. The dominance of the spot market in price discovery also implies the need for regulators to monitor information absorption asymmetry to identify potential disruptions in this process.

The results of the study also provide valuable insights for investors. In particular, they reveal that the high leverage of SSFs does not confer an informational advantage to the derivatives market over the stock market. Therefore, investors should exercise caution when using SSF prices for predictive purposes, closely tracking price movements in the underlying stocks, which typically react more swiftly to new market information than futures. Furthermore, the detection of bidirectional causality between spot and futures prices for some of the companies under study allows for a broader conclusion: when allocating capital to high-multiplier stock futures or their corresponding equities, investors should closely monitor price changes in both markets. Observing price movements in one market may enhance the accuracy of price forecasts in the other, thereby enabling the construction of more effective investment strategies.

Based on the presented research findings, one should not hastily conclude that the WSE derivatives market fails to fulfill its price discovery function effectively. While, as mentioned in the introduction, previous studies on foreign markets indicate that in mature and liquid markets, the futures market takes over the price discovery function from the spot market, nearly all of these studies focus on stock index futures rather than single-stock futures. During the analysed period of 2020-2023, an average of 90.3% of the annual turnover in the WSE derivatives market was generated by WIG20 index futures, whereas single-stock futures accounted for only 5.2% of total derivatives trading. This suggests that the futures market's role in price discovery may be significantly greater for WIG20 constituent stocks than for stocks outside the index. Although studies conducted by Bohl et al. (2011) and Marcinkiewicz and Kompa (2013) found that the influence of the index market on the futures market is stronger than the reverse causal relationship, the WSE derivatives market has undergone significant development since their research. Consequently, the conclusions they formulated may no longer be valid.

Thus, to determine unequivocally whether, despite the significant development of the index futures and SSFs market on the Warsaw Stock Exchange, the spot market still plays a dominant role in the price discovery process, further research in this area is necessary. First, it would be valuable to expand the study to include more classes of stock futures, incorporating derivatives with a lower multiplier into the analysis. Second, a re-examination of the causal relationships between the WIG20 index and WIG20 futures, focusing on recent years, should also be conducted. Finally, interesting conclusions could be drawn from a combined analysis of the

causal relationships between stock prices of the companies listed in the WIG20 index, the prices of SSFs on these stocks, and the price of WIG20 index futures.

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# EMPLOYEE MOTIVATION IN THE CONTEXT OF AN ERROR CULTURE

Katarzyna TOBÓR-OSADNIK[1]*, Julia OSADNIK[2]

[1] Department of Safety Engineering, Silesian University of Technology, Poland;
katarzyna.tobor-osadnik@polsl.pl, ORCID: 0000-0003-4568-3485
[2] Radboud University, Nijmegen, Netherland; julia.osadnik@gmail.com
* Correspondence author

**Purpose:** The aim of this article is to present the results of a study of error culture in companies.
**Design/methodology/approach**: The methodology included a survey method and literature analysis.
**Findings:** The results of the survey analysis are presented in the form of graphs, together with comments.
**Practical implications:** The article has presented the results of research that can be applied to improving motivation systems in occupational safety management.
**Originality/value:** The article is a valuable material both for theoreticians in the field of research into the company's error culture, as well as for practitioners who prepare motivation systems in the organization.
**Keywords:** motivation, error, organizational culture.
**Category of the paper:** research paper**.**

## 1. Introduction

### 1.1. Motivation at work

'Motive' and 'need' co-develop theories of motivation. P.G. Zimbardo and R.J. Gerrig (2022) define motive as 'a state, usually of a social or psychological nature, that serves to direct an individual's behaviour towards a specific goal'. Motive for action is assumed to be correlated with the feeling of need. 'Need' can be understood as an internal state in which a person feels a lack of something, which, like 'motive', conditions his or her behaviour (Potocki, 2005).

An interesting approach to the hierarchy of needs in management terms is C. Conley's (2007) pyramid based on the idea (model) of A. Maslow (Maslow, 2023) depicted in Figure 1.




**Figure 1.** Pyramid of needs.

Source: Conley (2007).

The need to survive in a company allows for the construction of motivational tools based on coercion and reward, but the need to succeed already allows for the use of non-financial tools that are highly motivating for specific behaviour. C. Conley (2007) bases his pyramids on the observation of stakeholder behaviour in his company (Joie de Vivre Hotels). C. Conley defined three basic groups that can influence the success of a company (Conley, Friedenwald-Fishman, 2006):

- employees,
- customers,
- investors.

Employees are a key factor in the area of incentive systems for safe work. Based on the new pyramid of employee needs according to Conley, besides the typical ones like remuneration or attachment to the company, a sense of purpose is important (Figure 2). So motivation for safe work should be based on demonstrating the purpose of appropriate behaviours that are meaningful to employees.




**Figure 2.** C. Conley`s hierarchy of workers needs.

Source: Conley (2007).

Therefore, based on his own observations, C. Conley outlined that a company that is to be successful in the long term should start by properly building a motivation system.

Historically, three approaches to employee motivation can be identified:

- traditional,
- cooperative theories,
- human resource management.

The traditional approach treats work as an unpleasant activity in which the employee is not interested. He or she is only interested in remuneration. The authors of this approach did not pay attention to other factors modelling people's behaviour at work. Very specialised, work had to be supervised and controlled.

Collaborative theories focus on cooperation between employees and social relations in the workplace (Gyekye, Salminen, 2007). They pay attention to employees' social needs in terms of work motivation (Griffin, 2024; Gyekye, Haybatollahi, 2014).

According to the third approach, human resource management focuses on the involvement of employees in the problem-solving and decision-making process. For the organisation, employee qualifications and competencies are important. For the employer, the employee's high emotional intelligence and teamwork skills are important.

In defining the concept of employee motivation, one can therefore use the definition created by D.P. Schultz and S.E. Schultz, who define motivation as ‘factors related to the work environment and individual characteristics that explain why people behave the way they do at work’ (Schultz, Schultz, 2011).

A. Pocztowski distinguishes between two basic concepts of work motivation (Pocztowski, 2018):

- attributive - the internal state and force that influences people's behaviour at work (intrinsic motivation) (Weiner, 2010),
- functional - external factors that trigger people's behaviour in the organisation (extrinsic motivation).

Taking both approaches into account, it can be concluded that employee motivation is a set of internal and external factors that determine employee behaviour and actions.

The motivation system being built in the company includes, first and foremost, work efficiency and safety. One of the areas of OSH management is the impact on accident reduction. If we look at accidents ‘as a consequence of mistakes made due to lack of motivation, knowledge and experience’ (Studenski, 1996) of employees, we can see that the sphere of management, motivation, proper training, evaluation and control of OHS prevention activities must be part of the human resources management system (Flin et al., 2000).

Experience shows that the effectiveness of motivation programmes is a combination of developed procedures, educational, technical and psychological measures that stimulate the intrinsic motivation of workers to work safely (Caruth et al., 2009).

Employer pressure on workers to comply with health and safety regulations is not sufficient to ensure safety in companies. Workers rarely follow the employer's or supervisor's instructions loyally or with sufficient commitment if the intrinsic motivation is not also working. The employee must believe in doing the right thing (Cooper, Philips, 2003).

Emergent independent incentives influence people's behaviour. The right motivation tools build a safety culture (DeJoy et al., 2010; Clark, 2010). Therefore, a well-designed motivational system within health and safety management must influence the intrinsic motivation of the workforce by inducing the right behaviours (Harter et al., 2002). Importantly, this does not have to involve an increase in financial outlay. It can be limited to an appropriate selection of a set of organisational measures in line with crew expectations. It should be noted here that identifying crew expectations is the most difficult task. The simplest and at the same time most effective tool may be an anonymous staff survey. The danger is to fill in the answers untruthfully and wishfully. Based on the results of the survey, you can build a system of consequences that employees develop themselves. In this way, the motivation of employees as co-authors of existing rules can be increased.

A system of incentives to motivate workers to comply with OSH regulations uses both financial and non-financial incentives. The choice of motivational tools depends on factors in the external environment (Ford, Tetrick, 2008).

Unfortunately, various mistakes are often made when building incentive systems in the area of health and safety (Studenski, 1996):

- collective responsibility - can, in extreme cases, lead to the concealment of occupational accidents in work teams in order to avoid losing bonuses or allowances for accident-free work of all employees,
- operating under the principle of ‘yesterday's results are today's plan’ - the initial commitment of employees decreases for fear that the employer's expectations will further increase,
- prioritising production targets over job safety,
- supervisor's inappropriate approach to compliance with health and safety regulations,
- inconsistency in giving instructions to workers,
- inadequate system of inspection and enforcement of safe work rules (irregularity, ambiguity of consequences, lack of transparency of results),
- failure to hear workers' constructive voice on OSH prevention,
- lack of rapid response to risks,
- failure to link career paths to compliance with OSH regulations

use of negative motivation - punishing negative OSH behaviour without rewarding positive actions.

### 1.2. Error in occupational safety management

The concepts of error, accident and motivation are thus inextricably linked. The first checks on the quality of food, clothing and shelter were made by 'trial and error', allowing experience and knowledge to be gained in the selection of goods with which Homo sapiens slowly surrounded himself. The term 'error' can be variously defined as, for example, 'a departure from correctness'. According to the Cambridge Dictionary (2024), it is 'something done or written by accident that is incorrect, imprecise or does not produce the correct result'. In addition to mistakes made by accident, a distinction can be made between mistakes that people make on purpose. Often defending himself against the consequences of other acts.

T. Kotarbinski, in his work entitled Efficiency and Error, draws attention to errorlessness. He treats errorlessness 'as the absence of misrepresentations as well as omissions' (Kotarbinski, 1960). He goes on to point out that in practice, erroneous behaviour can be divided into nine groups:

- substitutes for action,
- automatisms of implementation,
- losing,
- forgetting to do something,
- being late in doing something,
- unsuccessful search,
- neglecting to intervene,
- impulsive, hectic reactions,
- practical errors based on logical fallacies.

The adopted 'Swiss cheese' model (Larouzee, Le Coze, 2020) (fig. 3) shows well how responding appropriately to errors can reduce their negative effects.

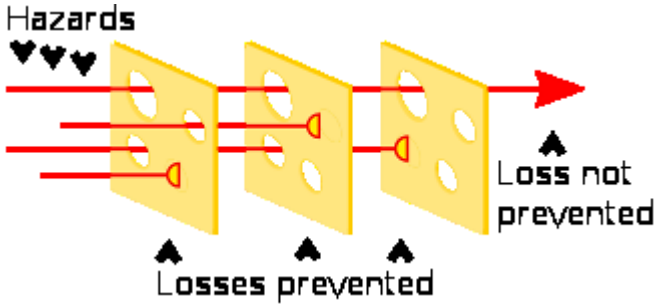



**Figure 3.** The Swiss cheese model.

Source: Shabani et al., 2024.

The model was developed by the British scientist J. Reason, a professor of psychology and renowned air crash researcher. J. Reason (1998) recognised that unsafe behaviour is primarily due to system failures. The question should always be asked: why did the system fail, not - who contributed to it?

In doing so, J. Reason proposed the following classification of errors (Olson, Raz, 2021):

- human error - despite a planned sequence of actions, the intended effect is not achieved,
- latent error - inappropriate decisions by senior management,
- active error - actions of those directly involved in the process,
- violation - error resulting from deliberate failure to follow established rules and procedures.

Using this model, a distinction can be made between intentional errors (fully conscious, deliberate and with a specific purpose) and unintentional errors (performed unintentionally, reflexively, under the influence of the moment).

Within the group of unintentional actions, two subgroups can be distinguished: mistakes and factual errors. Mistakes are errors that do not result from a lack of knowledge or experience, but from the fallibility of human memory, stress resistance or fatigue. Factual errors are the result of a misunderstanding of facts or situations and are also due to a lack of knowledge (Kuchta et al., 2017).

F. Arnstein also distinguishes latent errors (Arezes, de Carvalho, 2016). These are unidentified system flaws that only become apparent under certain circumstances. They are failures due to lack of work ergonomics, lack of training, lack of qualifications, lack of knowledge, incorrect rules adopted in the organisation, imperfect records, lack of sufficient assistance or supervision, haste, social and cultural factors. Hidden errors can be expressed by the so-called iceberg (fig. 4). They are generally not identified, with the result that they contribute to the greatest costs.

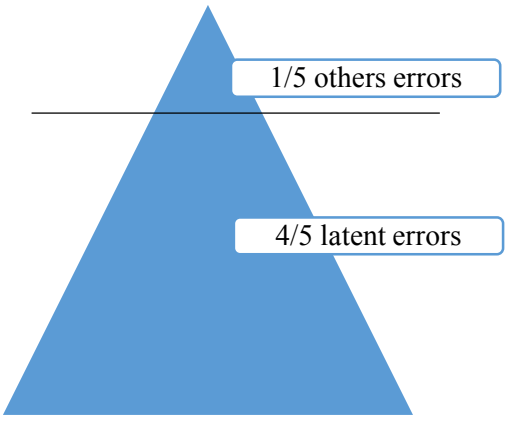



**Figure 4.** Error iceberg.

Source: Tobór-Osadnik, Bluszcz, 2023.

The approach to making mistakes in an organisation is primarily driven by the leadership style of the employees. A mistake is feedback to management that there is an area for improvement. Such a mistake should be a stimulus for development. Making a mistake itself is not a problem, but what is important is the number of mistakes and the lack of learning from them. Lack of space for error leads to strong frustration and high stress levels among the workforce, and this always results in a threat to the safety status of the company.

In engineering analysis, human error is defined as the resultant effect of technical, organisational and psychological factors on humans (Reason, 2017). Originally, special attention was paid to the technical aspect. Over time, attention has turned to the importance of the human factor (Korban, 2024). Building an organisation's specific approach to making mistakes and learning from near misses can improve the company's safety performance.

## 2. Methods and results of the surveys

The research questionnaire contained 21 questions about the culture of errors and the characteristics of the respondents, and five of these were used in this publication. In the first phase of the research, the questionnaire was sent out to 190 people employed in various companies in the Silesian Voivodeship. 30% of the questionnaires (57 respondents) were correctly completed. The metric included: gender, education, job position, size of the company divided into micro, small, medium and large. These results were treated as preliminary for further, in-depth research into error culture according to various criteria. This publication presents a summary of the results regarding respondents' opinions on the error reduction motivation tools used in enterprises.

The research hypothesis set is: *$H_1$ appropriate motivation influences the perception of the role of error in occupational safety management*.

Figures 5-9 present a summary of the results.

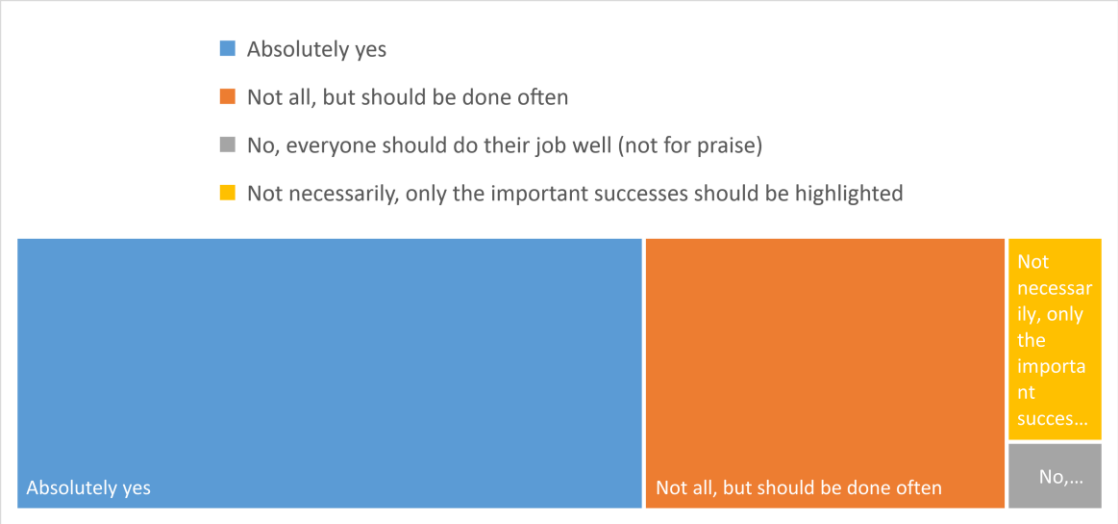



**Figure 5.** Is it necessary to notice and appreciate every success and effort you put into your work?
Source: own study.

Employees expect non-financial reinforcement. Confirmation of good behaviour and praise are important to them.

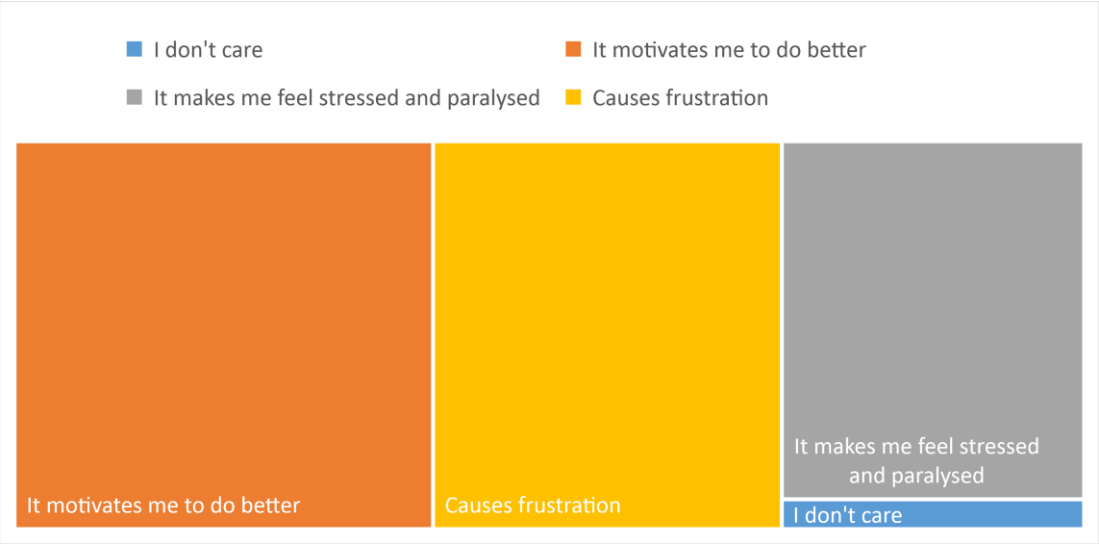



**Figure 6.** What feelings do you get from pointing out mistakes in your work?

Source: Own study.

The answers to the question What feelings do you get from pointing out mistakes in your work are interesting? Seemingly, the majority confirm that it motivates them to do a better job. However, when you combine the answers that it causes frustration and strongly frustrates, most people react badly to pointing out mistakes directly. So should it not be done? Of course not, but the right motivational methods should be chosen to ensure that the effect of such conversations produces positive results.

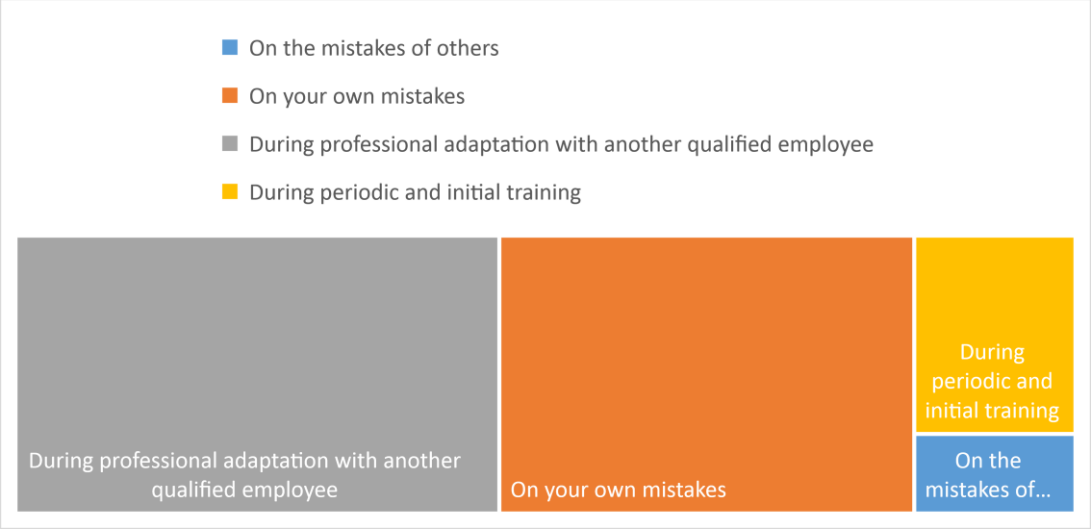



**Figure 7.** When is the best time to learn so-called safe behaviour at work?

Source: own study.

Well-conducted professional adaptation and so-called ‘learning from one's mistakes’ are highly valued. The question is whether it is always ‘learning from mistakes’ that is acceptable from the point of view of safety in the company. At the same time, by allowing mistakes to be made, are we not giving permission to make more? These doubts should form the basis for building effective motivation.

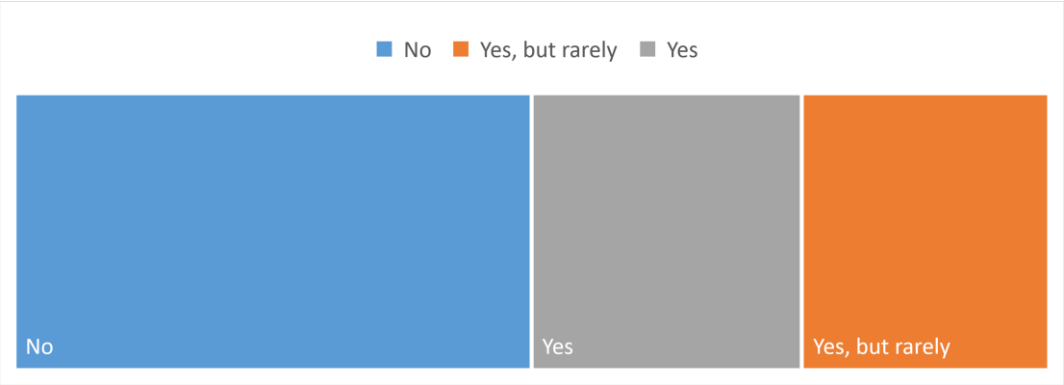



**Figure 8.** Does your workplace happen to stigmatize people into some negative category?

Source: Own study.

Examples were shown to respondents as stigmatisation: someone is incompetent, this one is dangerous to work with, this one is disliked. Respondents mostly confirm that stigmatisation situations at work do not occur or are rare. This organisational climate is conducive to the use of tools based on dialogue and interpersonal relationships. However, almost 50% of respondents condemned that such situations occur. This is a very high rate. In companies where such situations occur, the employer should react quickly. Especially as this is also the creation of a hostile working environment, which is prohibited by law. The problem arises when the author of such behaviour is a superior.

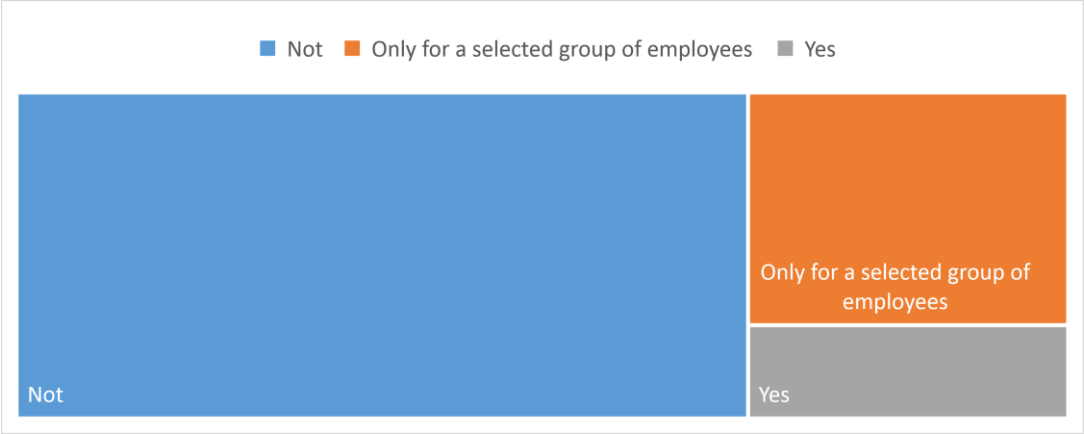



**Figure 9.** In your work, does your management use a management method based on guilt input and non-conformity with requirements?

Source: Own study.

For the most part, the answer to the question (Fig. 9) is ‘No’. However, the significant number of respondents who indicated the use of such methods in selected groups of employees is of concern. These responses confirm the results of the question shown in Figure 8.

## 3. Conclusions

Analysing the results of the survey, several conclusions can be formulated:

- pointing out mistakes at work motivates, but at the same time most respondents react badly to direct pointing out of mistakes,
- the so-called 'learning from mistakes' is highly valued by the respondents, but it is difficult to determine the limit of acceptable mistakes,
- financial motivation is lower valued than the use of non-financial tools,
- emphasising tools based on dialogue and interpersonal relations,
- as a problem they signal the creation of divisions of employees into groups that are not protected from stigmatisation.

In conclusion, respondents consider good staff adaptation or learning from their mistakes to be effective methods of eliminating errors. For the organisation, it is important to maintain continuity in the transfer of knowledge and skills from experienced colleagues. This eliminates the creation of a generation gap and a break in the continuity of learning in the organisation. At the same time, interviewees point out the emergence of negative stigmatisation of employees and driving employees into a sense of guilt. Such negative motivation always produces bad results. Employees start to avoid all activity and do not focus on working safely. One of the principles of the learning process is also the law of effect (Horn, 2007). The law of effect states that our behaviour is a consequence of our experiences. Thus, if there is a state of pleasure between the situation and the response to it, the strength of the connection increases. Therefore, positive reinforcement through praise and an appropriate selection of motivational tools is well received by the interviewees. The results of the initial research confirm that it is feasible to continue and seek more precise directions for improving employee motivation together with building an appropriate error culture in the organisation's safety culture.

## 4. Discussion

Most of the literature treats error in occupational safety management as a source of accidents. It has a pejorative character. The authors propose to look at the issue from a different angle. In particular, the reporting of near misses (Wozniak, Hoła, 2024) and the internal audit method (Tobór-Osadnik, Wyganowska, 2016; Wyganowska, Tobór-Osadnik, 2018; Przybylska, Kańduła, 2019) should be used. As is well known, an individual's behaviour and attitudes result from a continuous learning process involving a relatively constant change in behaviour arising from a set of experiences. In this situation, resulting from 'learning from mistakes'. The learning process can thus be seen as a component of the process of remembering

and continuously modifying behaviour based on a set of experiences (Tobór-Osadnik, 2016). Various learning techniques adapted to the individual's abilities and character can be used to enhance the learning effect. However, regardless of the techniques used, continuous repetition and training of acquired skills has a positive effect. It is therefore important to design employee management in such a way that it is proactive and does not repeat the same mistakes. Based on learning techniques, it is possible to influence employee behaviour by reducing the number of mistakes made.

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# THE IMPACT OF LOGISTICS CUSTOMER SERVICE IN E-COMMERCE ON ONLINE AUCTION PORTAL PURCHASES

Daniel TOKARSKI[1*], Mehmet Sait ŞAHİNALP[2], Łukasz KULIŃSKI[3]

[1] University of Lodz, Poland; daniel.tokarski@uni.lodz.pl, ORCID: 0000-0002-3475-1115;
Harran University, Turkey
[2] Harran University, Turkey; sahinalp@harran.edu.tr, ORCID: 0000-0001-8848-529X
[3] Social Academy of Sciences in Lodz, Poland; 113317@student.san.edu.pl
* Correspondence author

**Purpose:** The aim of the study is to assess the impact of customer service in logistics on auction portal users and to determine the role it plays in the overall e-commerce activity. The subject of the study is the area related to the competitiveness of enterprises.
**Methodology**: Survey research is the most popular method of social research, therefore, to obtain the data necessary to achieve the aim of the work, a research tool in the form of a survey questionnaire was used.
**Findings:** Detailed analysis confirmed that logistic customer service in e-commerce plays a key role for the proper functioning of an enterprise operating in the online space and is a factor determining consumer choices.
**Originality/value:** The publication covers the subject of impact of logistics customer service on e-commerce. Combining interdisciplinary research in the areas of management and quality science with economics and finance.
**Keywords:** e-commerce, logistic customer service.
**Category of the paper:** Research paper.

## 1. Introduction

The global expansion of enterprises has significantly increased logistics demands, particularly in the context of e-commerce. Limited knowledge of new markets, insufficient infrastructure, and unfamiliarity with local regulations have led many businesses to rely on third-party logistics providers. In light of market volatility and fluctuating consumer demand, companies are increasingly avoiding large capital investments. Instead, they prefer flexible and scalable solutions that convert fixed logistics costs into variable ones by paying for services based on actual use (Sevim et al., 2008; Tokarski et al., 2024a).

Amazon's broad operational scope and strong brand recognition have enabled the company to generate substantial revenues that support continued investment. Despite Amazon's many strengths, analyzing its competitive position requires consideration of other companies offering similar services and their operational characteristics. The growing importance of online commerce further reinforces the need to implement modern technological and logistical solutions to maintain competitiveness and growth. Failure to adapt may lead to declining financial performance and reduced profitability (Campisi et al., 2023; Tokarski, Fajczak-Kowalska, 2024).

Among Amazon's global competitors, two platforms stand out: eBay and AliExpress. eBay, launched in 1995, has grown into a major player in the e-commerce market. Its core business model, which facilitates transactions between buyers and sellers without offering its own products, contrasts with Amazon's integrated sales structure (Kağnıcıoğlu, 2019; Żak, 2019). Although eBay offers a broad range of goods and transactional formats, such as auctions and fixed prices, and remains popular in certain regions, it does not surpass Amazon in overall market share or service diversification (Öztürk, 2019; Łepkowska, 2023).

AliExpress, launched in 2010, initially targeted the Chinese market but quickly expanded globally. Like eBay, it acts as an intermediary platform without selling its own goods, allowing international consumers to purchase products from various external sellers, especially from Asia (Wawryszuk, 2021). The platform has expanded its language options and geographic reach, contributing to its global recognition. AliExpress is particularly known for competitive pricing and accessibility, aligning it closely with Amazon's operational approach (Stefanowicz, 2025).

In the Polish market, Empik and Allegro serve as local equivalents of Amazon. Both are recognized as leading e-commerce platforms in terms of market share and consumer popularity (Kokoszkiewicz, 2021). Originally a brick-and-mortar retail chain, Empik has transformed into a marketplace model, offering products from external sellers through its digital platform. This strategic shift aligns Empik more closely with Amazon's business model.

Allegro, another key Polish player, operates as a marketplace as well, but does not sell products under its own brand. Its business model is centered on providing digital infrastructure to third-party sellers and generating revenue through commissions and marketing services. Allegro's strong brand presence and ongoing investment in operational efficiency have reinforced its market position. It is often viewed as Amazon's local counterpart, albeit with a narrower scope of services (Głogowski, 2023; Lucas et al., 2023).

In analyzing the competitive landscape in e-commerce, it is essential to consider both global corporations and regional entities. Understanding their market positions, operational models, and growth potential is key to shaping effective strategies and sustainable business plans (Tokarski et al., 2024b).

The originality of this study lies in a comparative analysis of global and local e-commerce leaders with particular focus on their logistical frameworks and consumer service models, emphasizing the role of logistics in maintaining competitiveness. The aim is to identify key logistics-driven factors that influence market positioning and customer satisfaction in both global and regional contexts.

## 2. Motivation and purpose

Recent years have brought significant changes to the global e-commerce landscape, impacting consumer expectations, shopping behaviors, and the growing number of companies operating online. These developments have pushed businesses to revise traditional strategies and adapt to new market realities. Standard tools such as product range and marketing are no longer sufficient to secure a competitive advantage. Instead, logistics customer service has emerged as a key factor in shaping the attractiveness of e-commerce offers (Iwańska-Knop, 2015; Canöz, Gündüz, 2022).

In Poland, the digital transformation driven by internet development has enabled the rapid growth of e-commerce. Technological advancements, globalization, and digitization continue to influence how businesses operate and how consumers make purchasing decisions. Logistics plays a central role in ensuring transaction efficiency, and proper integration of the supply chain is essential for success (Kaźmierczak, Szymczyk, 2021). According to Szymański (2016), the appeal of e-commerce stems from low entry costs, widespread information access, and user convenience.

The roots of global e-commerce trace back to the 1960s with electronic data exchange, but mass adoption began at the turn of the 21st century. In Poland, widespread internet access started in 2001, marking a breakthrough for e-commerce development. Early Polish pioneers included platforms such as Allegro and Empik (Kaźmierczak, Szymczyk, 2021).

Statistical data highlights the scale of this growth. In 2013, 75% of Polish households had internet access, increasing to 92% by 2020 (E-commerce…, 2020). The COVID-19 pandemic played a major role in accelerating this shift, forcing many consumers to adopt online tools (Fajczak-Kowalska, 2023; Tokarski, Wolak, 2023).

E-commerce market value in Poland has grown consistently across both B2C and B2B segments. In 2013, the market was worth PLN 221 billion (PLN 197 billion B2B; PLN 24 billion B2C). By 2019, it had reached PLN 413 billion, with further sharp growth during the pandemic. In 2021, total market value hit PLN 771 billion (PLN 637 billion B2B; PLN 134 billion B2C). Forecasts suggest that B2C e-commerce alone may reach PLN 187 billion by 2027 (PwC Polska, 2022).

Logistics is a cornerstone of retail e-commerce. A single error in logistics can undermine customer trust. Effective management of both forward and reverse logistics is essential. Key performance factors include reliability, cost-efficiency, delivery speed, service flexibility, and smooth information flow (Deliçay, 2021).

## 3. Methods

This survey, conducted as part of the main research objective, which was to determine the importance of logistics customer service in e-commerce, consisted of 6 metric questions, which concerned, among others, age, gender and other data enabling the identification of respondents, and 20 thematic single-choice questions, which allowed for drawing conclusions in the scope of the verified research problem. Some of the survey questions concerned subjective experiences and opinions within the broadly understood e-commerce, and the considerations carried out also included issues related to areas related to logistics. Analysis in the scope of hypotheses, according to which the broadly understood logistics customer service in relation to e-commerce has a significant impact on the proper functioning of organizations, and also determines the level of their competitiveness on the market, was possible thanks to the research questions posed. Their content referred directly to determining the elements that, according to the respondents, are considered to be particularly important in the scope of logistics customer service in the virtual space. The variables analyzed are primarily price, time and quality of individual services, but attention was also paid to the importance of establishing relationships between the parties to the transaction. Research questions concerned, among others, the frequency of purchases on online platforms, the importance of a properly functioning logistics system and providing potential customers with clear and credible offers of a given company as a basis for creating a positive image of the company.

The study was conducted electronically using a survey questionnaire that was made available to a wide audience. The aforementioned form was available to all interested parties who expressed their willingness to present their opinions on the subject under study. The period in which the questionnaire was available for collecting responses covered the third and fourth quarters of 2023. Therefore, the subject of this study were potential customers of online stores aged 18 and over, regardless of gender, property status and place of residence.

In addition to the main research objective, which is to determine the importance of logistics customer service in e-commerce, the collected responses within the analyzed aspects allow for the search for new solutions and improvements that can be the basis for improving the processes currently functioning in companies operating in the Internet space. The idea of restructuring and improvements in the area of transport and logistics should be based primarily on data

indicated by respondents as necessary and key. Therefore, it is reasonable to consider factors requiring improvement taking into account the specificity of a given organization.

# 4. Results

## 4.1. Characteristics of respondents and online shopping behavior

The study included 100 respondents. Their characteristics are presented in Table 1.

**Table 1.**
*Characteristics of the study population*

| Criterion | | Surveyed population | Percentage of respondents |
|---|---|---|---|
| **Gender of the respondent** | man | 39 | 39% |
| | woman | 61 | 61% |
| **Age of the respondent** | 18-24 years old | 52 | 52% |
| | 25-34 years old | 27 | 27% |
| | 35-55 years old | 13 | 13% |
| | over 55 years old | 8 | 8% |
| **Professional status** | white-collar worker | 41 | 41% |
| | blue-collar worker | 19 | 19% |
| | student | 25 | 25% |
| | entrepreneur/business owner | 6 | 6% |
| | unemployed | 9 | 9% |
| **Education** | higher | 62 | 62% |
| | medium | 20 | 20% |
| | basic vocational | 15 | 15% |
| | basic | 3 | 3% |
| **Gross monthly income level on 1 person in the farm home** | above 4000 PLN | 30 | 30% |
| | 3001-4000 PLN | 42 | 42% |
| | 2001-3000 PLN | 18 | 18% |
| | 1000-2000 PLN | 7 | 7% |
| | below 1000 PLN | 3 | 3% |
| **Domicile** | city with more than 100 thousand inhabitants | 57 | 57% |
| | city with 50 to 100 thousand inhabitants | 17 | 17% |
| | city with up to 50 thousand inhabitants | 11 | 11% |
| | village | 15 | 15% |

Source: own study based on empirical research.

The majority of respondents (84%) shop on online auction platforms several times a month. A smaller group shops several times a week (6%) or several times a year (7%). Only 3% do so less than once a year. Regarding the frequency of product returns, 54% of respondents sometimes return online purchases, 29% do so often, and 14% rarely. Only 3% never return products. A total of 83% have canceled an online purchase due to high shipping costs. Most respondents (76%) consider information on product availability important when making purchasing decisions.

When choosing online offers, the most important factors were product price (28%) and quality (19%), followed by customer reviews (11%), delivery speed (11%), and transaction security (8%). Respondents declared the following delivery method preferences: courier delivery (46%), parcel lockers (37%), direct store delivery (8%), postal services (4%), and personal collection (5%). When asked to compare fast delivery and low cost, 67% prioritized low cost, while 28% valued speed. The remaining 5% indicated no clear preference.

### 4.2. Logistic service factors in e-commerce

Customer service in logistics was rated as having a significant impact on shopping satisfaction by 66% of respondents. For 27%, it had some impact, while 7% assessed it as having little or no influence. Delayed deliveries were reported to impact future purchase decisions significantly by 38% of respondents, slightly by 28%, and not at all by 34%.

Key logistics factors influencing purchasing decisions included: free delivery (27%), fast delivery (24%), guaranteed delivery time (12%), flexible delivery options (11%), shipment tracking (9%), easy returns (7%), effective customer service (6%), secure packaging (3%), and regular order status updates (1%). Regarding the importance of timely delivery, 66% of respondents considered it essential, 22% moderately important, and 11% rarely important. Only one person did not consider it important at all.

For 67%, delivery options are of some importance, though not decisive. For 30%, flexible delivery is a priority, and for 3%, it is irrelevant. When comparing online and traditional shopping, 49% of respondents said logistics customer service is more important online, 28% saw no difference, and 16% did not consider it more important online.

Proper delivery logistics was seen as positively influencing a store's image by 50% of respondents. However, 28% did not consider it influential, 6% thought it had no impact, and 16% had no opinion. Most respondents (69%) stated that effective customer service encourages repeated purchases. For 19%, it had no effect, and 12% had no opinion.

Damaged goods during delivery were never experienced by 64% of respondents, while 24% encountered this at least once. Incomplete or incorrect orders were never experienced by 63%; 17% experienced either issue, and 3% experienced both. The most commonly reported negative logistics experiences were poor customer service and communication (27%), delays (25%), refund difficulties (13%), and return/exchange issues (10%). Lastly, 79% of respondents believe that innovative logistics solutions (e.g., drones, automation, smart tracking) have high development potential. Only 13% disagreed, while 8% had no opinion.

The conducted research holds significant value for the broader field of management sciences, particularly in the areas of strategic management, logistics, and digital business transformation. By offering a comparative analysis of global and local e-commerce platforms through the lens of logistics operations and customer service models, the study contributes to a deeper understanding of how logistical efficiency and innovation affect competitive advantage and consumer satisfaction. The insights derived from this research can inform

managerial decision-making processes, especially in designing flexible, customer-oriented supply chains and platform-based business models. Moreover, the findings can be utilized in policy development, benchmarking practices, and academic curriculum design, fostering a more holistic and adaptive approach to managing e-commerce enterprises in a rapidly evolving digital economy. This study also opens avenues for future research focused on regional consumer behavior, technological adaptation, and the sustainability of logistics systems within different market environments.

## 5. Conclusions

Using the data obtained in this empirical study, it should be emphasized above all that online shopping is very popular nowadays. The consequence of this is the need to ensure the proper and satisfactory level of all stages of the transaction from placing an order to its delivery. Nevertheless, special attention should be paid to the broadly understood logistics service of the customer, including the elements that are key to satisfaction and the final reception of a given company. The direct effect will be an expansion of the group of regular buyers who, thanks to positive experiences, will be willing to make online purchases again.

The presented research shows that currently the key factors influencing the attractiveness of a given offer are the price and quality of products, as well as the timeliness of delivery. Hence, companies should focus their activities on guaranteeing these factors in order to encourage potential customers to use the offered services. Referring to the issue of delivery, it is worth emphasizing that the attractive price of this service is still a key determinant of the buyer's choice, thus putting the speed of delivery of the ordered goods in the next place in terms of consumer priorities. Another aspect directly related to the discussed element of logistics customer service is the importance of guaranteeing the possibility of choosing from different delivery methods due to the diverse preferences of customers in this area. Equally important, in the eyes of consumers, basic information constituting the final purchase decision is the approximate date of order completion and its delivery, as well as the availability of the considered product. Hence, it should be concluded that these elements should always be included in e-shop offers. Customers also appreciate the possibility of contacting the company in order to clarify any doubts, and any difficulties in establishing contact or a complete lack of response negatively affect the company's credibility.

Referring to the negative aspects resulting from online sales, it seems reasonable to draw attention to the fact that e-commerce processes require improvement in order to increase the efficiency of operations, because according to respondents, there are irregularities, especially related to delivery, and to a lesser extent also at the level of order fulfillment. Hence, processes carried out in the area of transport and logistics should be improved in order to increase the efficiency of the supply chain, thus reducing the risk of possible irregularities or delays.

Logistic customer service in e-commerce therefore plays a key role in the proper functioning of every company operating in the online space and is a determinant of consumer choices. In addition, it is a factor that determines the competitiveness of companies in the context of their industry and the entire e-commerce market. Moreover, comparing the essence in the area of e-commerce and traditional sales, one can notice the diametric advantage of the importance of thematic customer service in the case of e-commerce, thus forcing companies to pay special attention to ensuring its highest quality as the basis for taking all competitive actions.

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# Appendix

**SURVEY QUESTIONNAIRE**

1. **What is your gender?**
   a) Male
   b) Female

2. **What is your age group?**
   a) 18–24
   b) 25–34
   c) 35–54
   d) 55 and above

3. **What is your employment status?**
   a) Manual worker
   b) White-collar worker
   c) Entrepreneur/business owner
   d) Unemployed
   e) Pupil/student

4. **What is your level of education?**
   a) Primary
   b) Vocational
   c) Secondary
   d) Higher education

5. **What is the estimated monthly net income per person in your household?**
   a) Below 1000 PLN
   b) 1000–2000 PLN
   c) 2001–3000 PLN
   d) 3001–4000 PLN
   e) Above 4000 PLN

6. **What is your place of residence?**
   a) Village
   b) Town with up to 50,000 inhabitants
   c) Town with 50,000–100,000 inhabitants
   d) City with over 100,000 inhabitants

7. **How often do you shop online?**
   a) Several times a week
   b) Several times a month
   c) Several times a year
   d) Less than once a year

8. **Do you believe that customer logistics service (e.g. delivery timeliness and quality, tracking options, simple return process) affects your satisfaction with online shopping?**
   a) Yes, logistics service greatly affects my online shopping satisfaction
   b) Rather yes, logistics service has some impact on my satisfaction
   c) Rather not, logistics service has little impact on my satisfaction
   d) No, logistics service does not affect my satisfaction

9. **Do you ever receive deliveries late? If so, does it influence your future online shopping decisions?**
   a) Yes, I sometimes receive deliveries late and it has a significant impact on my future decisions
   b) Yes, I sometimes receive deliveries late, but it has little impact on my future decisions
   c) No, I usually receive deliveries on time and it does not influence my decisions
   d) No, I never receive deliveries late

10. **Which logistics factors matter most to you when shopping online?**
    a) Fast delivery
    b) Accurate shipment tracking
    c) Delivery options (e.g., home delivery, pick-up)
    d) Safe and sturdy packaging
    e) Simple and flexible return process
    f) Effective customer service
    g) Regular updates about order status
    h) Delivery time guarantee
    i) Free delivery
    j) Other (please specify)

11. **Which delivery method do you prefer the most?**
    a) Personal pick-up at a collection point
    b) Parcel locker delivery
    c) Postal services
    d) Courier delivery to the specified address
    e) Delivery arranged directly by the store

12. **Have you ever abandoned an online purchase due to poor delivery experience?**
    a) Yes, I have abandoned a purchase due to poor delivery experience
    b) No, I have never abandoned a purchase due to delivery issues

13. **Does effective customer service encourage you to make further purchases from the same seller?**
    a) Yes, good customer service makes me more likely to shop again
    b) No, it doesn't influence my decision
    c) I have no opinion on this

14. **Do you often return products bought online?**
    a) Yes, I often return products
    b) Sometimes I return products
    c) I rarely return products
    d) I never return products

15. **What factors influence your decision to shop at a particular online store?**
    a) Product price
    b) Product quality
    c) Product availability
    d) Customer reviews and ratings
    e) Customer service quality
    f) Delivery speed
    g) Secure payment options
    h) Promotions and discounts
    i) Customer-friendly policies

16. **Do you pay attention to delivery time information provided by the store?**
    a) Yes, I pay close attention
    b) Sometimes I check it
    c) I rarely check it
    d) I do not pay attention to it

17. **Do you prefer online stores that offer various delivery options (e.g., express delivery, personal pick-up)?**
    a) Yes, I only choose stores that offer flexible delivery options – it is a priority for me.
    b) Delivery options matter, but they are not the most important factor – I also consider price, reviews, product quality, etc.
    c) I do not pay attention to delivery options – I focus on other factors like product range, price, promotions, reviews

18. **Do you think customer logistics service is more important in online shopping than in traditional stores?**
    a) Yes, I believe it's more important online
    b) No, I don't think it's more important
    c) I believe it's equally important in both cases
    d) I have no opinion

19. **Do you think well-organized delivery logistics influences the image of an online store?**
    a) Yes, it positively influences the store's image
    b) I have no opinion
    c) I don't think it affects the store's image
    d) I don't pay attention to logistics and don't think it influences the store's image

20. **Are product availability updates important to you when making online shopping decisions?**
    a) Yes, it is important and influences my decisions
    b) Sometimes I pay attention, but it doesn't have a big impact
    c) I don't pay attention and make decisions regardless.
    d) I'm not sure if it matters

21. **Is fast delivery more important to you than lower delivery costs?**
    a) Yes, speed is more important
    b) I have no preference
    c) I prefer lower delivery costs
    d) I don't care about speed or costs

22. **Have you ever received a damaged package during transport?**
    a) Yes, I have received a damaged package
    b) No, I have never received a damaged package
    c) I don't remember
    d) I don't use e-commerce, so it doesn't apply to me

23. **Have you ever received an incomplete package or one containing incorrect products?**
    a) Yes, I have received both incomplete and incorrect packages
    b) I have never received an incomplete or incorrect package.
    c) I once received an incomplete package, but never incorrect products
    d) I once received incorrect products, but never an incomplete package

24. **What logistics-related issues do you find most frustrating when shopping online?**
    a) Delivery delays
    b) Damaged or poorly packaged items
    c) No real-time tracking
    d) Difficult return/exchange process
    e) Unclear or outdated order status info
    f) High or hidden delivery fees
    g) Delivery not available in my region
    h) Poor customer service/communication
    i) Incomplete or incorrect orders
    j) Difficulty in getting refunds

25. **Have you ever abandoned an online purchase due to high delivery costs?**
    a) Yes, I have abandoned a purchase due to high delivery costs
    b) No, I have never done that

26. **Do you think innovative logistics solutions (e.g. drone delivery, warehouse automation, smart tracking systems) will become popular in the future?**
    a) Yes, I believe they have great potential and could become mainstream
    b) No, I don't believe they will become popular
    c) I have no opinion

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# SKILLS GAPS IN EDUCATION SECTOR – EUROPEAN PERSPECTIVE

Weronika TOSZEWSKA-CZERNIEJ

Koszalin University of Technology; wtoszewska@gmail.com, ORCID: 0000-0001-7139-3962

**Purpose:** Technological developments, changes in the labour market, low level of adaptation of the education process to market needs make it important to identify and analyse the skill mismatch phenomenon in detail. This article aims to present the significance of the skill mismatch phenomenon and to determine the levels of skill gaps in the education sector of EU countries.
**Methodology:** The presented empirical part shows the commonness and scale of the gap phenomenon in the categories of numeracy, job specific, social and digital skills in education sector. The analysis is based on research results conducted by the European Centre for the Development of Vocational Training (Cedefop) published in the report in the "Second European Skills and Jobs Survey" from 2023.
**Findings:** The presented research results indicate the diversity, complexity and inconsistency of skill levels and their gaps with particular emphasis on education sector employees. The presented data showed the scale of the gap phenomenon in the entire European Union and Poland, based on presentations of averages.
**Value:** An attempt is made to demonstrate the significance of the education process for the mismatch phenomenon and skill gaps and the consequences of skill gaps by impact scale as well as the role played by broadly understood education in each of the scales. Skills gaps in the education sector can create a multiplier effect, so even the smallest increases in match make a big difference.
**Keywords:** skills mismatch, skills gaps.
**Category of the paper:** Research paper**.**

## 1. Introduction

The education process plays a special role in the process of building and developing competences, primarily because implementing and developing knowledge, shapes human potential, which has the ability to generate added value. The abilities gained through education and work experience are viewed as crucial elements in establishing a competitive edge (Barney, Clark, 2007).

The human capital theory is based on the assumption that the level of human potential is proportionally valued by the level of remuneration that an employee receives in the process of engaging their own human capital (Becker, 1964; Mincer, 1974). A key parameter in this area is matching, because skills should be used to the extent consistent with the needs of the organization (Scottish Government, 2008; Skills Australia, 2010). The lack of consistency results in a mismatch of human capital. The mismatch causes insufficient use of human capital (HC) in enterprises resulting from a mismatch between employee competences and company requirements. In the literature, this is referred to as the skills mismatch (SMM) approach (European Commission, 2012).

Studies on estimating HCU and explaining the significance of its growth are mainly based on one of three approaches: the time-related approach (Allen, Velden, 2002, 2007, 2013) and the category of underemployment, skill mismatch and existing measurement categories, and the procyclicality of labor productivity, i.e. the category of labor accumulation (Vella, 2018; Radlińska 2023). Each of them is based on a different way of measuring the underutilization of HC and indicates its different aspects.

Important from the point of view of the presented issues are the statements, defining that the efficiency, productivity and effectiveness of the organization are determined by the accumulation of skills (Dess, Jason, 2001; Hecklau et al., 2016; Hirsch, 2005). The key process for skills accumulation that will ensure a high level of coherence with the requirements of enterprises is education. It is assumed that the general conditions characterizing the education system, i.e. infrastructure, organization of processes, legal regulations and the potential of teachers determine the system's ability to build human capital through the education process.

The first stage of the process in this area is the macroeconomic verification of the levels of adjustment of the education sector in general for individual EU countries, and then the verification on a microeconomic scale taking into account the categorization into levels of education and fields of science. This approach will allow for holistic views with an appropriate level of detail that will show the levels and differentiation of areas of skill mismatches in the education process. Verifying the levels of mismatches in education is important for creating development processes, implementing economic changes, shaping competitiveness, improving education processes, and building balance on the labor market. Countries can accelerate their economic growth, increase equity, and reduce poverty by building an efficient education system (Bakker et al., 2020). Furthermore, the education system plays a key role in the economic growth of a country (Mayr, 2010). Cedefop estimates that the EU workforce is about one fifth below what is needed for workers to perform their jobs at the highest level of productivity (Cedefop, 2018). The forecast found that, from now up to 2035, 57 out of every 100 job openings will be for people with high-level qualifications, 41 for people with medium-level and only two for people with low-level qualifications (Cedefop, 2023).

Despite the growing number of studies on skills mismatch in Europe, the vast majority of analyses focus on the industrial, IT and service sectors, omitting the education sector as a subject of detailed analysis (de Grip, 2008; Panos, 2022). Meanwhile, socio-technological changes accelerated by the COVID-19 pandemic have highlighted significant competence gaps also among teachers and other staff of educational institutions, especially in the area of digital competences (ILO, 2014; CEDEFOP, 2018).

Current studies indicate that educators often lack competences in the use of digital tools, distance learning methodologies, as well as flexible response to changing needs of students and the labor market (Böheim, 2011; Cultrera, 2022). At the same time, teacher education systems rarely take into account dynamically changing competency requirements, which deepens the structural mismatch between professional requirements and real skill resources (Oosterbeek, 2016). There is also a noticeable gap in the literature regarding the integration of knowledge on the competency mismatch in vocational education and training systems (VET) and in the area of lifelong learning. CEDEFOP (2023) and EIB (2019) studies indicate that both initial and continuing education lack mechanisms for systematically updating competency requirements in response to digital transformation and changes in the labor market. Additionally, this problem remains under-researched from a qualitative perspective – there is a lack of analyses based on the experiences of teachers, school principals, or representatives of training institutions that could provide knowledge about the actual barriers and adaptation practices in different educational contexts.

Therefore, this study aims to provide an in-depth analysis of the competency gap phenomenon in the education sector in Europe, with particular emphasis on the digital, political and organizational dimensions. Taking up this topic is justified both for cognitive and practical reasons – in the context of planning educational reforms, professional development of teachers and the development of sustainable personnel strategies in educational institutions.

The main objective of the article is to present the significance of the skill mismatch phenomenon and to determine the levels of skill gaps in the education sector of EU countries. The article is an attempt to answer the question about the size and diversity of mismatch of selected skill groups in the distinguished education sector.

## 2. Theoretical background

The term skills is most often considered through the prism of the characteristics that an employee has and the abilities required to perform specific professional tasks (Cedefop, 2021). The concept of skills is considered in the context of the ability to complete work sub-processes as well as a factor determining the value in the implementation of organizational processes. The direct connection of the issue of skills with the theory of human capital means

that skills are also distinguished by high complexity, heterogeneity and, through their multidimensionality, create the specificity of the possessor. This specificity means that no research process can define a complete set of skills for a job, process or employee. However, due to the importance of the issue, it is widely undertaken. The processes of measuring skills usually include the identification of components for specific manual, verbal or mental areas. Then it is possible to measure them using a performance test that verifies quantitative and qualitative parameters in a unit of time.

Skills mismatch research defines a skill as any ability that meets certain practical requirements of the work process (Handel, Valerio, Sanchez Puerta, 2016; Kentaro, 2020). Skills analysis requires direct linkage of skills with the process they concern. (Maltseva, 2019). But the multidimensionality of the phenomenon and the specificity of human capital mean that measuring the mismatch between skills and themselves will only slightly ensure comparability and universal usability of the tools used. For this reason, it is common to categorize skills into groups that take into account general skill components independent of the work process. These should be skill groups that will constitute a basis guaranteed by the functioning education system. Therefore, the skill areas specific to the education process included in the table 1 should be thoroughly examined and interpreted.

In order to examine the selected issue concerning the levels of gaps in the field of education, the classification of specific competences used in education based on International Standard Classification of Occupations ISCO supplemented with digital competences presented in Table 1 was used. The reason for the transformation is the growing technological pressure, which has caused obsolescence and loss of skills, which may result in mass job losses in some sectors (Schwab, 2016, 2017).

Of the presented in table 1 skills groups, the cognitive skills are distinguished by its individual character. This causes a great challenge in terms of measurement, especially due to:

- the complexity of the components that build the group (Kulikowski, Yoav, 2024),
- a high level of variability between individual human beings (Piacentini, 2024),
- the lack of static skills in this category, they can change through education, experience and practice (Laajaj, 2017),
- they are characterized to a large extent by a significant dependence on the context (Foster, 2024).

Due to the presented features that create limitations in the scope of measurement, the verification of gaps for this group of skills will not be presented in the article.

**Table 1.**
*Skills classification for the education sector*

| Skills type | Definition | Selected skills- examples |
|---|---|---|
| **Cognitive skills** | Cognitive skills are the core skills that allow to acquire knowledge and manipulate information. Involve abilities, which are developed through education and life experiences. The measurement depends on the combination of an individual's actual competence and the motivation (Hanushek, Woessmann, 2008). | • sustained, divided and selective attention,<br>• long-term and working memory,<br>• logic and reasoning,<br>• auditory and visual processing. |
| **Foundations skills** | Foundation skills are the skills that people need to perform work, education, or social activities. They are necessary for transmitting and receiving information, and provide a foundation for supporting action and learning. They are transferable because, rather than being specific to a job, they can be applied at some level to a wide range of jobs (ACT, 2013). | • reading skills,<br>• writing skills,<br>• oral communication skills,<br>• numeracy skills,<br>• learning skills,<br>• problem solving skills,<br>• initiative and enterprise skills,<br>• teamwork skills. |
| **Job specific skills** | Job-specific skills are any proficiencies, knowledge or training that make an employee good at a certain job. They are directly related to the tasks that need to be done and are intended to capture skills reflecting the acquired knowledge specific areas (Kirby, Riley, 2006). | • designing and preparing courses of study,<br>• preparing lectures, seminars and laboratory,<br>• supervising work,<br>• administrating, evaluating and marking examination papers and tests,<br>• preparing scholarly books, papers or articles,<br>• participating in faculty meetings, seminars and conferences, |
| **Socio-emotional** | Social-emotional skills are examples of non-intellectual abilities that develop throughout life, leading to personality evolution (Jan, Srivastava, 1999), non-cognitive skills make it possible to describe the personal attributes of an individual (Heckman, Kautz, 2014). | • (open-mindedness) curiosity, flexibility, self-reflection, creativity,<br>• (task performance) self-control, persistence,<br>• (emotional regulation) stress resistance, resilience, emotional control,<br>• (engaging with others) sociability, tolerance, assertiveness,<br>• (collaboration). empathy, trust, cooperation. |
| **Digital skills** | Abilities to use digital devices, communication applications, and networks to access and manage information (Unesco, 2020). | • use of applications and programs,<br>• job specific computer skills required,<br>• use of electronic equipment for teaching, research and administration works,<br>• handling information,<br>• being safe and compliant online. |

Source: own elaboration based on: Estimating the Determinants and Extent of Morocco's Education and Skill Mismatch Through the STEP Survey Zineb Draissi1 and Yu Rong1, International Standard Classification of Occupations ISCO Vol 1, ILO, Genewa 2012.

Research on skills mismatch management (SMM) began in the 1970s and 1980s, coinciding with a significant rise in the educational levels of workers in high-income countries (Maltseva, 2019). Richard B. Freeman's work (Freeman, 1976) introduced the concept of over-education, which laid the groundwork for extensive studies on the discrepancy between workforce skills and labor market demands. Further research examined the impact of skills mismatch, particularly over-education, on the labor market (Allen, van der Velden, 2001; Bauer, 2002) and human capital development (Mendes de Oliveria, Santos, Kiker, 2000). Findings indicated

that skills mismatch leads to substantial costs at both macroeconomic and microeconomic levels, adversely affecting overall labor productivity, technological progress, wages, and job satisfaction (McGowan, Andrews, 2015; McGuinness, Pouliakas, Redmond, 2018).

An approach to the SMM verification process preceded by a thorough skills analysis allows for a broader perspective and better understanding of the causes of mismatches, principles and practices that determine mismatches and adjustment of preventive measures. Verification of both the level and areas of skill mismatches is crucial for the data contained in reports and studies on the coherence of the labor market, its needs, the education process, the potential or human capital of society. The conducted research on skills in general allowed for the following conclusions to be obtained, importantly, these studies never concerned only the education process. The research conducted so far in the field of SMM indicates the following conclusions:

- employees who know the scope of their skills are more optimistic about the future,
- employees who know which places and scopes of work will change have a better chance of survival (Consultancy, 2021),
- transformation of the work environment in connection with remote or hybrid work influences changes in the implementation of HR processes, control of work results, changes in organizational structures (van Vulpen, 2021; Dettmers et al., 2013),
- nearly 60% of employees want to work remotely full-time after the pandemic (Totah, 2021; Apollotechnical, 2020),
- vertical mismatch retains part of the specific human capital acquired through formal education (Salas-Velasco, 2021); there is a greater likelihood of horizontal mismatch among graduates of fields that provide more general skills (Robst, 2007).

The dominant theoretical approaches to studying skills mismatch are the theory of human capital and labor economics, work psychology, development of potential and resource-based management. In addition, the signalling theory (Spence, 1973). Most areas of human resources research include the analysis of the work system based on performance (Owl Labs, 2021), effectiveness and potential of employees (UoM, 2022), but they do not include the verification of skill mismatch, usually specifying the values obtained in selected competence areas for individual employees or groups of employees.

Skills mismatches are seen as a significant source of inefficiency in the labor market, which can lead to capacity constraints and underemployment (e.g. McGowan, Andrews, 2015; Cedefop, 2018, OECD, 2017; Salas-Velasco, 2021). A detailed classification of skills mismatch types is included in figure 1.




**Figure 1.** Skills mismatch classification.

Source: own elaboration based on Maltseva (2019).

The analysis conducted by McGuinness et al. in 2017 revealed that there are clear gaps in the research on the topic covered by the article. Individual approaches to measurement result in a large number of types of SMM included in Diagram 2. The number of publications on skill mismatch varies significantly, the most studied area is overeducation, for which 86 scientific papers were recorded by 2018, followed by the area of undereducation with 24 publications, and the least works devoted to the area of skill obsolescence - only 5 (McGuinness et al., 2017).

Verification of the phenomenon in the macro sphere indicates several basic causes of skill mismatch: limited information about the labor market, differences between people leading to mismatch for their jobs, and underinvestment in training and education, suboptimal education system. The verification of the previously conducted studies of mismatches in the micro-area led to conclusions and results in the following selected aspects of this approach (Mavromaras, McGuinness, O'leary, Fok, 2009, 2010; Sloane, 2014) estimated the level of skill mismatch based on the results of the Household, Income and Labor Dynamics in Australia (HILDA) and the British Workplace Employment Relations Survey (WERS). In the case of Australia, over-skilling reached an average of 14%, while in the United Kingdom it was as high as 21%. The results in both countries indicate the problem of over-skilling and significant job mismatches and the negative impact of over-skilling on wages. Research conducted by Al-Yahya based on Heller's 1988 studies showed that the underutilization rates for Oman and Saudi Arabia were 40% and 46%, while Heller's European average was 20% in 1988 (Al-Yahya, 2017). Barone and Ortiz (2011) studied overeducation among university graduates

in eight European countries, overeducation was not observed in most countries. The presented research results are characterized by selectivity. There is no full verification of the types of skill mismatches, studies and factors determining the values of the measures used.

Each human being has certain limitations in the scope of shaping and developing their own potential. This is determined by both internal factors such as perception, intelligence, information processing ability and external conditions, living conditions, the influence of the microenvironment, the level of consumption and investment, especially in the initial period of life. Therefore, the ability to acquire and develop one's own human capital, including skills, is diversified and strongly dependent on education, the scheme of the process is shown in Figure 2.

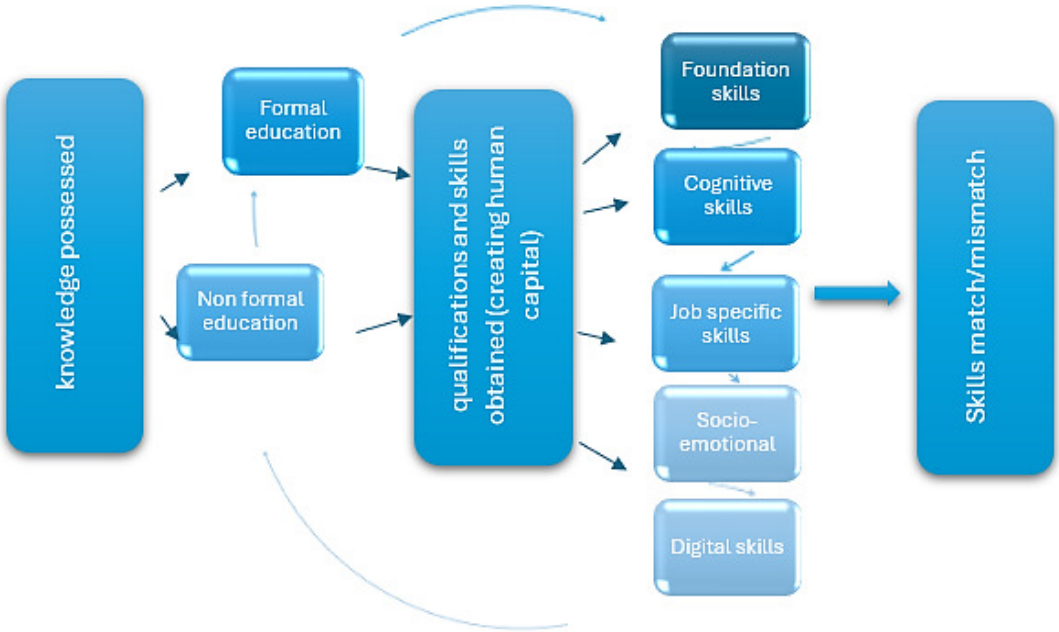



**Figure 2.** The importance of education in shaping human capital mismatch.

Source: own elaboration based on Stoevska, 2017.

Different initial levels of knowledge cause different levels of acquisition of formal and informal education. In a situation where the program and path of education itself do not provide optimal growth of skills and their adjustment to the requirements of the labor market, this causes an increase in disproportions, deepening gaps and skill shortages. That is way, the created human capital does not allow for achieving such differentiation and adjustment of skills to avoid the consequences resulting from mismatches.

For this reason the education system and the entire education sector are of great importance for the course and effects of the potential building processes and at a later stage its adjustment to market requirements. That is way a detailed diagnosis of mismatches in education is needed and then redesigning processes so that they have the least negative impact on the matching of skills. Educational policy must therefore take into account changes such as digitalization, generational and technological changes.

## 3. The methodology used to measure skills gaps

Skill mismatch is a complex issue in the many ways how it manifests itself, is measured, is conditioned, and how its consequences are experienced. Some of the studies that have been conducted examine mismatches from the perspective of employees (Hirzel et al., 2017; Belfield, Sloane, 1999; Dolton, Vignoles, 2000), while others examine employers and firm-level difficulties (McGowan, Andrews, 2015; McGuinness, Pouliakas, Redmond, 2018). Different approaches to the concept of skill mismatch make it difficult to define, categorize, and measure. Looking at the labor market side, measures of mismatch can be divided into two groups, measured from the perspective of the employee or the company. Studies tend to focus on the extent to which employees possess the skills or educational levels required to perform their job duties (Cedefop, 2010; Quintini, 2011; Cedefop, 2015).

The SMM measurement does not achieve comprehensiveness, because it is not possible to verify all the skills that characterize a given profession or are used in a given process (Cedefop, 2021). In addition, detailed verification of individual professions is not entirely justified, as it could exclude or significantly limit comparability. Another problematic aspect is that the study of skill mismatch is based on specific data in the current time, but the phenomenon of mismatch itself assumes the verification of the relationship between the state and competency requirements over time.

The study of skills mismatch including gaps is linked to the labour market and economy, in areas such as the underemployment rate, structural unemployment, job polarisation and income inequality. These issues are characterised by a significant dependence on skills mismatch. This phenomenon is particularly visible in Europe, which is characterised by unfavourable demographic trends (EESC, 2018). Despite numerous limitations related to measurement, it should be recognised that SMM is an important area, where any research process contributing to increasing the level of knowledge and understanding of the phenomenon is justified. Skills gaps as one of the types of mismatches refers to the situation in which employees do not have the skills required by employers. This is a gap between the skills that employees have and those that are needed in the labor market. On the other hand, the skills mismatch phenomenon covers a broader range of problems related to verifying mismatches based on over- or under-skilling.

The aim of minimizing errors and immeasurability of the process is to apply various methods of collecting data on mismatches to the research process, among which can distinguish:

- Descriptive statistics, based on measuring the general demand and supply of skills.
- Quantitative forecasting of demand for specific skills through the use of econometric modelling.
- Skills and job research, consisting in defining and assessing the demand and supply of skills on an enterprise scale.

- Tracking graduates, which allows for verification of people and their skills through the prism of the education and work process, showing the usefulness of education in assessing the labor market.
- Qualitative research, which provides information on both current and future needs in terms of skills, verifying the supply and demand side of the labor market.
- Big Data, based on data from the network using technologies such as Business Intelligence, cloud computing and databases, allows for the collection and classification of data on skills, vacancies, technologies obtained from large, variable and diverse data sets (Cedefop, 2021)

To verify the main objective of the of the article the study attempted to answer questions regarding selected skill groups and their gaps with particular emphasis on the education sector. Literature studies and analysis of empirical studies allowed the formulation of the following hypotheses:

- H1 The numeracy gap in education is the lowest across all sectors among the verified skills type.
- H2 The gap of job specific skills in education sector is lowest among all considered sectors.
- H3 Social skills are characterized by the largest gap among verified skills type.
- H4 Digital gaps for education sector are the highest among all considered sectors.

In order to verify the presented hypotheses included in the article, the results of research conducted by the European Center for the Development of Vocational Training (Cedefop) will be presented. The survey whose results will be used to show the current state of affairs is Cedefop's Second European Skills and Jobs Survey (ESJS) conducted from 2018 to 2024 is a periodic survey that gathers information on job skills requirements, digitalisation, skills mismatch and workplace learning (ESJS, 2023). The survey was conducted in all EU countries as well as Iceland and Norway, based on representative samples among employees. The study was conducted using a standardized methodology to provide information on the impact of digitalisation on the future of work and skills. The methodology of the process was based on the use of the following techniques (computer assisted telephone interviewing (CATI) and computer assisted web interviewing (CAWI)). A total of 46,213 interviews (telephone and online) were conducted (Cedefop, 2021). The study was divided into 10 thematic areas concerning individual areas and types of skill mismatch and skill gaps, but also education processes, job satisfaction or the impact of covid-19 on the work process. As part of this study, the results of identifying skill gaps will be presented for the average of EU countries. The verification of hypotheses will be divided according to their order of presentation in the article.

## 4. Results

The education process has a decidedly positive impact on the socio-economic situation of the population, supporting the formation of attitudes that are conducive to innovation and employment, improving productivity for economic growth, and improving the earning capacity of employees (Hanushek, 2016). Studies have also shown that higher education leads to greater political awareness and participation in elections, lower crime and poverty, higher employment rates, and less dependence on government assistance, and is also associated with better health (Münich, Psacharopoulos, 2018). Education should enable the development of competencies that enable development and appropriate remuneration (Zieliński, 2007). Therefore, determining whether and to what extent there is a mismatch of skills in the education sector is considered an important action.

The main premise for taking up the topic of the scale of skills gaps in the education sector in the EU and focusing on selected skill groups in the context of existing gaps was the verification of previous activities in the field of SMM analyses. Skill gaps refer to a situation where employees do not have the competencies adequate for the position. On the other hand, skills shortages arise when an employer cannot fill specific positions with suitably qualified Staff (Cedefop, 2010; Quintini, 2011; Cedefop, 2015a; McGuinness et al., 2017). The research results showed that there are significant mismatches between the needs of the labor market and the potential of employees (ETP, 2022; Cedefop, 2010; Predovic, Dennis, 2020; Kentaro, 2020). Studies that have examined the general approach to the mismatch process have led to the following conclusions:

- Almost 60% of employees want to work remotely full-time after the pandemic (Totah, 2021; Apollotechnical, 2020).
- Graduates from fields that provide more general skills are more likely to experience horizontal mismatch (Robst, 2007).
- The transformation of the work environment is affecting changes in the performance of HR processes and the control of work outcomes (van Vulpen, 2021; Dettmers et al., 2013).
- Vertical mismatch preserves some of the human capital acquired through formal educational qualifications (Salas-Velasco, 2021).

The verified research results concern selected areas of the skill gaps. The results presented in this article maintain the coherence of the entities considered in the study, namely they take into account the average level of a given measure for all EU member states and the average level for Poland. A key aspect is the inclusion of results breakdown by sectors, concerning the education sector. The results taking into account the sectoral analysis refer to the averages for the sector in all European Union countries.

The first area of skill gaps considered numeracy skills, presented in Figure 3. SMM is a significant problem in OECD countries, according to PIAAC data, on average 14% of workers have a literacy and/or numeracy mismatch (Pellizzari, Fichen, 2013). Respondents were asked whether they needed further development of numeracy skills to perform their main job to a better extent. This group of skills is an element of the so-called foundation skills, which refer to the ability to read, write, math and think logically. Their comparison shows that less than a quarter of employees are employed in positions that do not require any math skills, which is the lowest among the remaining basic skills (Cedefop, 2024). Therefore, in the verification of skill gaps, this group of numeracy skills was taken into account and presented in the figure 3.

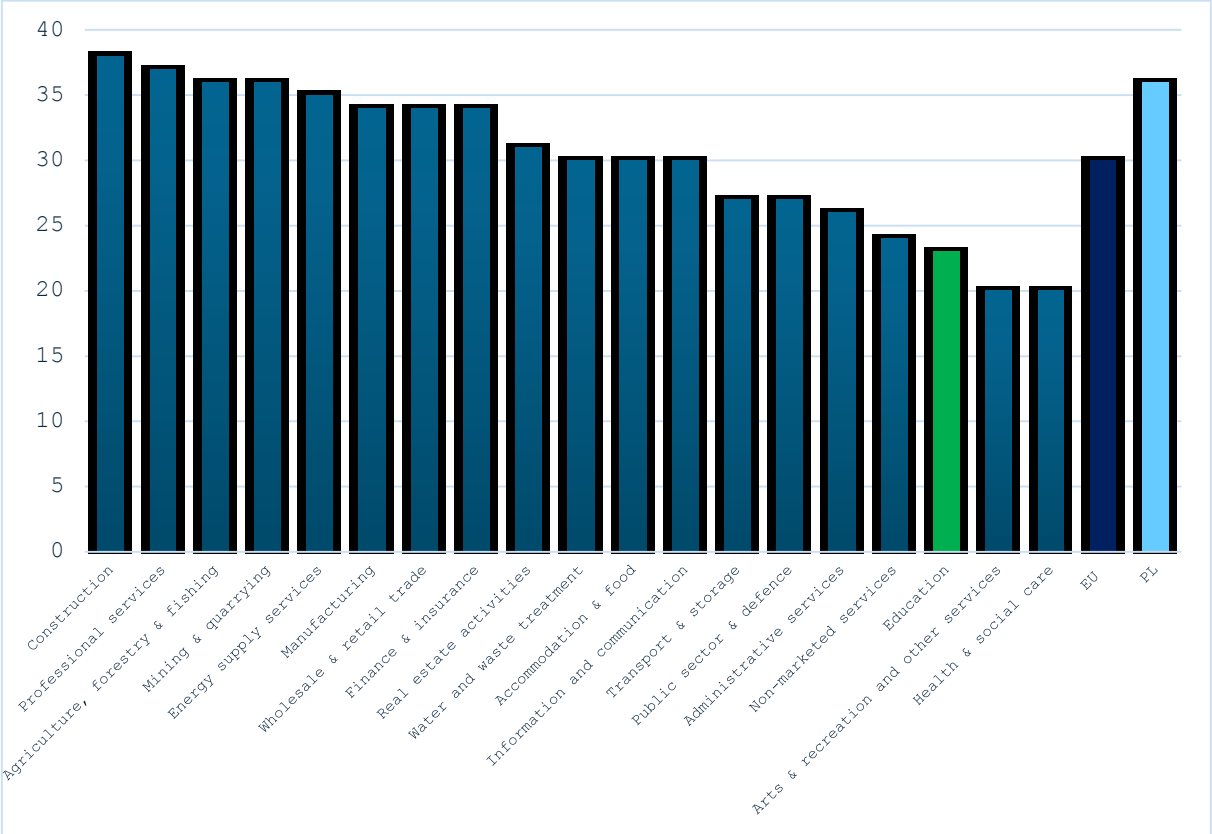



**Figure 3.** Skills gap for numeracy skills.

Source: own creation based on Introduction | CEDEFOP (europa.eu).

According to the data show in figure 3 the largest gap in numeracy skills is shown by respondents from Poland, 36% of the survey participants claim that this group of skills should be developed. The smallest gap was shown by the arts and health sectors, 20%, education was ranked third out of all 19 sectors considered. According to the data, only 30% of the education sector participants declare the need to develop numeracy skills. Referring the presented information to the adopted hypothesis that the numeracy gap is the lowest across all sectors among the verified skills type, it should be considered as false, because the digital skills gap is lower.

The next group of skills gaps reviewed concerns job-specific skills which are crucial for success in competitive markets, emphasizing the need for multidimensional abilities beyond traditional degrees to excel in diverse job roles (Vitthal, 2013). Professional skills in education are crucial for developing employability. Developing professional skills in education is crucial for career development of both the teacher and the future employee (Cheramie, 2014). The skills considered as typical for the education sector are considered according to the information provided in Table 2. Figure 4 shows that the level of the gap for the education sector in job-specific skills is insignificant in relation to other sectors.

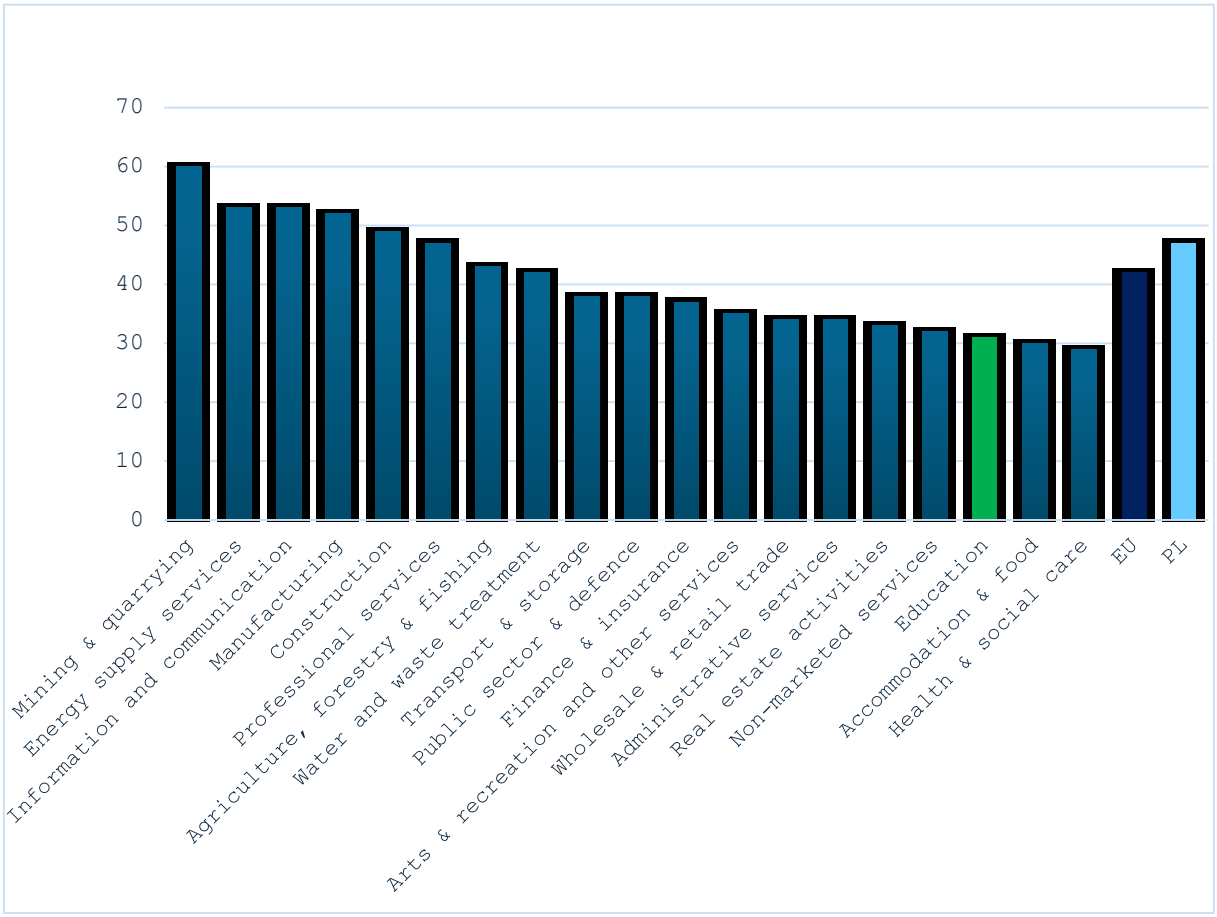



**Figure 4.** Skills gaps for job specific skills.

Source: own creation based on Introduction | CEDEFOP (europa.eu).

The respondents assessed whether they need to further develop any of the job-specific skills in education sector to do their main job even better, 31% of respondents had represented education sector showed a gap in this area of skills. In relation to the Polish average of 47% and the EU average of 42%, this is a good result. The lowest level of the gap in the considered skills was obtained by the health and social care sector at 29%. The literature analysis shows that the level of education required for jobs will be strongly related to the complexity of the numeracy and literacy tasks in the workplace as well as the requirements for reasoning (Handel, 2023). Referring the presented information to the adopted hypothesis that the gap of job specific skills in education sector is lowest among all considered sectors should be consider false.

Third skills type considers social skills, shown in Figure 5. The social skills considered in the ESJS include whether adult workers engage in: providing advice and consultation, oral presentations, customer service, teaching or training, providing care services, selling or teamwork as part of their job (Cedefop, 2024). This group of skills is characterized by the largest gap among the types of skills gaps examined. Half of the respondents from EU countries declare that they need to supplement their social skills. This is the group of skills with the largest gap for all 27 countries, Poland showed the existence of the gap at the level of 61%. Taking into account the categorization into sectors, the key sector education from the point of view of the presented content achieved the level of the social skills gap of 57%, which means that more than half of the entities in the sector claim that these skills need to be supplemented for better performance of employee duties.

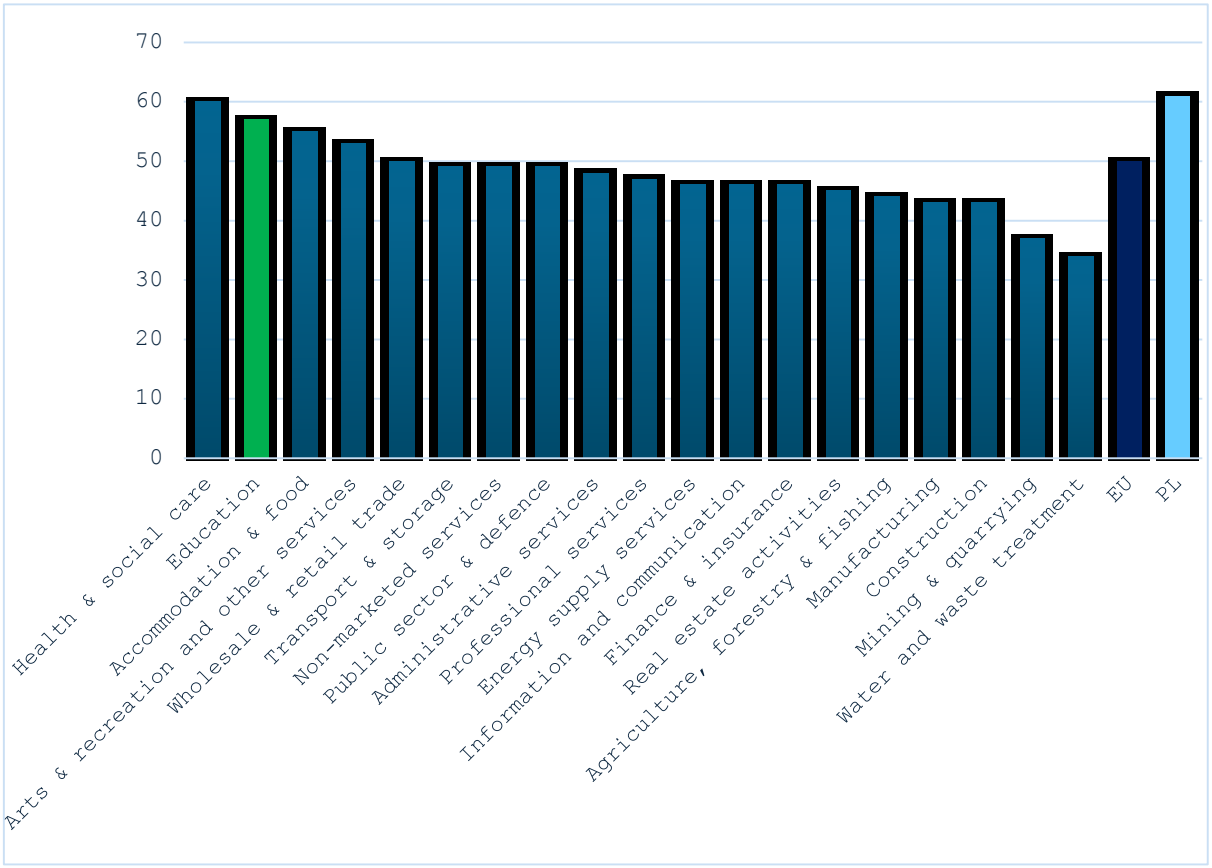



**Figure 5.** Skills gaps for social skills.

Source: own creation based on Introduction | CEDEFOP (europa.eu).

When considering social skills across sectors, education comes second, with only the health and social care sector showing a bigger gap. Developing social skills in education is crucial, as it improves communication, self-expression and adaptability, supports personal development and innovation (Musienco, 2023). Referring the presented information to the adopted hypothesis that the social skills are characterized by the largest gap among verified skills type, the statement should be considered true.

The UK Skills Mismatch in 2030 report published in 2019 indicates that the largest skills mismatch will be in basic digital skills (ISC, 2019). It is predicted that by 2030, 5 million British workers could become significantly mismatched in terms of basic digital skills (ISC, 2019). Therefore, there is no doubt that it is necessary to verify the level of digital skills, raise awareness of the community about them, but above all build and develop them. More and more skill classifications and mismatches include the level of digital skills. Within the general classification, in addition to skill areas such as fundamental, interpersonal, manual or cognitive, digital skills are becoming another pillar.

The directions of research and their scopes aimed at verifying the impact of technological changes on behavioral processes, development activities and activities in the area of building skills show a clear trend. Namely, the ongoing technological progress clearly shapes the directions of changes in the area of skills, proving the growing importance of digitalization for shaping and developing the potential of human competences. Digital skill gap verification is usually divided into a group of respondents who are users of digital technologies in their work and those who do not use digital tools to perform their main scope of duties. The values presented in Figure 6 include gap verification for people who are users of digital technology in their work.

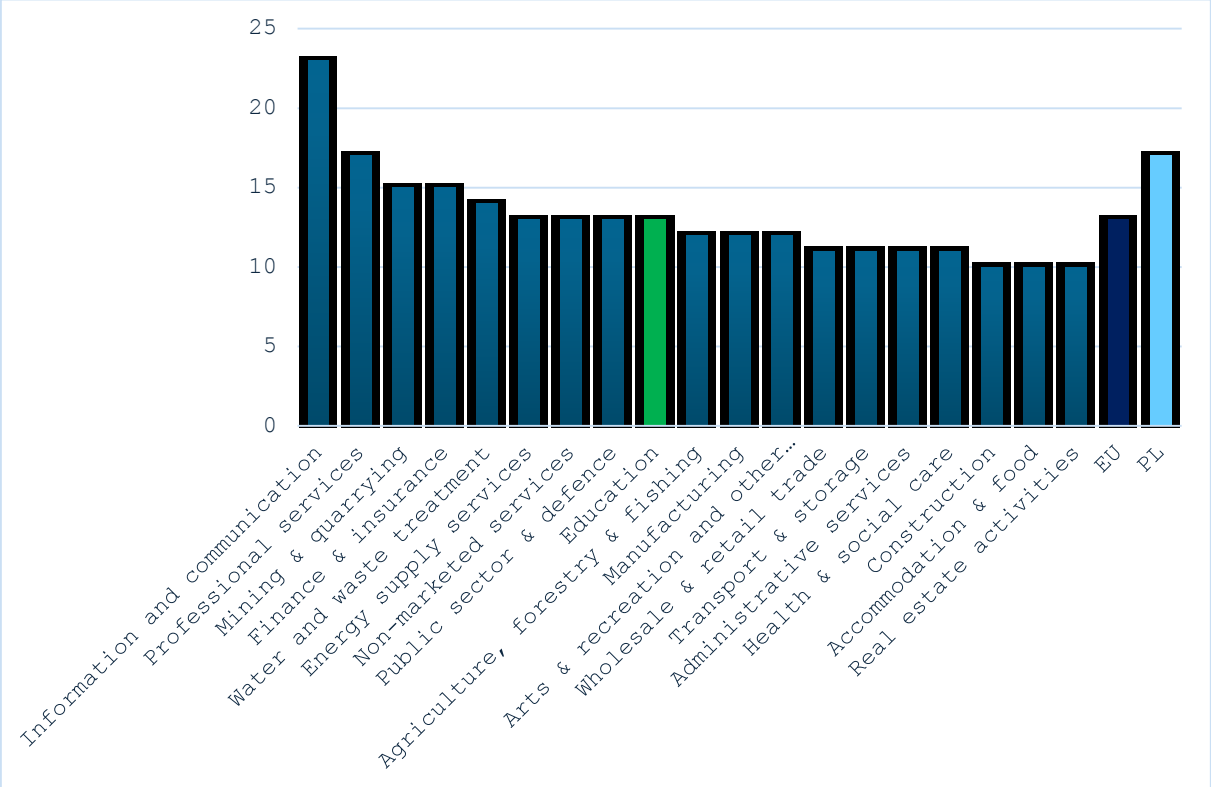



**Figure 6**. Skills gaps for digital skills.

Source: own creation based on Introduction | CEDEFOP (europa.eu).

The 2015 Cedefop Skills and Jobs Survey showed that more than eight out of ten jobs in the EU require at least a basic level of digital competences (Cedefop, 2015a). Public awareness is growing, driven by clear and visible signals from companies about the need to increase the level of digital competences in order to cope with technological developments in organisational processes. Digitalization across all sectors means that those who use computer technology see their productivity increase, while unskilled workers see their jobs replaced by computers (Autor, 2008). The data presented in Figure 4 are based on analyses of occupations requiring the use of digital competences. show that the level of the digital skills gap by sector is quite consistent, ranging from 23 to 10%, including the education sector at 13%. Surprisingly, the largest gap was shown by employees of the information and communication sector. The presented results do not allow for positive verification of the accepted hypothesis.

## 5. Discussion

Basing the conclusions on the theoretical considerations and empirical data presented in the article, it can be stated that the phenomenon of skill mismatches and the occurrence of skill gaps is common and undeniable. Gaps occur in every sector of the economy in all European Union countries. The process of diagnosing and assessing mismatches and gaps as well as attempts to forecast the demand for specific types of skills, building programs for acquiring and developing selected skills are the first point in striving to solve the existing situation. Actions aimed at better matching the education sector to the requirements of the labor market include various areas of intervention, they concern lifelong learning, preventing the obsolescence of competences, improving education programs, developing the competences of school representatives. An effective strategy for building and developing the skills in the education sector and minimizing skill gaps is a key element. The impact and role of education on the skills gaps is shown in table 2. The lack of action in this area will lead to a deeper differentiation and mismatch of the value of human capital with the needs of the labor market. The dimensions of the impact of deepening gaps and lack of preventive measures will affect the units in each scale shown in table 2. The occurrence of mismatches and gaps increases the level of structural unemployment, lowers the level of economic output relative to the potential level of output and limits GDP growth through the misallocation of human capital (OECD, 2017).

**Table 2.**
*Consequences of skills gaps by impact scale*

| Scale | Consequences | Education influence | Education Role |
|---|---|---|---|
| **individual** | - Skill gaps and shortages reduce job opportunities.<br>- Lost wages due to underutilization of existing skill levels.<br>- Underestimation of wages in relation to skill levels can lead to dissatisfaction.<br>- Employment at sub-optimal productivity potential.<br>- Inadequate or misaligned training and development processes. | Provides individuals with the necessary skills and knowledge, which creates individual potencial.<br>Encouraging continuous education and professional development helps individuals adapt to changing job requirements. | Adopting the principles of lifelong learning and continuous professional development helps individuals to prevent their skills from becoming obsolete. |
| **company** | - negative impact on productivity and competitiveness,<br>- difficult introduction of new technologies, products and services,<br>- mismatch affects employee turnover,<br>- the need to fill gaps increases recruitment and training costs,<br>- negative impact on the optimization of the work process organization,<br>- reduced or lost profits and market position. | Educational programs which provides hands-on experience and practical skills to students and new graduates, making them better prepared for the workforce and reducing the skills gap.<br>Designing education programmes with the involvement of enterprises from a given sector promotes greater consistency between skills and the requirements of job positions in the sector. | Increasing the scope between educational institutions and industry will increase the usability of education programs and reduce gaps in specific skill groups. |
| **region or country** | - gaps and mismatches affect unemployment levels,<br>- negative impact on competitiveness,<br>- lower attractiveness to potential investors, which affects job creation opportunities,<br>- need for increased public and private investment in the processes of filling gaps and shortages,<br>- uncertainty about the effectiveness of undertaken programmes to fill gaps in terms of job security, employment, wage levels,<br>- the existence of skills mismatches results in lower returns on investment. | Updating and adapting curricula to reflect current and future job market trends ensures higher level of economic competitiveness.<br><br>Government policies and investments in education and training can significantly influence the quality and accessibility of education, impacting the overall skill levels of the workforce. | Striving to ensure greater compliance of curricula with the needs of industry.<br>Regardless of the level of education, providing practical skills and experience which will increase people's readiness to work.<br>Continuous integration of digital skills into the education system ensures a greater level of coherence between the potential possessed and required in the labor market<br>Successful resolution of barriers to education, taking into account elements such as socio-economic status, gender and geographical location.<br>Equal access to education is crucial. |

Source: own elaboration base on ILO 2020 What is skills mismatch and why should we care? | International Labour Organization (ilo.org).

Mismatches, including gaps and skills shortages, result from and affect the potential of employees and enterprises. In the presented article, special importance is attributed to the conditions related to the functioning and influence of the education sector on the concept of skills mismatch. First of all, it was assumed that the implementers of education processes, just like others, are exposed to the occurrence of skill gaps, and thus reduce abilities to build the skills of participants in the education process. The education sector and its functioning is a very important factor for the emergence and essence of the SMM phenomenon.

## 6. Summary

In a narrow scope, learning and understanding the skills gaps and skills shortages in education will improve the competitiveness, attractiveness and usefulness of education processes in terms of labor market conditions. In a broader scope, the analysis of education sector gaps and actions to eliminate them will minimize HC abuses in enterprises and better match employee skills to the requirements of the enterprise. Skill mismatches can generate a greater risk of unemployment, lower wages, lower job satisfaction or a general deterioration of career prospects in the macroeconomic dimension (OECD, 2016).

It should be emphasized that even well-functioning education systems do not guarantee full skill matching, as they may be the result of employees building their own career paths, perceptual limitations, realization of professional ambitions or the result of age-related changes or changing preferences. In such cases, short-term mismatches may occur naturally. However, chronic skill gaps or shortages in the long term may have negative economic consequences for individuals, companies and the entire economy (Cedefop, 2019). Therefore, the attempt made in the article to show the significance of the phenomenon of mismatches in education and the presented research results may constitute a contribution to undertaking a more detailed analysis of the discussed phenomenon.

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# ECONOMIC ASPECTS OF DISSIMILAR BRAZE WELDING OF AUSTENITE-COPPER FOR RAIL TRANSPORT APPLICATIONS

Tomasz WĘGRZYN[1*], Bożena SZCZUCKA-LASOTA[2*], Adam JUREK[3], Paweł PIOTROWICZ[4], Artur LABUS[5], Patrycja LASOTA[6]

[1]Politechnika Śląska; tomasz.wegrzyn@polsl.pl, ORCID: 0000-0003-2296-1032
[2] Politechnika Śląska; bozena.szczucka-lasota@polsl.pl, ORCID: 0000-0003-3312-1864
[3] Novar Sp. z o.o, Gliwice; adam.jurek@novar.pl, ORCID: 0000-0002-9552-0062
[4] TUV, SUD Polska. z o.o., Warszawa; pawel.piotrowicz@tuvsud.com, ORCID: 0009-0001-7776-0716
[5] TUV, SUD Polska. z o.o., Warszawa; Artur.Labus@tuvsud.com, ORCID: 0009-0008-8330-0936
[6] Politechnika Śląska; PL315065@student.polsl.pl, ORCID: 0009-0005-8536-5539
* Correspondence author

**Purpose:** Novelty of the paper is to present the economic aspect of austenite-copper alloy braze welding for rail transport application. Braze welding copper with austenite is treated as a difficult and expensive procedure. The aim of the article is to develop the MIG (Metal Inert Gas) welding process for dissimilar austenite-copper joining without preheating that is much less expensive process of welding with preheating.
**Design/methodology/approach**: Main parameters of the braze welding process were tested and then the quality of the obtained joint was checked.
**Findings:** Filler materials were determined without preheating to 600° C, that is much more energy-intensive process.
**Research limitations/implications**: It was suggested to investigate the effect of modified dissimilar austenite-copper joining.
**Practical implications:** The proposed process innovation will result in savings of production of cost of the elements of the locomotive transformer holder.
**Social implications:** New dissimilar austenite-copper joining process allows for energy savings.
**Originality/value:** It is to propose a new solution in rail transport. The article is especially addressed to the elements of the locomotive transformer holder.
**Keywords:** production savings, transport, braze welding.
**Category of the paper:** Research paper.

## 1. Introduction

In recent years, great importance has been attached to savings during production and the search for new solutions that will guarantee good results, environmental benefits and large savings. Braze welding of austenitic steel with copper is a much cheaper process than classical welding. This is because the expensive preheating of copper to approx. 600°C can be eliminated. Dissimilar joining copper and austenitic steel is a rather specific process because it combines two materials with very different physical and chemical properties. Copper has very good thermal and electrical conductivity and a low melting point (approx. 1085°C). Austenitic steel (in this case material 304) has much lower thermal and electrical conductivity and has a much higher melting point (approx. 1434°C). This is important information from the point of view of production management (in this case, locomotive transformer holders). It be easily calculated that the approximate value of energy needed to heat a copper element with dimensions of 300 × 300 × 8 mm is 0.4 kWh, the amount of propane needed to heat this element is 0.1 kg (Li, Hou, Tian, Hong, Nord, Rohde, 2022). Copper welding was the successful work of great Polish scientist Prof. Jan Węgrzyn, a pioneer of modern welding. He developed an innovative method of cold welding of copper, which was patented in Poland under the number PL 54612 in 1966. This method involves the use of a specially designed coated electrode, which allows for welding copper without the need for prior heating. The new electrode allows for welding with an efficiency up to 30 times greater than traditional gas methods. Welds made using this method are characterized by high quality, do not require additional heat treatment or forging, and their electrical and thermal conductivity is similar to that of wrought copper. This method was developed by Prof. Jan Wegrzyn was constantly improving and patented the research results in 1987: "Coating of electrodes for welding copper and copper alloys (patent PL 153863). The method of cold welding of copper was considered a breakthrough in the field of welding and was included among the ten most important achievements in this field in the world. Additionally, prof. Jan Wegrzyn is the author of other patents related to non-conformal welding of copper, such as "Method of welding a copper strip with a steel element" (PL 158594). Laser welding of copper alone has begun to replace the previous methods: gas welding and welding with coated electrodes. It was noted that the preheating temperature should reach up to 600°C for Punzel, E., Hugger, F., Dörringer, R., Dinkelbach, T.L., & Bürger, A. (2020). In copper laser welding, attempts were made to use lower and lower preheating temperatures (Punzel, Hugger, Dörringer, Dinkelbach, Bürger, 2020). In the following years, attempts were made to make non-similar joints. An important and well-recognized process is the welding of copper with titanium. A welding process without preheating was used here (Yee et al., 2023). Welding copper with austenitic steel is more difficult. Laser welding gave good results, but preheating was necessary (Mannucci, Tomashchuk, Vignal, Sallamand, Duband, 2018). Similar results were also obtained by other

researchers (Lee, Jeong, Lee, Fujii, Shin, Lee, 2023). Currently, attempts are being made to weld Cu using methods related to green energy (Beck, Bantel, Boley, Bergmann, 2021). Dissimilar copper laser welding was tried to be associated with environmental protection (Kumar, Arya, Palani, Madhukar, Sathiaraj, Patel, 2022). Currently, copper welding using the TIG method has been mastered, paying attention to environmental issues (Sairam, Balaji, Menon, Manikandan, 2023). The authors of this article attempted to weld Cu to austenitic steel using the MIG process to also contribute to environmental protection and reduce production costs, in this case related to the needs of the railway industry.

## 2. Materials

A single lap joints were made of 8 mm thick copper sheet and 10 mm thick austenitic steel. Two electrode wires with silicon (CuSi3) and silicon and manganese (CuSi3Mn1) additions were selected for braze welding. Table 1 presents the mechanical properties of tested materials in dissimilar braze welding process.

**Table 1.**
*Tensile strength of tested materials*

| Material | YS, MPa | Elongation A5 | Hardness, HB |
|---|---|---|---|
| Cu | 220 | 41 | 60 |
| Austenite steel 304 | 570 | 45 | 170 |

Austenitic steel 304 is a commonly used stainless material of the 18-8 grade (18% Cr, 8% Ni). This steel additionally contains 0.08% C, 2% Mn, 1% Si. The two tested braze welding wires (diameter 1 mm) have a chemical composition other than austenite, and more similar to the second jointed material, which is pure copper. The chemical composition of the wires is presented in Table 2.

**Table 2.**
*Chemical composition of wires for braze welding*

| wires | Si, % | Mn, % | Fe, % | Zn, % | Ni, % | Cu, % |
|---|---|---|---|---|---|---|
| CuSi3 | 2.9 | 1.2 | 0.5 | 0.1 | 0.05 | bal |
| CuSi3Mn1 | 3.9 | 1.5 | 0.4 | 0.2 | 0.5 | bal |

The main alloying elements in wires are Si and Mn, which is consistent with the symbol of the material. It was decided to realize MIG braze welding with a single lap joints character. Joints were made of 8 mm thick copper sheet and 10 mm thick austenitic steel. The weld was formed as single-pass. The joint was protected by argon as shielding gas with constant flow on the level of 13 $dm^3$/min.

At the beginning of welding process, the current and the voltage parameters were suggested:

- welding current was varied 3 times: 155 A, 165 A, 175 A,
- arc voltage: 23 V,
- welding speed was varied twice: 250 mm/min and 290 mm/min,

The use of high purity argon is important to avoid braze welding incompatibilities Actually helium is occasionally used in argon gas mixture.

## 3. Methods

After the MIG braze welding process, the non-destructive test (NDT) and also destructive tests (DT) were realized. Firstly, VT - visual test (using EN ISO-17638 standard) and TP - penetration test was realized. Penetrant was DBR, cleaner was BRE-S, developer was BEA. Time of penetration was 30 min. Secondly destructive test was carried out mainly based on EN ISO 14273:2016 (Resistance welding - destructive testing of welds - specimen dimensions and procedure for tensile shear testing resistance spot and embossed projection welds (ISO 14273:2016) and bending test according to PN-EN ISO 5173 standard.

## 4. Results and discussion

Dissimilar lap joints were made using two wires (CuSi3 and CuSi3Mn1) and with 2 various welding speed. Welding was realized without heat treatment. Following all the experiments, 12 different samples were made (tab. 4).

**Table 4.**
*Samples designations*

| Sample | Current, A | wire | Welding speed mm/min |
|---|---|---|---|
| U1 | 155 | CuSi3 | 250 |
| U2 | 165 | CuSi3 | 250 |
| U3 | 175 | CuSi3 | 250 |
| U4 | 155 | CuSi3 | 290 |
| U5 | 165 | CuSi3 | 290 |
| U6 | 175 | CuSi3 | 290 |
| U7 | 155 | CuSi3Mn1 | 250 |
| U8 | 165 | CuSi3Mn1 | 250 |
| U9 | 175 | CuSi3Mn1 | 250 |
| U10 | 155 | CuSi3Mn1 | 290 |
| U11 | 165 | CuSi3Mn1 | 290 |
| U12 | 175 | CuSi3Mn1 | 290 |

Only three samples marked as U2, U5, U11) were free from welding defect and incompatibilities (table column are marked in green), but nine samples were prepared incorrectly (table column marked in pink). The VT (visual test) and TP (penetration tests) results with observation comment are presented in Table 5.

**Table 5.**
*VT results for tested dissimilar braze welds*

| Sample | Observation |
|---|---|
| U1 | Small cracking in weld from the face and root sides |
| U2 | Small cracking in HAZ |
| U3 | Correct weld, defect free, correct form and dimension of HAZ |
| U4 | Small cracking in HAZ |
| U5 | Correct weld, defect free, correct form and dimension of HAZ |
| U6 | Small cracking in weld from the face and root sides |
| U7 | Small cracking in HAZ |
| U8 | Small cracking in HAZ |
| U9 | Small cracking in weld from the face side |
| U10 | Small cracking in weld from the root side |
| U11 | Correct weld, defect free, correct form and dimension of HAZ |
| U12 | Small cracking in weld from the face and root sides |

First of all, it was found that the selection of current and kind of wire is more important than welding speed. The welding current should be on the level of 165 A. Initial observations indicate that CuSi3 wire is more suitable for the tested brazed joint. Based on visual tests, it can also be concluded that a faster welding speed may be more suitable for solving the welding problem. The next part of the investigation was to perform a tensile strength of the dissimilar lap braze weld. Only samples that tested positive in NDT tests were taken to the account (U2, U5, U11). Table 7 presents the tensile strength (UTS) of the of the dissimilar lap braze weld.

**Table 7.**
*Tensile strength of the dissimilar lap braze weld*

| Sample | UTS [MPa] |
|---|---|
| U2 | 134 |
| U5 | 145 |
| U11 | 103 |

The data from the Table 7 prove that there is high tensile strength of all tested joints over the 100 MPa. The analysis of Table 7 shows that the joints made using the CuSi3 wire electrode have much more advantageous mechanical properties. A bending tests was carried out to check the plastic properties of the joints as a last point of investigation. A bending test was realized at room temperature. The bending angle was 30 degrees. The results of bending test are demonstrated in Table 8.

**Table 8.**
*Bending test of braze weld*

| Sample | observations |
|---|---|
| U2 | No cracks |
| U5 | No cracks |
| U11 | small cracks |

The bending angle was 30 degrees. The joints U2 and U5 (using wire CuSi3) showed no defects or discrepancies, the test result according to the standard is positive. The joint U11 had minor defects in the form of cracks.

## 5. Summary

The article presents the possibility of economic dissimilar braze welding Cu-austenite without preheating, that is treated as expensive procedure due to the consumption of energy and propane preheating, gas for heating. Based on the literature included in the introduction, it can be easily calculated that one propane bottle, which costs 40 euros, is needed to make 100 tested dissimilar braze welds. Joints of this type are made on a large scale for use in the railway industry. The newly developed method allows for large savings, as the use of expensive propane for preheating is completely eliminated. The properties of braze welding were tested using non-destructive and detractive methods. The joints, despite the much cheaper production method, are characterized by good properties. It is difficult to determine the optimal process parameters, because only 3 trials out of 12 different parameters gave a positive result. Based on the dissimilar braze welding study it was possible to conclude that:

1. Braze welding of Cu-austenite steel without preheating leads to process savings, because welding without using propane for heating is much cheaper.
2. Braze welding parameters (wires, current and speed) should be selected with great knowledge and sensitivity.
3. The best mechanical properties of braze welds were obtained when:
   - the electrode wire CuSi3 gives better results than CuSi3Mi1,
   - the welding speed on the level of 290 mm/min gives better results than 250 mm/min; this also translates into the economic aspects of the process, because the efficiency increases,
   - for this type of joint, the welding current should be on the level of 165 A.

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# THE IMPACT OF INNOVATION IN THE TECHNOLOGICAL PROCESS ON QUALITY. IMPROVEMENT: A CASE STUDY OF THE BAKERY INDUSTRY

Radosław WOLNIAK[1*], Radosław DROZD[2]

[1] Silesian University of Technology, Organization and Management Department, Economics and Informatics Institute; rwolniak@polsl.pl, ORCID: 0000-0003-0317-9811
[2] Gdansk University of Technology, Department of Informatics in Management; rdrozd@zie.pg.gda.pl, ORCID: 000-0003-1797-4488
* Correspondence author

**Purpose:** The aim of the article is to present the impact of innovation in the technological process on the improvement of bread quality, using the bakery industry as an example.
**Design/methodology/approach**: The literature research and the critical analysis of both, the national and foreign subject literature have been used as the research methodology.
**Findings:** In response to the transformations occurring within the bakery industry and considering the growing demand in Poland for bread that meets consumer quality expectations, research was conducted to examine the impact of innovations in the technological process on the improvement of bread quality. The indicated survey research was carried out between 2020 and 2023, involving 51 bread producers from the Pomeranian Voivodeship, where 56 innovations implemented in the bread production technological process were identified. The analysis and evaluation of the research results were carried out in individual groups of innovations. The attempt undertaken in this article to determine the impact of the implemented innovations on improving the quality of bread indicates that the implemented innovations in the technological process had a noticeable impact on improving the quality of bread in all groups covered by the study, both for the producer and the consumer.
**Practical implications**: Practical implications include presenting the impact of innovation in the technological process on improving the quality of bread using the bakery industry as an example. This will be an important solution in making a number of decisions by managers and bakery owners in terms of strategic use of them.
**Originality/value:** The article may be a recommendation for manufacturing companies. The structure of the suggested management functions allows for manufacturing companies optimization, process control and manufacturing quality.
**Keywords:** bread quality, the essence of product innovations in the technological process, the classification of innovations within the technological process, the hierarchy of the impact of innovations in the technological process on the improvement of bread quality.
**Category of the paper:** research paper.

## 1. Introduction

Bread is a fundamental component of every Pole's diet. Within the structure of bakery products, bread accounts for approximately 70% (Ambroziak, 2002; Dziki et al., 2016). Bread and other bakery goods can contribute significantly- around 25–30% - to the body's daily energy requirements (Gambuś, Litwinek, 2011). The caloric value of bread is determined by its content of sugars, proteins, and fats. Bread, especially wholemeal varieties, alongside fruits and vegetables, is a primary source of dietary fiber. It also contains microelements and B-group vitamins (Dziwkosz, 2012). In this context, the issue of bread quality remains highly relevant.

Ensuring consumers have access to high-quality bread that simultaneously guarantees nutritional value and health safety should be a paramount concern for producers (Drozd, Wolniak, 2023). In recent years, a decline in the demand for bread has been observed; however, the share of all bakery products in overall food expenditures has decreased only slightly. The importance of other fresh bakery goods is steadily increasing (Drozd, 2021).

Following the economic system transformation, many new bakeries emerged. At the same time, factors such as significant price increases and changes in lifestyle have led to a partial reduction in bread consumption (Drozd, Wolniak, 2021). Intense competitive struggles have become a pressing issue for the modern bakery industry. The growing societal demands regarding bread quality have necessitated new solutions, with quality becoming a strategic objective.

In response to the transformations occurring within the bakery sector and considering the rising demand in Poland for bread of the quality expected by consumers, research was conducted between 2020 and 2023 to investigate the impact of innovations in the technological process on the improvement of bread quality. The survey involved a group of 51 bread producers from the Pomeranian Voivodeship, where a list of 56 innovations implemented in the bread technological process was compiled

## 2. The essence of product innovations in the technological process

The successful development of enterprises, both locally and globally, is conditioned by conscious and thoughtful implementation of innovations. It increasingly turns out that without their use, gaining a lasting competitive advantage has become practically impossible. Innovations are currently the most effective way to attain long-term market success. Nevertheless, to maintain adequate competitiveness, enterprises should strive to create new or enhance existing products and services, production processes, organizational structures, and marketing strategies (Wiśniewska, Grudowski, 2014; Żołnierski, 2006).

Starting from the methodology consistent with the Oslo Manual (Oslo, 2018), we can distinguish two main types of innovation:

- Innovations that lead to changes in a company's products (product innovations).
- Innovations that lead to changes in a company's business processes (business process innovations).

Product innovation includes activities aimed at a new or improved good or service that differs significantly from the enterprise's previous goods or services and that has been introduced to the market (Singh et al., 2022).

Business process innovation refers to a new or improved business process for one or more business functions that differs significantly from the company's previous business processes and that has been implemented for use by the enterprise.

For the purposes of the research, the technological process was treated as a functional whole within which product innovations are implemented.

According to the Oslo Manual, product innovations must provide a significant improvement in one or more characteristics or functional specifications. This includes the addition of new functions or improvements to existing functions or user utility. Relevant functional features in this context include quality, technical specifications, reliability, durability, cost-efficiency during use, affordability, convenience, usability, and user-friendliness.

Product innovations do not necessarily have to involve improvements in all functions and operational specifications. Enhancing or adding a new function may entail the loss of other features or a decrease in performance in certain aspects. Product innovations may be based on the use of new knowledge or technology, or they may rely on new applications or combinations of existing knowledge or technology.

In American literature, the production process is understood as the sum of all activities undertaken to produce a finished product within a manufacturing plant.

Within the production process, two fundamental areas can be distinguished: the technological process and auxiliary activities, which include transport, inspection, maintenance, and storage (Srivatsan et al., 2018).

The technological process is by far the most important element of the production process. It is defined as an organized and systematic set of activities aimed at altering the properties (physical or chemical) of the objects of labor (Feld, 2000). This issue can also be described as intentionally carried out chemical and physical phenomena that are designed to lead to the creation of the desired product.

Everything begins with a set of raw materials that undergo a deliberate transformation, resulting in the emergence of the final product (Sharma, 2017).

The technological process is an organized set of purposeful activities carried out during production, starting from the withdrawal of input material from the warehouse, through all technological, transport, inspection, and storage operations (including natural processes),

up to and including the delivery of the finished product (Duda, 2000). In these activities, specific resources are used to transform inputs into outputs (Zgodavova et al., 2020).

Many enterprises harbor concerns about implementing and applying new solutions based on innovations in technological processes. However, the growing pressure to improve market competitiveness and to provide better customer service makes this, at present, the only viable path for a company's development (Hall, 2005).

## 3. The impact of innovations in the technological process on the improvement of bread quality

### The classification of innovations in the technological process

In response to the transformations occurring within the bakery industry and considering the growing demand in Poland for bread that meets consumer quality expectations, research was conducted to examine the impact of innovations in the technological process on the improvement of bread quality. The indicated survey research was carried out between 2020 and 2023, involving 51 bread producers from the Pomeranian Voivodeship, where 56 innovations implemented in the bread production technological process were identified.

The innovations were systematized and divided into technological lines and machines.

Subsequently, the 22 technological lines (see Table 1) were classified into lines for the production of bread, bakery goods, frozen dough, and lines incorporating the use of robots.

The machines, totaling 34 units (see Table 2), were categorized into specific groups, including: silos, mixers with bowls, proofing chambers (dough proofers), thermal oil and electric ovens, and X-ray detectors.

**Table 1.**
*Type of Innovation – Technological Lines*

| TYPE OF INNOVATION – TECHNOLOGICAL LINES |
|---|
| **I. LINES FOR BREAD PRODUCTION** |
| 1. Industrial eco-friendly automated line |
| 2. Cyclothermal automatic line |
| 3. Automated line with overhead intermediate proofing |
| 4. Automated line - producer no. 1 |
| 5. Automated line - producer no. 2 |
| 6. Automated line - producer no. 3 |
| 7. Automated line for the preparation and baking of bread with extended shelf life |
| 8. Automated line with static intermediate proofing |
| **II. LINES FOR BAKERY PRODUCT PRODUCTION** |
| 9. Eco-friendly automated line |
| 10. Automated line - producer no. 1 |
| 11. Automated line - producer no. 2 |
| 12. Automated line - producer no. 3 |
| 13. Modified automatic line |

Cont. table 1.

| **III. LINES FOR FROZEN DOUGH PRODUCTION** |
|---|
| 14. Automated line for frozen dough production - producer no. 1 |
| 15. Automated line for frozen dough production - producer no. 2 |
| 16. Designed automated line for frozen dough production |
| 17. Automatic line for bread production from frozen dough |
| **IV. TECHNOLOGICAL LINES WITH ROBOTS** |
| 18. Robotic system for loading and unloading bread from bakery ovens - producer no. 1 |
| 19. Robotic system for loading and unloading bread from bakery ovens - producer no. 2 |
| 20. System for palletizing and depalletizing with the participation of a multi-tasking robot |
| 21. Robotic system equipped with advanced machine learning functions with innovative software supporting production processes |
| 22. Transport system for handling specific machines by a robot |

Sources: Studies based on data received from the bakery.

**Table 2.**

*Type of Innovation – Machines*

| **TYPE OF INNOVATION – MACHINES** |
|---|
| **I. SILOS** |
| 1. External silos made of acid-resistant steel for storing non-standardized flour, with automated delivery of the raw material to production |
| 2. Monolithic silos made of stainless steel with automated flour delivery to production |
| 3. External silos with automated flour delivery to production |
| *4.* Automated internal silos made of fiberglass |
| 5. Automated internal silos made of fiberglass |
| 6. Automated internal silos made of fiberglass |
| 7. Automated flexible internal silos made of antistatic fabrics |
| 8. Automated internal silos made of aluminum alloy |
| **II. MIXERS WITH BOWLS** |
| *9.* Automated set of spiral mixers with movable bowls |
| 10. Automated set of spiral mixers with movable bowls |
| 11. Automated set of spiral mixers with bottom discharge bowls |
| 12. Automated set of spiral mixers with fixed bowls |
| 13. Mixers with bottom discharge bowls |
| 14. Spiral mixers with bowls on mobile carts |
| **III. DOUGH PIECE PROOFING CHAMBERS *(PROOFING CHAMBERS)*** |
| 15. Set of proofing chambers |
| 16. Set of proofing chambers |
| 17. Set of freezing-proofing chambers |
| 18. Set of proofing chambers |
| 19. Through-flow proofing chambers |
| 20. Chambers for delayed baking |
| **IV. THERMO-OIL AND ELECTRIC OVENS** |
| *21.* Automated thermo-oil ovens |
| 22. Automated rack-type thermo-oil ovens |
| 23. Automated batch-type thermo-oil ovens |
| 24. Automated tunnel-type cyclothermal ovens |
| *25.* Automated rotary thermo-oil ovens |
| 26. Thermo-oil ovens with an automatic dough loading system |
| 27. Trolley-type thermo-oil ovens |
| 28. Automated electric ovens |
| 29. Automated modular bakery ovens |
| **V. X-RAY DETECTORS** |
| 30. Industrial X-ray detector |
| 31. X-PERT X-ray detector |
| *32.* EAGLE X-ray detector |
| 33. NEXT GUARD X-ray detector |
| 34. DMX X-ray detector |

Sources: Studies based on data received from the bakery.

The description of the individual groups of innovations implemented in the technological process, along with their expected impact on the improvement of bread quality, was developed based on: domestic and foreign literature, information provided by bread producers in questionnaire surveys, participant observations conducted in bakeries.

Innovations in the technological process are primarily aimed at introducing changes in the methods of product manufacturing (Andersson et al., 2020). Meanwhile, bread quality is the result of a range of factors shaping the production process, including the machinery used (Ribeiro, Collins, 2007).

## 4. Determining the expected impact of innovations on the improvement of bread quality in bakeries

The innovations implemented in the technological process across the 51 surveyed bakeries share common features that contribute to the improvement of bread quality, in particular:

1. The machines installed in the technological lines were made of high-quality, smooth materials, easy to keep clean, which helps protect the working environment by reducing dust pollution in production areas (Drozd, 2019; Carla et al., 2024). The hermetic sealing of technical equipment, in turn, limits the dispersion of flour dust. This dust, when combined with high humidity and air temperature, creates favorable conditions for the development of microorganisms (such as mold spores) and pests such as cockroaches, weevils, and mites (Drozd, 2020; Cauvain, 2017). To produce high-quality bread, it must be manufactured under conditions that meet applicable hygiene standards, to which specialized technical equipment designed for the bakery industry significantly contributes. Production safety thus translates directly into the health safety of bread (Cappelli et al., 2021).
2. Specialized technical equipment is designed to prevent the deterioration of raw material quality during the technological process, mainly by ensuring strict adherence to technological parameters. This approach protects, among other things, the nutritional value of bread (Cauvain, Clark, 2019). Technological parameters that affect bread quality include fermentation time, dough yield and the degree of souring during the various production phases, dough mixing time and intensity, proofing time of dough pieces, as well as baking temperature and time (Cacak-Pietrzak, Rakocka, 2022). New bread production technologies enable the shortening of production phases or even entire processes, while simultaneously improving product quality (Oest et al., 2020). This is associated with changing bread yield standards, which are influenced, among other factors, by the production technology conditions of the bakery where the measurement is taken (Sassanelli et al., 2021). The standards for average bread yield

must allow for the achievement of optimal bread quality within the existing technical conditions of the bakery (Drozd, 2019).

3. The broad and diverse range of recipes currently available in Poland has greater application potential in automated and robotized bakeries. With the use of appropriate technology, the proper composition of raw materials, i.e., the recipe, should ensure the intended nutritional value (Drozd et al., 2022).
4. Automation and robotization primarily ensure the repeatability and accuracy of individual production phases, which significantly affect bread quality (Hawryluk, 2019).
5. The quality of bread and the repeatability of its technological parameters are determined primarily by the knowledge and qualifications of employees, as well as by the high quality of machines and equipment (Drozd, 2019; Van der Spiegel et al., 2005). Innovations introduced into the technological process necessitate the employment of workers with appropriate qualifications to operate technological lines, robots, and machines.
6. In professional literature, the selection and stability of optimal process parameters are recognized as key factors shaping bread quality (Kamel, Stauffer, 2003). This task falls mainly to the management staff overseeing the technological process, particularly technologists.

The first group of innovations implemented in bakeries concerned technological lines.

Specialized bread production lines are currently equipped with various machines, particularly dividers or scales integrated with dividers, rounders, molders, dough piece separators, and belt conveyors. The rounder installed in the technological line gives the dough pieces a smooth surface, which, when sprayed with water, affects the bread crust. A specific microclimate is created in the dough proofing chamber, allowing the dough to "relax" and stabilize its structure. The molder gives the loaves their proper shape. The ideal synchronization of the line's operations ensures that the bread baking process occurs precisely within the specified time frame (Bejaei et al., 2021; Constantinescu, 2021).

Modern automated lines also make it possible to produce health-promoting loaves containing sourdough additives, which enhance both the flavor and aroma, as well as loaves with extended shelf life. A popular bread production line in Poland is the ICP Bread Line, which features an overhead intermediate proofer. The arrangement of machines within this line can be adapted to the spatial conditions of the bakery. Automated bread production lines, in particular, guarantee the baking of highly consistent doughs, resulting in loaves with perfect shape and that meet strict technological parameters (Drozd, 2019; Dan et al., 2018).

Producers from the Pomeranian Voivodeship have invested in specialized automated technological lines for bread production, sourced both from the Polish and international markets.

The bread production lines installed in the Pomeranian Voivodeship are high-quality specialized technical devices that enable the manufacture of a wide range of top-quality bakery products. The quality of bread is greatly influenced primarily by the gentle "handling" of the dough without damaging its structure. The dough is highly consistent, has an ideal shape, and meets strict baking parameters.

Automated lines have a modular design and mainly consist of a dough divider, molder, rounder, and intermediate proofer. Additionally, automation and production efficiency are supported (depending on the type of line) by other machines such as bowl tippers, funnels, weight controllers, conveyors (various solutions), and greasing devices. Automated bread production lines guarantee excellent results in the production of many types of bakery products, both in terms of recipes and product shape. Automation allows for the fine-tuning of line parameters by stimulating specific technological processes in bread production and optimizing changeovers in the longer term (Kotsianis et al., 2022).

Only specialized lines are used for the production of frozen dough. Frozen dough is intended for baking rolls and bread directly at the point of sale. Most large distribution chains, restaurateurs, and even convenience stores at petrol stations are moving toward the final baking of bread at the point of sale. Two delayed baking technologies are employed: one involves shock-freezing raw dough pieces and storing them frozen, while the other involves shock-freezing partially baked dough pieces, which are then finished baking later (Słowik, Staszewska, 2002).

During the dough freezing process, the development of microorganisms is inhibited; however, this requires precise cooling to produce high-quality dough that meets established bakery standards. Frozen bread does not contain preservatives or artificial colorings but is generally devoid of natural sourdough (Ocieczek et al., 2016). Despite its advantages and disadvantages, bread made from frozen dough enjoys steady demand because it provides consumers with the key attribute of freshness, identified with external appearance-crumb structure, aroma, and crust. Among the specialized lines for frozen dough production, a custom-designed line was also installed in the Pomeranian Voivodeship.

An inseparable element of every robotized technological line is the inclusion of components related to occupational safety and hygiene, in the form of so-called technological fencing (Drozd, Wolniak, 2023; Kaczmarek, Panasiuk, 2015). The primary purpose of this enclosure is to properly secure the entire robotized technological line against accidental or unauthorized access by external persons, as well as to prevent cross-contamination (Gawęcki, Roszkowski, 2010).

Cross-contamination by pathogenic agents significantly impacts food safety and public health levels and is among the most common causes of food poisoning (Adams, Moss, 2008). Robots intended for contact with food must meet high standards of occupational safety and hygiene. For example, mandatory equipment includes grippers with "soft fingers", stainless

steel connectors, emergency stop switches, and vision systems-all of which also influence the health safety of food products (Mortimore, Wallace, 2013).

The benefits of implementing robots in technological processes also extend to the reliability of machines within robotized systems, due to their increasingly faster operating speeds. This, in turn, helps ensure the timely delivery of fresh bread to the retail network (Drozd, 2019).

In Europe, the following advantages of robotization are recognized: greater flexibility of manufacturing processes, improvement of the standard and quality of food products, and enhancement of workplace safety (Cséfalvayb, Gkotsis, 2018). Robotization does not require fundamental changes to the production process but rather modifies tasks that represent "bottlenecks" within the technological process (Kaczmarek, Panasiuk, 2014).

In the bakeries of the Pomeranian Voivodeship, robots have been applied in the technological process for tasks such as loading and unloading dough from bakery ovens, palletizing and depalletizing with the use of multifunctional robots, transport to service specific machines, and controlling specific production phases (Drozd, 2019, 2020). Each implemented robotized system requires an individualized approach to the design of work and operation (Nasruddin et al., 2013).

The second group of innovations implemented in the bread technological process consisted of machines, which were assigned to specific categories. Silos are intended for the storage of the basic raw material, which is flour. Flour is delivered directly into the silos from specialized transport vehicles. Modern silos are equipped with a control system featuring scales and tensometric sensors. Thanks to the operation of such a system, a bakery has full control over flour delivery and consumption throughout the entire production cycle.

The installation of sifting systems, screens, and the hermetic sealing of storage tanks ensures high quality and cleanliness of the raw material, eliminating the presence of foreign bodies. Regular aeration of the flour (the so-called "massaging" process) creates excellent conditions for its maturation (Drozd, Wolniak, 2023). Bakeries have also invested in silos made from acid-resistant steel, intended primarily for the storage of non-standardized flour without chemical additives and enhancers. Depending on the spatial conditions, either external or internal silos are installed. Bread producers aim, whenever possible, to purchase internal silos, which, in their opinion, offer more favorable flour storage parameters (Lubczyńska, 2002). External silos, however, are exposed to changing weather conditions. The introduction of modern silo systems significantly contributes to the improvement of bread quality, mainly through the optimal aeration and loosening of flour.

Mixers with bowls represent the next group of machines within the bread technological process. After sifting, the flour is combined with other ingredients such as yeast or natural sourdough, salt, sugar, enhancers, and water, which is gradually added. Automated mixers are connected to high-precision weighing hoppers and a control computer, ensuring the consistency of raw materials and the precise execution of recipes. The water added also has a strictly controlled temperature. These procedures ensure the even combination of all dough ingredients

during the mixing, creaming, kneading, and folding stages, within a specified timeframe. Through automated control processes, excellent dough consistency and a reduction in mixing time are achieved, both of which positively impact bread quality (Sassanelli et al., 2021).

It is worth emphasizing that in modern mixers with bowls, together with auxiliary devices, the following solutions are used: variable mixing speeds to eliminate dough overheating, an optimized mixing process guaranteeing good aeration, the ability to accelerate dough development through intensive high-speed mixing with reduced yeast quantities, laser measurement of dough temperature, and the fulfillment of stringent hygiene and occupational safety standards. Manufacturers of bakery equipment also offer the integration of a linear transport system, which guarantees a high level of automation. This system enables the simultaneous management of dosing, mixing, and bowl emptying processes, allowing multiple recipes to be executed at once in different mixers (Drozd, 2020).

Dough piece proofing chambers (proofing chambers) are responsible for the resting phase of dough pieces, which significantly affects their proper rising. This production phase requires the appropriate temperature, air humidity, and proofing time. Modern proofing chambers allow for the implementation of various initial fermentation times for the dough. Inside the chamber, ideal conditions are maintained for yeast activity, ensuring that the fermentation process proceeds in a stable and repeatable manner. Furthermore, modern proofing chambers allow precise control of air humidity and temperature, with the ability to adjust conditions individually for each type of dough. Proper dough rising fundamentally influences the structure and flavor of the final product (Martinez-Monzo et al., 2022).

In the Pomeranian Voivodeship, a chamber for delayed baking has also been installed. It allows dough to be stored under optimal temperature and humidity conditions for a specified period. Thanks to this, production can be planned in advance, using ready dough for baking at the appropriate moment. Delayed baking chambers eliminate the risk of excessive or insufficient dough rising, which affects its structure, flavor, and even shelf life (Maśliński, 2008).

The functionality and reliability of bakery ovens are of great importance for maintaining a stable baking temperature, depending on the type of dough being baked (Niziński, Michalski, 2007). According to bakers, the optimal baking temperature primarily determines characteristics such as the shape, color, elasticity, aroma, flavor, and crust of the bread. Modern thermo-oil ovens are made entirely of acid-resistant steel and are designed for intensive use. They are equipped with control systems linked to computers that continuously monitor the proper operation of the devices. The construction of thermo-oil ovens ensures even temperature distribution across the heating plates, guaranteeing uniform and repeatable baking (Drozd, 2019).

In one of the bakeries, a rotary oven was installed, which is considered one of the most energy-efficient models and significantly impacts the quality of the bake (Karaszewski, 2005). The baking parameters of the dough are specific to each oven model and must, therefore,

be determined empirically for each individual unit (Ambroziak, 2002). In the Pomeranian Voivodeship, a set of automated electric ovens was also installed. This system consists of six independent baking chambers of various capacities. Each chamber is equipped with its own steaming system and control panel. The advantage of this solution is the ability to simultaneously bake a variety of pastry assortments.

In bakeries within the Pomeranian Voivodeship, a cyclothermal tunnel oven and a thermo-oil rack oven were also installed. Cyclothermal tunnel ovens are intended for the mass production of specific products and operate based on the circulation of hot air through recirculation channels, providing these ovens with a high thermal capacity (Banooni et al., 2023). Thermo-oil rack ovens are versatile and combine the advantages of rotary ovens with classic deck ovens. Gentle heat radiation, the application of air convection, and an appropriate steaming system all contribute to the continuous improvement of baking quality (Cappelli, Cini, 2021).

The operating principle of the detector is based on X-ray structural analysis. Thanks to the diffraction scattering of radiation generated by sources of ionizing radiation, a projection of the object's internal structure is produced and monitored on a screen. The X-ray detector is capable of inspecting both unpackaged bread and bread packaged in metallized foil, while simultaneously performing weight measurements (Mathanker, Weckle, 2020).

Above all, the X-ray detector enables the detection of high-density foreign bodies and contaminants such as metals, glass, stones, bones, rubber, and plastics, and it rejects contaminated bread. Additionally, certain types of X-ray detectors can identify product defects such as breakage or deformation, as well as assess bread weight, degree of filling, and shape (Gawęcki, Roszkowski, 2010). In the Pomeranian Voivodeship, high-quality X-ray detectors were also installed. The integration of X-ray detectors into technological lines contributes to food safety, improves the shape and volume of the bread, and enhances hygienic and sanitary conditions. According to the World Health Organization, the irradiation of food does not affect its safety or nutritional value (Cafarelli et al., 2022).

## 5. Summary

The functionality of modern, automated technological machine lines, implemented in the bakeries during the study period, differs significantly from technological processes controlled manually by humans. Modern machines within technological lines now fulfill tasks that were previously performed by employees and, moreover, contribute to the improvement of bread quality. Nevertheless, appropriate qualifications are necessary to operate modern machinery.

The research procedure was conducted with the aim of determining the expected impact of the innovations implemented in the technological process on the improvement of bread quality.

The analysis and evaluation of the research results were carried out within the individual groups of innovations. Among the automated technological lines for the production of bread and bakery products, in terms of improving bread quality, all three groups of factors related to the technological process should be highlighted, particularly: the repeatability and precision of individual production phases; the ability to apply appropriate raw material compositions to ensure the intended nutritional value; the ideal synchronization of the line's operation, ensuring that the baking process takes place precisely at the scheduled time; the possibility of optimizing process parameters; the elimination of human errors; the monitoring and control of technological process parameters; the protection of raw material quality through compliance with strict technological parameters; and ensuring a sufficient supply of fresh bread to the market, identified by its external characteristics such as crumb structure, aroma, and crust quality.

Specialized lines for frozen dough production, designed for baking rolls and bread at the point of sale, provide consumers with high-quality products (provided precise freezing is maintained), free of preservatives and colorants while guaranteeing freshness. In terms of bread quality, freshness is the most valued attribute by consumers. The benefits of implementing robots are primarily observed in ensuring hygienic and sanitary conditions as well as the reliability of machinery, in addition to modifying tasks that previously represented "bottlenecks" within the technological process. Moreover, the entire operational area of a robot is secured through technological barriers, which also prevent cross-contamination.

The impact of innovative machine groups, primarily automated, on the improvement of bread quality manifests itself in terms of technological and raw material factors, namely:

- Silos – providing appropriate storage conditions for the primary raw material, flour; introducing a sifting and aeration system; and ensuring direct connection to the technological machine line.
- Mixers with bowls – achieving the even incorporation of all dough ingredients within a specified time and obtaining excellent dough consistency.
- Dough piece proofing chambers – ensuring appropriate temperature, air humidity, and proofing time for the dough pieces, conditions that modern chambers can precisely deliver.
- Bakery ovens – maintaining the designated baking temperature at a stable level depending on the type of dough being baked.
- X-ray detectors – intended for the detection of foreign bodies and the rejection of contaminated bread. Some types of detectors, also installed in the Pomeranian Voivodeship, are capable of detecting product defects such as breakage or deformation.

Regardless of the specific actions undertaken to improve bread quality through the implemented innovations, it should be noted that all modern technical devices installed within the technological lines are made from high-quality smooth materials that are easy to clean and are hermetically sealed. This contributes to the reduction of dust and flour particle contamination, thereby improving hygienic and sanitary conditions in bakeries.

The attempt undertaken in this article to determine the impact of implemented innovations on the improvement of bread quality indicates that the technological innovations introduced have had a noticeable and positive effect on the enhancement of bread quality across all groups covered by the study, benefiting both producers and consumers.

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# ANALYSIS OF CHANGES IN SOCIAL ATTITUDES OF YOUNG PEOPLE BASED ON THE EXAMPLE OF PARTICIPATION IN RELIGION CLASSES

Radosław WOLNIAK[1*], Bożena SKOTNICKA-ZASADZIEŃ[2]

[1] Silesian University of Technology, Faculty of Organization and Management; Radoslaw.wolniak@polsl.pl, ORCID: 0000-0003-0317-9811
[2] Silesian University of Technology, Faculty of Organization and Management; bozena.skotnicka@polsl.pl, ORCID: 0000-0003-1717-304X
* Correspondence author

**Purpose:** In Poland, changes are taking place in the perception of the church by young people, and this is visible in the reluctance of young people to attend religious education classes. This article attempts to analyze and evaluate the attendance of young people in religious education classes. In the present times, young people leaving the church is one of the factors of the ongoing social changes.
**Design/methodology/approach**: The publication utilized data on the religious attendance index in Poland across dioceses for the years 2018-2023 (six years) for individual dioceses. The publication analyzed data on the religious attendance index for the whole of Poland and for each of the 41 existing dioceses. Indices for different types of schools were also analyzed, including preschools, primary schools, general secondary schools, and technical schools. The raw data was sourced from the mentioned sources. Data on religious education in schools was provided by the Commission for Catholic Education of the Polish Episcopal Conference (KEP). The data was analyzed using Excel spreadsheets. Based on the data, indicators such as changes in the religious attendance indicator between two consecutive years and the changes in religious attendance index in individual dioceses for the years 2018-2023 were calculated.
**Findings:** The analysis showed The analysis showed that there is a systematic decrease in the number of people participating in religious education classes in both primary and secondary schools in Poland. Based on the conducted analysis, it can be observed that among Polish children and youth, religious education classes are progressively becoming less popular.
**Research limitations/implications**: The limitations of qualitative research are the relatively small sample size and lack of representativeness. A natural continuation of the research may be the quantitative verification of identified dysfunctions and their sources.
**Practical implications:** In the article, based on the data, markers such as the change in the attendance rate in religion classes between subsequent years and the changes in attendance in religion classes in various types of schools in Poland in the years 2018-2022, divided into individual dioceses, were calculated. These studies showed how to change in the case of religion among children and youth on various educational topics.
**Social implications:** Understanding the factors that influence changes in the attitude of young people in Poland towards the church, indicating the causes of this phenomenon and proposing actions for improvement.

**Originality/value:** The article contributes to expanding knowledge about social changes caused by the decreasing interest of young people in the church and willingness to participate in religious education classes both in the whole country and in individual dioceses.
**Keywords:** religious attendance, Catholic Church, religious education, religious education, Poland.
**Category of the paper:** Research paper.

## 1. Introduction

In recent years, across Europe, including Poland, there has been a significant decline in the importance of religious life, especially among young people. This is linked to the ongoing process of secularization throughout Western Europe and the changing attitudes towards matters of faith and spirituality, as highlighted by J. Mariański in his articles (Mariański, 2021; Mariański, 2014). According to this author, the declaration of belonging to a religious group is an external indicator of religiosity (Mariański, 2014). Among older people in Poland, the declaration of belonging to a religious group and the declaration of attitudes towards religious institutions and the church remain high, with these individuals fully identifying with religion and the Roman Catholic Church (Mariański, 2014). However, the identification rate with religious affiliation is significantly lower among youth, especially in secondary schools. Young people do not identify with the Catholic Church, do not see a place for themselves within it, and reject its religious and moral doctrine (Urbańska, 2021). This attitude among young people leads to an increasing number of them opting out of religion classes. As evidenced by sociological research, this is currently a growing trend (Jedynak, 2019; Kućko, 2019).

Therefore, it is important to identify the percentage of young people opting out of religion classes, broken down by types of schools and individual dioceses in Poland. Considering these aspects, the following research questions are posed in this article:

- How has the religious education attendance index in Poland changed from 2018 to 2023?
- What are the differences in the religious education attendance index between individual Polish dioceses, and what are the reasons for these differences?
- What differences in the religious education attendance index exist between different types of schools?

The answers to the research questions posed in the article and the analysis of youth participation in religion classes at different educational stages will provide the opportunity to identify problems and actions that need to be taken to prevent the issue of opting out of religion classes, and consequently the declaration of belonging to the Catholic Church, from worsening.

## 2. Literature review

In contemporary Poland, a process of secularization is evident, which is associated with a significant decline in the number of people participating in religious practices. A considerable number of Poles are increasingly declaring weaker Catholic convictions and are less involved in the life of the Catholic Church. This trend has intensified over the past twenty years, while in Western European countries it has been occurring for the past sixty years (Kućko, 2019). Sociologists consider the transformations in religiosity and the decline in the number of people declaring belonging to the Catholic Church from two perspectives. The first perspective relates this to the transformation, i.e., the integration with Western countries and the adoption of Western European patterns of religious life, as noted by M. Grabowska (Grabowska, 2018). According to the author, the Polish Church has undergone a socio-cultural shift and an unfavorable change in views on religiosity and the Church, especially among the youth (Grabowska, 2018). The second perspective, according to sociologists, is the rapid radical social secularization and the beginning of a secular era, particularly in Western Europe (Kućko, 2019; Grabowska, 2018). It seems that the second perspective, in which we would have a secular era, is less likely.

The issue of departing from the Catholic Church and the decline in religiosity is particularly visible among the youth, both in Western Europe and in Poland. Among Polish youth, there is a significant trend related to the loss of importance of traditional forms of religiosity and the weakening role of moral norms in the daily lives of young Poles, as researchers point out in their studies (Adamczyk, 2023; Dziedzic, 2016; Zellma et al., 2022; Sowa-Behtane, 2020). These authors express the view that the future of religiosity in our country depends on the state and degree of religious education. It is very important that religious education in schools is delivered in an engaging manner for both younger children and teenagers. The Catholic Church should particularly care for the youngest generations of Poles, as they will shape and influence the Polish Church (Sowa-Behtane, 2020; Kiełb et al., 2021; Szymczak et al., 2022; Boguszewski et al., 2019). This is especially important in the face of increasingly weakening public trust in the Church and the rapid secularization of young Poles in recent years (Szymczak et al., 2022). Sociological studies indicate that more and more young people declare themselves as non-believers, about 17% in 2018, and religiously indifferent, about 21% (Szymczak et al., 2022; Boguszewski et al., 2019). Unfortunately, the departure of youth from the Church is increasing, and it is also associated with opting out of religion classes, especially in secondary schools. This is a process that is growing year by year in Polish schools (Kaźmierska, 2023; Mąkosa et al., 2022; Horawski, 2022).

## 3. Research methodology

The publication utilized data on the religious attendance index in Poland across dioceses for the years 2018-2023 (six years) for individual dioceses. The research employed data from the Polish Institute of Catholic Church Statistics (Instytut Statystyki Kościoła Katolickiego SAC, 2018, 2019, 2020, 2021, 2022). In recent years, there have been significant changes in the level of religiosity in Poland, which, particularly in large cities, is declining. These changes are evident, for example, in the dominicantes index (Wolniak et al., 2023) and overall participation in religious practices, which may suggest that they could also affect children's participation in religion classes at school A diocese (latin: *dioecesis*) is defined as a territorial unit in the Western Church managed by a bishop; it forms part of an ecclesiastical province (metropolis) and is directly subject to the pope; it has legal personality. A diocese comprises deaneries and parishes.

The publication analyzed data on the religious attendance index for the whole of Poland and for each of the 41 existing dioceses. Indices for different types of schools were also analyzed, including preschools, primary schools, general secondary schools, and technical schools. The raw data was sourced from the mentioned sources (Instytut Statystyki Kościoła Katolickiego SAC, 2018, 2019, 2020, 2021, 2022). Data on religious education in schools was provided by the Commission for Catholic Education of the Polish Episcopal Conference (KEP). The data was analyzed using Excel spreadsheets. Based on the data, indicators such as changes in the religious attendance indicator between two consecutive years and the changes in religious attendance index in individual dioceses for the years 2018-2023 were calculated.

## 4. Religious education attendance indicator analysis

In Figure 1, data on the number of students attending religion classes in Poland from 2019 to 2023 is presented, while Figure 2 shows the percentage changes in this regard for each of the years studied. The data indicates that over the past few years, the percentage of students attending religion classes in school has been decreasing annually. In the 2018/2019 school year, 88% of students attended religion classes; in 2019/2020, it was 87.6%; in the following year, 86.7%; then 85.7% in 2021/2022; and in the last school year, 2022/2023, the studied index reached its lowest level in history at 80.3%.

Analyzing the annual percentage changes, it is evident that the phenomenon has accelerated in the last two years. Particularly, the largest decrease in the number of students attending religion classes was observed in the 2021/2022 school year, which was 3.3%. In the last school year, 2022/2023, the decline was 2.1%. In none of the studied years was there an increase in the percentage of students attending religion classes in school.

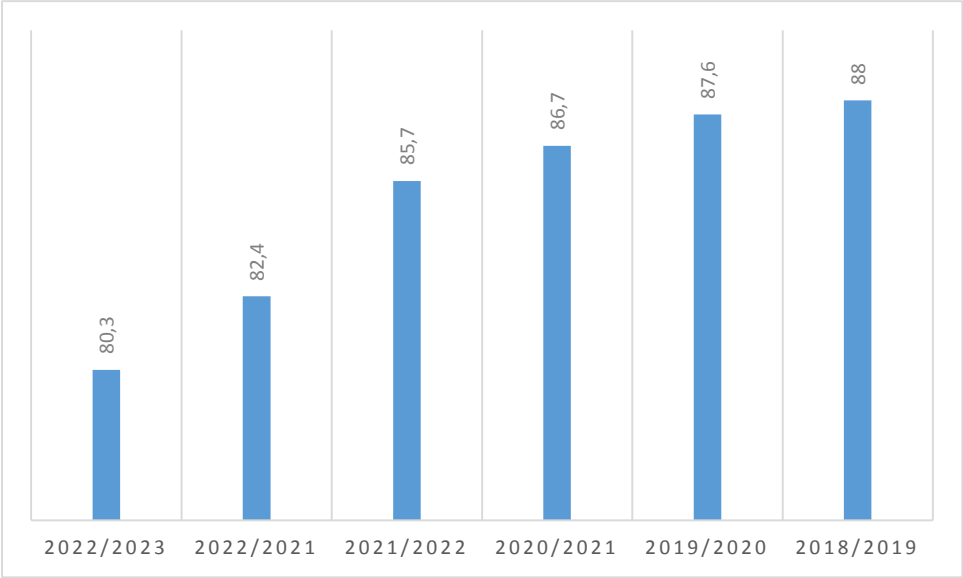



**Figure 1.** Religious education attendance in Poland [%].

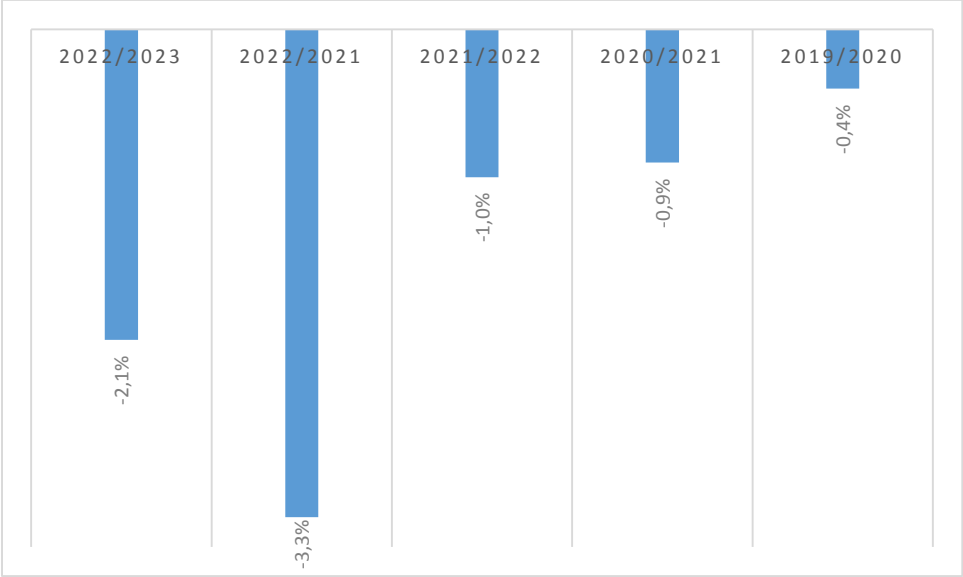



**Figure 2.** Year to year changes of religious education attendance in Poland [%].

The observed trends are concerning for the Catholic Church in Poland. Their causes are complex and multifaceted. Firstly, it is worth noting that an increasing number of Poles identify as non-believers or agnostics. The rise in religious awareness and the search for alternative spiritual paths influence parents' decisions to withdraw their children from religion classes (Grabowska, 2021). Secularization trends appear to be one of the main factors affecting the decrease in the percentage of students attending religion classes. As civilization progresses and social changes occur, more people may abandon traditional religious practices, and worldview values are becoming more diverse (Grabowska, 2021).

Similar trends can be observed worldwide and have been visible in many countries since the 20th century. The changing preferences of the younger generation are a significant element of this phenomenon. The new generation may show less interest in religion classes at school

than previous generations, seeking alternative forms of spirituality or abandoning religious practices in favor of more individual searches (Konczal, 2023).

The influence of the family and cultural environment is crucial. The cultural environment, particularly peers and the Internet, can shape attitudes and preferences related to participation in such classes. The new generation exhibits less interest in religion classes, which may be related to the search for alternative forms of spirituality or the abandonment of religious practices in favor of more individual searches. This poses a challenge for the Church in attracting the younger generation.

According to P. Mąkosa (2022), the greatest challenge in religious education today is secularization and practical atheism, affecting both parents and their children. This is happening because, especially in large cities, religious values are increasingly rarely transmitted within the family in contemporary times. This has many consequences for the faith and religiosity of the younger generation. It strongly impacts religious education, particularly in the confessional and catechetical-evangelical approach. There is also a noticeable lack of coordination in catechetical activities by the Polish Catholic Church in this regard.

Table 1 presents data on the religious education attendance indicator in Poland, divided by individual dioceses over the studied years. An analysis of the data on participation in religion classes in Polish dioceses from 2018 to 2023 reveals significant variability in the percentages of students attending these classes across different dioceses. The 2022/2023 school year shows lower indices compared to previous years, not only in aggregate data but also for the majority of dioceses.

In most dioceses, a decrease in attendance at religion classes was observed from 2018 to 2023. This decline is most evident in the dioceses of Wrocław (from 87.3% to 63.4%), Gdańsk (from 85.3% to 69.4%), and Łódź (from 77.7% to 65.4%). However, there are a few exceptions. For example, the dioceses of Sandomierz, Przemyśl, and Tarnów show high and stable attendance rates, which may be due to the strong entrenchment of religious traditions in these communities.

The dioceses with the highest attendance in 2023 include Przemyśl (96.5% in 2022), Tarnów (96.3%), Rzeszów (94.9%), Radom (94.6%), Łomża (94.1%), and Kalisz (91.5%). In all these dioceses, attendance has remained high for years. Conversely, dioceses such as Warsaw (59.8% in 2023), Warsaw-Praga (66.9%), and Opole (63.4%) show the lowest percentage of students attending religion classes. This may be associated with a higher degree of secularization in these societies, changing attitudes towards the Church, and the influence of pastoral activities.

Analyzing the data, it can be noted that, generally, in the eastern, and particularly southeastern, dioceses of Poland, the religious education attendance indicator is higher compared to western dioceses. This is because Eastern Poland has stronger religious traditions dating back to the pre-partition era. The Catholic Church played an important role in shaping national identity there. Historically, the region has been closely linked to the Catholic Church.

The level of religiosity is higher there than in other parts of the country, which translates into greater parental involvement in their children's religious education. The Catholic Church plays a crucial role in the social and cultural life of southeastern Poland. Parishes are often centers of local communities, and priests enjoy significant authority. In some southeastern communities, there is social pressure for children to attend religion classes. Parents who do not enroll their children in these classes may face criticism from other community members.

However, it is worth noting that in recent years, there has also been a slight decrease in the percentage of children attending religion classes in southeastern Poland. This is linked to the overall decline in religiosity in Poland, as well as increased parental awareness of their rights regarding their children's religious education.

**Table 1.**
*Religious education attendance in Poland in dioceses in years 2018-2023 [%]*

| The Diocese | 2022/2023 | 2022/2021 | 2021/2022 | 2020/2021 | 2019/2020 | 2018/2019 |
|---|---|---|---|---|---|---|
| białostocka | 75.4 | 77.4 | 80.6 | 89.5 | 92.6 | 85.4 |
| bielsko-żywiecka | 83 | 82.6 | 84.6 | 87.5 | 90.6 | 88.4 |
| bydgoska | 81.9 | 74.9 | 83.6 | 84.7 | 88.4 | 89.4 |
| częstochowska | 86.8 | 90.3 | 91.4 | 90.3 | 92.6 | 94.3 |
| drohiczyńska | 84.9 | 84.9 | 93.7 | 90.8 | 89.8 | 92.9 |
| elbląska | 82.5 | 83.8 | 86.6 | 87.5 | 89.2 | 90.1 |
| ełcka | 87.7 | 86.6 | 87.5 | 87.7 | 87.5 | 91.7 |
| gdańska | 69.4 | 77.2 | 80.7 | 80.9 | 80.8 | 85.3 |
| gliwicka | 74.7 | 80.6 | 83.5 | 83.5 | 83.8 | 83 |
| gnieźnieńska | 69.5 | 72.9 | 74.1 | 80.6 | 84 | 86.4 |
| kaliska | 91.5 | 92 | 93.6 | 93.7 | 93.8 | 93.7 |
| katowicka | 82.4 | 84.8 | 85.7 | 88.6 | 88.5 | 90 |
| kielecka | 88.4 | 93.3 | 93.1 | 93.1 | 93.3 | 89.1 |
| koszalińsko-kołobrzeska | 73.8 | 76.2 | 83.9 | 84.7 | 85.1 | 94 |
| krakowska | 82.9 | 85.6 | 87.2 | 87.1 | 87.4 | 92.3 |
| legnicka | 69.2 | 77.3 | 83.7 | 84 | 85 | 87.1 |
| lubelska | 87.6 | 89.7 | 90.7 | 91.2 | 91.8 | 93.9 |
| łomżyńska | 94.1 | 95.2 | 92.9 | 93.7 | 94.1 | 96.5 |
| łowicka | 82.7 | 87.2 | 87.1 | 87.3 | 87.8 | 96.5 |
| łódzka | 65.4 | 70.8 | 75.6 | 75.7 | 76.2 | 77.7 |
| opolska | 63.4 | 77.4 | 84.8 | 84.9 | 86.5 | 93.8 |
| pelplińska | 88.2 | 83.4 | 94.8 | 96.4 | 99.2 | 99 |
| płocka | 86.5 | 86.7 | 86.5 | 86.7 | 93.6 | 95 |
| poznańska | 78.2 | 81.6 | 82.3 | 81.9 | 80.3 | 82.4 |
| przemyska | 96.5 | 97.3 | 97.6 | 97.8 | 97.9 | 98.6 |
| radomska | 94.6 | 93.6 | 94.6 | 95.2 | 95.7 | 96.8 |
| rzeszowska | 94.9 | 95.9 | 97.1 | 97.6 | 97.9 | 99 |
| sandomierska | 91.4 | 92.7 | 86.2 | 87.3 | 88.1 | 92 |
| siedlecka | 92.2 | 94.9 | 96 | 96.9 | 97.2 | 98.4 |
| sosnowiecka | 79.8 | 81.2 | 85 | 85.6 | 80.8 | 75.2 |
| szczecińsko-kamieńska | 67.4 | 69.6 | 80.5 | 79.9 | 79.5 | 85.2 |
| świdnicka | 77.5 | 80.9 | 82 | 81.3 | 83.5 | 87.5 |
| tarnowska | 96.3 | 97.5 | 97.8 | 96.8 | 95.9 | 97.3 |
| toruńska | 79 | 83.6 | 88.5 | 88.6 | 89.4 | 91 |
| warmińska | 76.5 | 78.8 | 74.4 | 75.5. | 70 | 79.4 |
| warszawska | 59.8 | 66.2 | 69.5 | 70.6 | 76 | 74.8 |
| warszawsko-praska | 66.9 | 70.6 | 75.6 | 76.7 | 82.8 | 84.6 |
| włocławska | 85.5 | 89.4 | 91 | 91.1 | 91.1 | 95 |

Cont. table 1.

| | | | | | | |
|---|---|---|---|---|---|---|
| wrocławska | 68 | 63.4 | 65.7 | 69.9 | 73.2 | 87.3 |
| zamojsko-lubaczowska | 87.4 | 93.7 | 94.7 | 93.4 | 92.1 | 96.6 |
| zielonogórsko-gorzowska | 78.9 | 82 | 85.7 | 85.9 | 86.9 | 83.1 |
| TOTAL | **80.3** | **82.4** | **85.7** | **86.7** | **87.6** | **88** |

Source: on the basis of (Instytut Statystyki Kościoła Katolickiego SAC, 2018, 2019, 2020, 2021, 2022).

In Table 2, data concerning the changes in the religious education attendance index in Poland between the surveyed years, as well as between the year 2018 and 2023, is presented. Throughout the entire period under study, the largest decline in school religious education attendance occurred in dioceses such as Opole (-30.4%), Koszalin-Kołobrzeg (-20.2%), Szczecin-Kamień (-17.8%), Wrocław (-19.3%), and Warsaw-Praga (-17.7%). The smallest decline in religious education attendance during the surveyed years was observed in the following dioceses: Sandomierz (-0.6%), Kielce (-0.7%), Tarnów (-1%), Przemyśl (-2.1%), Kalisz (-2.2%), and Łomża (-2.4%). The only diocese where an increase in the religious education attendance index was recorded during the surveyed years was the Sosnowiec diocese (4.6%). Despite occasionally minor increases in individual dioceses in a given year, a clear downward trend is evident across all dioceses except Sosnowiec (which maintains a relatively low index level).

**Table 2.**

*Changes in religious education attendance in Poland in dioceses in years 2018-2023 [%]*

| The Diocese | 2022/2023 | 2022/2021 | 2021/2022 | 2020/2021 | 2019/2020 | 2018-2023 |
|---|---|---|---|---|---|---|
| białostocka | -2.0% | -3.2% | -8.9% | -3.1% | 7.2% | -10.0% |
| bielsko-żywiecka | 0.4% | -2.0% | -2.9% | -3.1% | 2.2% | -5.4% |
| bydgoska | 7.0% | -8.7% | -1.1% | -3.7% | -1.0% | -7.5% |
| częstochowska | -3.5% | -1.1% | 1.1% | -2.3% | -1.7% | -7.5% |
| drohiczyńska | 0.0% | -8.8% | 2.9% | 1.0% | -3.1% | -8.0% |
| elbląska | -1.3% | -2.8% | -0.9% | -1.7% | -0.9% | -7.6% |
| Ełcka | 1.1% | -0.9% | -0.2% | 0.2% | -4.2% | -4.0% |
| gdańska | -7.8% | -3.5% | -0.2% | 0.1% | -4.5% | -15.9% |
| gliwicka | -5.9% | -2.9% | 0.0% | -0.3% | 0.8% | -8.3% |
| gnieźnieńska | -3.4% | -1.2% | -6.5% | -3.4% | -2.4% | -16.9% |
| Kaliska | -0.5% | -1.6% | -0.1% | -0.1% | 0.1% | -2.2% |
| katowicka | -2.4% | -0.9% | -2.9% | 0.1% | -1.5% | -7.6% |
| kielecka | -4.9% | 0.2% | 0.0% | -0.2% | 4.2% | -0.7% |
| koszalińsko-kołobrzeska | -2.4% | -7.7% | -0.8% | -0.4% | -8.9% | -20.2% |
| krakowska | -2.7% | -1.6% | 0.1% | -0.3% | -4.9% | -9.4% |
| legnicka | -8.1% | -6.4% | -0.3% | -1.0% | -2.1% | -17.9% |
| lubelska | -2.1% | -1.0% | -0.5% | -0.6% | -2.1% | -6.3% |
| łomżyńska | -1.1% | 2.3% | -0.8% | -0.4% | -2.4% | -2.4% |
| łowicka | -4.5% | 0.1% | -0.2% | -0.5% | -8.7% | -13.8% |
| łódzka | -5.4% | -4.8% | -0.1% | -0.5% | -1.5% | -12.3% |
| opolska | -14.0% | -7.4% | -0.1% | -1.6% | -7.3% | -30.4% |
| pelplińska | 4.8% | -11.4% | -1.6% | -2.8% | 0.2% | -10.8% |
| płocka | -0.2% | 0.2% | -0.2% | -6.9% | -1.4% | -8.5% |
| poznańska | -3.4% | -0.7% | 0.4% | 1.6% | -2.1% | -4.2% |
| przemyska | -0.8% | -0.3% | -0.2% | -0.1% | -0.7% | -2.1% |
| radomska | 1.0% | -1.0% | -0.6% | -0.5% | -1.1% | -2.2% |
| rzeszowska | -1.0% | -1.2% | -0.5% | -0.3% | -1.1% | -4.1% |
| sandomierska | -1.3% | 6.5% | -1.1% | -0.8% | -3.9% | -0.6% |

Cont. table 2.

| | | | | | | |
|---|---|---|---|---|---|---|
| siedlecka | -2.7% | -1.1% | -0.9% | -0.3% | -1.2% | -6.2% |
| sosnowiecka | -1.4% | -3.8% | -0.6% | 4.8% | 5.6% | 4.6% |
| szczecińsko-kamieńska | -2.2% | -10.9% | 0.6% | 0.4% | -5.7% | -17.8% |
| świdnicka | -3.4% | -1.1% | 0.7% | -2.2% | -4.0% | -10.0% |
| tarnowska | -1.2% | -0.3% | 1.0% | 0.9% | -1.4% | -1.0% |
| toruńska | -4.6% | -4.9% | -0.1% | -0.8% | -1.6% | -12.0% |
| warmińska | -2.3% | 4.4% | -1.1% | 5.5% | -9.4% | -2.9% |
| warszawska | -6.4% | -3.3% | -1.1% | -5.4% | 1.2% | -15.0% |
| warszawsko-praska | -3.7% | -5.0% | -1.1% | -6.1% | -1.8% | -17.7% |
| włocławska | -3.9% | -1.6% | -0.1% | 0.0% | -3.9% | -9.5% |
| wrocławska | 4.6% | -2.3% | -4.2% | -3.3% | -14.1% | -19.3% |
| zamojsko-lubaczowska | -6.3% | -1.0% | 1.3% | 1.3% | -4.5% | -9.2% |
| zielonogórsko-gorzowska | -3.1% | -3.7% | -0.2% | -1.0% | 3.8% | -4.2% |
| TOTAL | **-5.4%** | **-4.3%** | **-1.9%** | **-1.3%** | **87.6%** | **-7.7%** |

Source: on the basis of (Instytut Statystyki Kościoła Katolickiego SAC, 2018, 2019, 2020, 2021, 2022).

Tables 3 and 4 present data on the religious education attendance index categorized by school types for the years 2018-2023. Table 4 specifically includes data on changes in this index over successive years and throughout the entire study period. The data reveals that the highest values of the religious education attendance index in Poland are observed in primary schools (88.9% for the school year 2022/2023) and preschools (83.7%). This index is significantly lower in secondary schools, with 60.1% in general high schools (liceums) and 65.7% in technical schools (technika).

Analyzing the changes in the index from 2018 to 2023, it is evident that the index decreased across all types of schools, with the smallest decline observed in preschools (-1.2%) and primary schools (-5.3%). The largest decline in the religious education attendance index from 2018 to 2023 occurred in secondary schools, where the index dropped by 20.7%. In the school year 2018/2019, there were fewer students attending religious education classes in general high schools as well, but the difference compared to primary schools was smaller at 13.6%. This difference increased over the years and currently stands at 28.8%.

In Poland, significant differences are noticeable concerning general high schools (liceums). Some areas maintain a high percentage of students attending catechesis, around 90-91%, while in other areas, this drops to 34-36%. Typically, technical schools (technika) have a higher participation rate in religious classes compared to general high schools (Konczal, 2023). For example, in Szczecin, only one in ten students attends religious education classes in post-primary schools, whereas in primary schools, this number reaches half of the students, indicating a significant decline (Kaczmarek, 2023).

According to CBOS research, the Church may bear partial responsibility for the abandonment of religious practices by people. Detailed research results indicate that the institutional church and clergy, especially concerning young people, provoke negative reactions. This stems from specific actions of clergy in public spaces and interpersonal relations, such as exclusion from religious classes or unfair treatment during confirmation. Personal negative experiences and environmental observations, reinforced by media reports,

have contributed to the formation of general attitudes of distance and reluctance in some communities towards the Church. This is particularly evident among students in secondary schools who have a greater influence on decisions regarding participation in catechesis (Stodolny, 2023).

**Table 3.**
*Religious education attendance in Poland in dioceses in years 2018-2023 – types of schools [%]*

| The Diocese | 2022/2023 | 2022/2021 | 2021/2022 | 2020/2021 | 2019/2020 | 2018/2019 |
|---|---|---|---|---|---|---|
| Kindergarten | 83.7 | 82.9 | 85.5 | 84.1 | 84.8 | 84.9 |
| Primary school | 88.9 | 90.2 | 92.1 | 93.1 | 94.1 | 94.2 |
| Liceums | 60.1 | 63.2 | 68.8 | 72.3 | 75.3 | 80.8 |
| Technika | 65.7 | 68.5 | 74.6 | 75.6 | 76.77 | 81.6 |

Source: on the basis of (Instytut Statystyki Kościoła Katolickiego SAC, 2018, 2019, 2020, 2021, 2022).

**Table 4.**
*Changes in religious education attendance in Poland in dioceses in years 2018-2023 – types of schools [%]*

| The Diocese | 2022/2023 | 2022/2021 | 2021/2022 | 2020/2021 | 2019/2020 | 2018-2023 |
|---|---|---|---|---|---|---|
| Kindergarten | 0.8% | -2.6% | 1.4% | -0.7% | -0.1% | -1.2% |
| Primary school | -1.3% | -1.9% | -1.0% | -1.0% | -0.1% | -5.3% |
| Liceums | -3.1% | -5.6% | -3.5% | -3.0% | -5.5% | -20.7% |
| Technika | -2.8% | -6.1% | -1.0% | -1.2% | -4.8% | -15.9% |

Source: on the basis of (Instytut Statystyki Kościoła Katolickiego SAC, 2018, 2019, 2020, 2021, 2022).

The Catholic Church can counteract the decline in the number of students attending religious education classes in Poland by adapting its message to the changing society. It can focus on a more open and flexible approach to teaching, taking into account ideological diversity. Furthermore, the Church can actively engage in dialogue with youth, listening to their needs and thoughts. Supporting moral and ethical education, not necessarily based solely on religious doctrines, can also contribute to young people's interest in values and spirituality. It is also crucial to respond to social challenges such as scandals and controversies with transparency, accountability, and actions aimed at restoring public trust. Lastly, the Church can invest in modern teaching methods to make religious education classes more interactive and appealing to the younger generation.

## 5. Conclusion

In the article, based on the data, indicators such as changes in the religious education attendance indicator between consecutive years and the changes in religious education attendance in different types of schools in Poland for the years 2018-2022, broken down by individual dioceses, were calculated.

Analyzing the changes in the indicator from 2018 to 2023, it can be observed that the indicator decreased in all types of schools analyzed, with the smallest decline noted for preschools (-1.2%) and primary schools (-5.3%). The largest decline in the religious education attendance indicator from 2018 to 2023 was recorded in secondary schools, where the indicator dropped by 20.7%. In the school year 2018/2019, there were also fewer students attending religious education classes in general high schools, but the difference compared to primary schools was not as significant, at only 13.6%. This difference increased over the years and currently stands at 28.8%.

Regarding participation in religious education classes in individual dioceses, decreases in attendance were also noted. Throughout the entire study period, the greatest decline in religious education attendance occurred in dioceses such as Opole (-30.4%), Koszalin-Kołobrzeg (-20.2%), Szczecin-Kamień (-17.8%), Wrocław (-19.3%), and Warsaw-Praga (-17.7%). The smallest decline in attendance during the surveyed years was observed in dioceses such as Sandomierz (-0.6%), Kielce (-0.7%), Tarnów (-1%); Przemyśl (-2.1%), Kalisz (-2.2%), and Łomża (-2.4%). The only diocese where an increase in the religious education attendance indicator was observed during the surveyed years was the Sosnowiec diocese (4.6%).

In summary, it must be stated that there is a systematic decrease in the number of people participating in religious education classes in both primary and secondary schools in Poland. Based on the conducted analysis, it can be observed that among Polish children and youth, religious education classes are progressively becoming less popular (Zaburzycka-Maciąg, 2021; Zellma, 2021). These analyses are consistent with studies presented by Rev. Paweł Mąkosa, who noted the largest decline in students attending religious education classes in high schools, with attendance ranging from 34-36% to around 60%. According to Rev. P. Mąkosa, the systematic decrease in participants of religious education classes among youth has been ongoing since 2010, and in the past three years, this process has accelerated significantly, especially with numerous resignations from religious education classes by secondary school students (Mąkosa, 2022).

Among children from primary schools, the number of those opting out of religious education classes is lower, especially in younger classes. Children in grades 1-3, before their First Holy Communion, form the largest group attending religious education classes. In older grades, although the participation is slightly lower, it remains significantly higher than in post-primary schools, possibly influenced by the fact that in the final year of primary school and the first year of high school, students undergo Confirmation. As observed, the highest number of children and youth attend religious education classes in classes preparing for First Holy Communion and Confirmation, as according to the adopted teaching model in Polish schools, these classes are intended to prepare students for receiving the sacraments.

The article also analyzed the participation of children and youth in religious education classes in individual dioceses in Poland. In his research, Rev. M. Mąkosa (similarly to the analysis presented in this article) pointed out that the highest percentage of students attending

religious education classes was recorded in dioceses of southeastern Poland, such as the Dioceses of Przemyśl, Tarnów, and Rzeszów. The lowest percentages were found in dioceses like Warsaw, Opole, and Łódź. These findings correspond with attendance at religious ceremonies, specifically Sunday Masses and holidays. The highest participation in Masses is observed in the southeastern part of Poland, while the lowest is in the central and southwestern regions (Mąkosa, 2022).

There is a need to consider why youth are opting out of religious education classes in such large numbers. The main reasons cited by youth include scheduling religious education classes as either the first or last lesson, a lack of identification with Catholicism and Christianity among youth, family factors, and environmental influences. Studies in the literature on the religiosity of youth clearly indicate that Polish youth are distancing themselves from the Church, and the current model of religious education in Poland is not fulfilling its role (Kiełb et al., 2023). Currently, Poland is one of the countries in Europe where the process of secularization is occurring rapidly, especially among young people and teenagers, and even among children in the final grades of primary school.

Looking at the results presented in the analysis, it is evident that the Church in Poland faces a challenge with the decreasing percentage of participants in religious education classes, especially in secondary schools, each year. It seems that the proposed changes in catechesis teaching in Poland by D. Kiełb, M. Pierzchała, and M. Gazda could reduce or even halt the decline of youth participation in religious education classes (Kiełb et al., 2023). These authors propose a model of religious education similar to those in Italy or Great Britain, where religious education focuses on imparting knowledge, and catechesis and evangelization are handled by the parish (Kiełb et al., 2023; Grondek, 2024).

It is certain that the current model of religious education in Polish schools must change to become more interesting and inclusive of all world religions for students. However, this requires reform in the Polish educational system and may be challenging due to religious homogeneity and the dominance of the Catholic Church in Poland, as noted by P. Mąkosa as early as 2015 in his article (Mąkosa, 2015).

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# FROM VISION TO REALITY: WHAT SHAPES THE FUTURE OF AUTONOMOUS PUBLIC TRANSPORT IN BIAŁYSTOK

Natalia ZAZULKA

Bialystok University of Technology; natalia.zazulka@pb.edu.pl, ORCID: 0009-0004-0532-0879

**Purpose:** The purpose of this article is to analyze the possibility of implementing autonomous vehicles in Bialystok.
**Design/methodology/approach**: The first phase of study focused on a critical analysis of the literature and a case study on the example of Bialystok. Then a diagnostic survey method, supported by the CAWI (Computer Assisted Web Interview) technique, was used to obtain data from users of Bialystok's public transportation. In addition, a statistical analysis of the survey results was undertaken to identify correlations between respondents' answers
**Findings:** The study showed that there is a possibility for the implementation of autonomous buses in Bialystok. However, in order for the implementation to be effective, it is necessary to analyze and modernize the current urban infrastructure, as well as raise public awareness and education about autonomous vehicles.
**Research limitations/implications**: The study is based on a diagnostic survey method, while it would be interesting for future research to use more elaborate statistical methods to deepen the analysis, for example identifying the profiles of potential users of autonomous vehicles.
**Practical implications:** Autonomous buses can impact the positive perception of public transportation and improve the frequency of public transportation use, but requires an analysis of the current state and appropriate regulations.
**Social implications:** Successful implementation of autonomous buses in Bialystok can help improve the residents' quality of life, travel comfort and even change habits by choosing public transportation more often than cars.
**Originality/value:** The study presents an analysis of the current state of public transportation in Bialystok and verifies users' opinions on autonomous vehicles, offering value to researchers and practitioners planning to analyze the conditions for implementing sustainable and intelligent mobility in cities.
**Keywords:** urban transportation, autonomous buses, smart urban mobility, sustainable urban mobility.
**Category of the paper:** Research paper.

## 1. Introduction

The rapid development of technology observed in recent years has greatly affected many different areas of daily life, including public transportation (Gohar, Nencioni, 2021). One of the most popular trends in this sector is autonomy and sustainability, which are closely related to the concept of smart and sustainable urban mobility (Herdiansyah, 2023). The goal of both ideas is not only to improve transportation, but also to minimize negative environmental impacts and adapt the city's infrastructure primarily to the needs of residents, but also to the constantly changing standards of modern and smart cities (Mach, Skrzypek, 2019).

It is true that modern cities are changing at a rapid enough pace to keep up with new technologies and call themselves the smart cities of modern times. A key element of these transformations is the development of urban mobility, so as to effectively face the new challenges of urbanization of cities, minimizing congestion, improving safety and protecting the environment (Mouratidis, Serrano, 2021).

One of the technological developments that are contributing to the modernization of urban development strategies in the transportation field is autonomous vehicles. Focusing on public transportation vehicles, one increasingly hears about autonomous buses. These driverless vehicles, capable of driving themselves without a driver, have great potential to revolutionize the way cities get around (Banach, 2020). This is already seen in more than a dozen cities in Europe and around the world that decided to test this means of transportation, such as Helsinki, Oslo and Stockholm (Olivier Wyman Forum, 2023).

An interesting example of a place where autonomous buses could be implemented is Bialystok, a city located in the northeastern part of Poland, which is the capital of the Podlaskie Voivodeship. On the one hand, the city remains open to innovation, as evidenced by its investment in a Traffic Management System or expansion of its electric bus fleet (Oficjalny Portal Miasta Białystok, 2025). On the other hand, residents of Bialystok may have a variety of opinions on such innovative solutions as driverless buses. Before deciding on implementation, it's worth studying public opinion, as residents will be the daily users of autonomous buses if the city finally decides to implement. In addition, the implementation of autonomous buses could help eliminate a problem in Bialystok of a deficit of bus drivers and a lack of applicants for this position (Barometr Zawodów, 2025).

Therefore, the purpose of this article is to analyze the possibility of implementing autonomous buses in Bialystok. The study will analyze the current situation of Bialystok's public transportation, as well as the opinion of residents about autonomous vehicles. The results of the analysis will indicate what steps should be taken to effectively implement autonomous buses in public transportation in the city of Bialystok.

# 2. Literature review

## 2.1. Concept of sustainable and smart urban mobility

We can term urban mobility as any way in which people move around in cities for daily duties, travel and other social purposes (Kos et al., 2023). It is worth noting that there is a steady increase in the mobility of society, and consequently growing needs for efficient relocation. In an attempt to meet these expectations, such methods of relocation are increasingly popularized, such as: public transportation or the rental and sharing of cars, motor scooters, electric scooters, bicycles (Janczewski, Janczewska, 2022).

Looking at modern urban development and the evolution of urban society, urban mobility requires special attention when implemented in urban spaces. Given the growing awareness of the need to protect the environment and the desire to follow the latest technological trends among today's communities, these issues should be a priority in the urban mobility design process (Kos et al., 2023). Focusing on these two overarching values, two related concepts have emerged in the field of urban mobility: sustainable urban mobility and smart urban mobility (Herdiansyah, 2023).

The topic of sustainable mobility in the European arena was addressed as early as 1992 by the European Union in the "EU Green Paper." This entry was one of the first to address the ever-increasing environmental impact of transportation, which was the direct cause for the concept of sustainable mobility (European Commission, 2025). For that moment, the concept was about reducing the negative impact of transportation on the environment, improving energy efficiency and taking care of the public's quality of life. Most of these goals are still relevant, but the scope of sustainable mobility issues has expanded to include a greater focus on sustainable urban mobility. This focus has begun to draw attention to challenges such as the excessive number of vehicles in cities, high emissions and increased noise levels (Holden et al., 2019, Aladayleh et al., 2023).

When it comes to smart urban mobility, it is also a current topic, as it is one of the six dimensions of smart city functioning (Herdiansyah, 2023). The idea of smart cities is shaping today's cities, which are trying to respond to any problems related to urbanization, pollution, mobility, economy, quality of life of residents or effective management of (Goumir et al., 2023).

One of the attempts to make efficient use of urban infrastructure and improve the comfort of residents' daily travel is smart mobility. The concept of smart mobility focuses on the design of intelligent, but also sustainable transportation, based on the use of Information and Communicastions Technology (*ITC*) - including, among others, the Internet of Things (*IoT*), artificial intelligence or real-time analysis of large data sets (big data) (Augustyn, 2020).

## 2.2. Sustainable and smart urban mobility solutions

The guarantee of a high level of sustainable and intelligent urban mobility in road transport is continuous improvement. By improvement we should understand the implementation of modern transport systems, the use of environmentally friendly measures to reduce emissions of exhaust fumes and pollutants, as well as the popularization of the combination of various forms of transport. The literature highlights more than a dozen available solutions that promote the progress of urban mobility at the same time and are complementary to each other. They can be classified into public transportation, micromobility and Intelligent Transportation Systems (*ITS*) solutions. (Janczewski, Janczewska, 2019). A detailed division with example technologies is presented in figure 1.

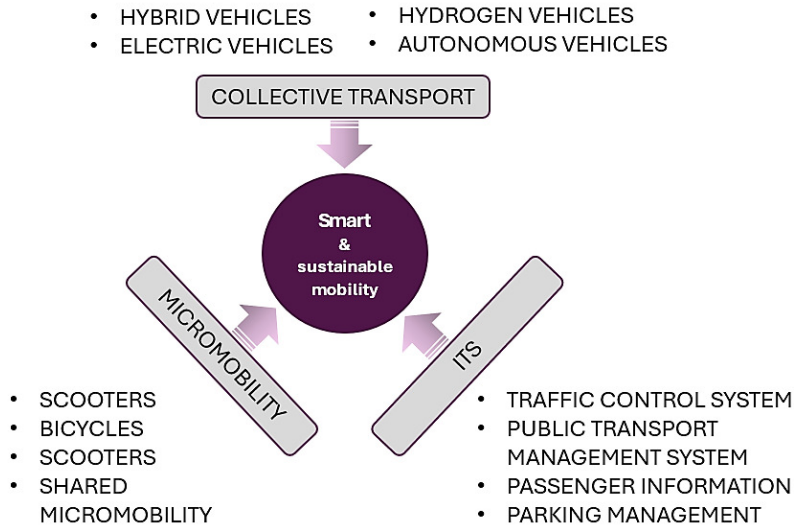



**Figure 1.** Classification of sustainable and smart urban mobility solutions.
Source: own elaboration.

The segment of solutions that the article particularly focuses on is public transportation. This group includes standard vehicles such as buses, streetcars, urban trains, subways (Nakamura, 2024). In the literature, most information can be found on the most common means of public transport - the bus (Jóźwiak, Guciewski, 2018).

More and more often hear about the modernization of classic buses, especially in cities implementing smart city concepts. One of the upgrades in the bus transportation industry is the introduction of autonomous buses, the kind that doesn't need the human driver's intervention to move (Banach, 2020).

Autonomous buses are a popular solution around the world, not only on public roads, but also in private areas such as universities and even cmenatres. As it turns out, the universities of Salford-Manchester, Gothenburg, Michigan and Adelaide have decided to test small autonomous shuttle buses in campus towns, which are used by the university community on a daily basis. (Navya, 2025). Of other interesting examples, self-driving shuttles were tested in 2021 in the Gdansk cemetery. Due to the high car traffic in the area, there was an initiative to

minimise the traffic, so autonomous buses were used to drive visitors along the main avenue of the cemetery (Trapeze, 2021).

These types of vehicles operate fully or partially without human supervision, which means they can autonomously perform such maneuvers for example accelerating, braking, turning and even reacting to obstacles on the road (Banach, 2020). This is possible by using artificial intelligence technology, navigation systems and rich equipment with various types of sensors placed on the vehicle. The more technologically advanced and better equipped a vehicle is, the higher level of autonomy it has (Scurt et al., 2021, Siderska et al., 2023). In order to correctly identify the environment and minimize human error, devices such as:

- video cameras - responsible for transmitting images,
- lidars (laser radars) - responsible for scanning the space around the vehicle,
- ultrasonic sensors - responsible for detecting obstacles over short distances,
- infrared sensors - responsible for detecting obstacles at long distances,
- microphones - responsible for detecting sounds around the vehicle.

Using the sum of the collected information from all sensors, it is possible to determine a complete picture of the traffic situation (Choromański et al., 2020). An example of sensor placement in an autonomous vehicle is shown in fig. 2.

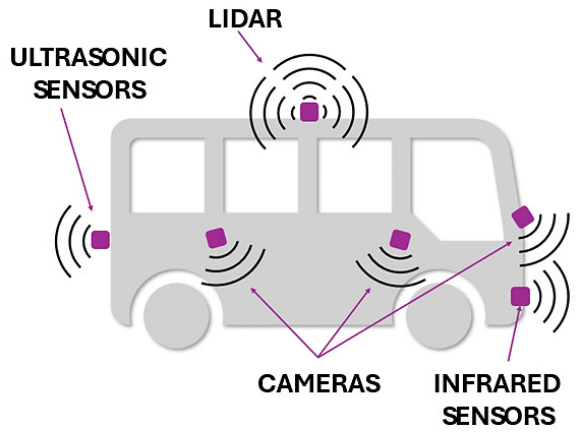



**Figure 3.** An example of the arrangement of basic sensors on autonomous vehicle.

Source: elaboration based on Choromański, Grabarek, Kozłowski, Czerepicki, Marczuk, 2020, p. 122.

### 2.3. Benefits and barriers to implementing autonomous vehicles

The implementation of autonomous vehicles is one of the newest steps being taken towards the development of public transportation and public transport. Like any novelty in the market, there are some benefits and barriers to implementation, which must be analyzed before implementing the technology on a larger scale (Olivier Wyman Forum, 2023).

There is no doubt that commercially available urban mobility solutions, including autonomous vehicles, offer numerous benefits for all users of transportation systems, such as drivers, pedestrians, passengers, public transportation, people with reduced mobility, but also institutions related to transportation management (Tomaszewska, 2022).

Conducting a review of the available literature and the research done, the benefits of implementing smart and sustainable solutions can be divided into three main categories:

- environmental benefits (environmental aspects),
- organizational benefits (economic aspects),
- social benefits (safety aspects, educational aspects, user comfort) (Tomaszewska, 2022).

The key benefits of implementing autonomous vehicles in public transport are primarily: reduced operating costs (due to the lack of need for physical drivers) (Kornaszewski et al., 2017), improving the quality of the environment (Tomaszewska, 2022), increase the safety of passengers and other road users (Crişan et al., 2021), as well as increasing the accessibility of public transport and more efficient traffic management in the city (Wach-Kloskowska, Rześny-Cieplińska, 2018). A detailed analysis of the benefits with specific categories is provided in table 1.

**Table 1.**
*List of benefits of implementing urban mobility solutions*

| Benefit category | Range of benefits | Examples of benefits |
|---|---|---|
| **Environmental benefits** | **Environmental aspects** | - Reducing the harmful impact of urban transport on the environment.<br>- Reducing exhaust and toxic emissions.<br>- Reduction of fossil fuel consumption.<br>- Reducing the loss of urban greenery. |
| **Organizational benefits** | **Economic aspects** | - Reduction in financial outlays for road resurfacing and repairs.<br>- Reduction of operating costs.<br>- Strengthening the city's budget. |
| **Social benefits** | **Safety aspects** | - Automated road safety inspection.<br>- Quick response when a dangerous situation is detected (accident, collision, other danger).<br>- Reduction of accidents and dangerous situations.<br>- Reducing traffic congestion.<br>- Optimal use of transport infrastructure potential.<br>- Optimal use and capacity expansion of available road infrastructure. |
| | **Educational aspects** | - Encouraging the public to use environmentally friendly travel methods.<br>- Promoting an environmentally responsible lifestyle.<br>- Continuous improvement of urban mobility solutions. |
| | **User comfort** | - Improved mental comfort due to the ability to track the location of the transport in real time.<br>- Save time with faster travel.<br>- Improved quality of life due to reduced noise and lower emissions.<br>- Improving travel comfort with the newest fleets.<br>- Reducing stress, for example, in connection with the search for a parking space. |

Source: elaboration based on Tomaszewska, 2022, pp. 345-346.

The risks, as well as the benefits associated with implementing autonomous vehicle solutions, can affect many levels of city operations and its stakeholders (Czupich et al., 2016). Possible difficulties most often arise at least from the structure of the city's finances, legal conditions, or public attitudes toward innovation and change (Hesse, 2008).

The fact is that the development, and subsequent implementation, of innovative projects and high-quality transportation services is an expensive process, especially in the early phases of the investment process. This is quite problematic given the public budgets of cities, which are often highly strained (Werland, Rudolph, 2019). Lack of adequate funding can also be a problem when it comes to infrastructure in need of renovation. Often the current transportation infrastructure in cities is not sufficient to adapt new technologies (Sadowski, Pasternak, 2014). The population, or potential users of autonomous vehicles, may also prove to be a challenge, mainly their beliefs and attitudes toward change. On the one hand, the current population is increasingly aware of the need to implement sustainability and ecological measures, and yet there are still concerns about the introduction of new technologies. Fear of change and resistance to adapting new solutions is a natural human reaction. In the face of such attitudes, there may be voices of opposition from residents, which will have to be faced by authorities wishing to follow the mobile development of their cities (Krawiec, Krawiec, 2019; Schachenhofer et al., 2023; Ejdys et al., 2024).

Therefore, it is possible to consider classifications of barriers to the implementation of autonomous vehicles distinguishing such types of barriers as financial, infrastructural, social and legal (Hesse, 2008). More examples of barriers considering the aforementioned division are presented in table 2.

**Table 2.**
*List of barriers in the implementation of urban mobility solutions*

| Types of barriers | Examples of barriers |
|---|---|
| **Financial barriers** | - High investment costs - costly urban mobility technologies.<br>- Burdened city budgets - no readiness to take on new investments.<br>- Difficulties in raising funds for new technologies.<br>- Unknown and lack of knowledge of all possible financing tools.<br>- Lack of skills or sufficient experience in preparing grant applications. |
| **Infrastructure barriers** | - Complete lack of infrastructure necessary to implement modern technologies.<br>- Current but insufficient urban infrastructure (unsuitable for adaptation of new technologies).<br>- Lack of funds to renovate outdated infrastructure.<br>- Difficulties in integrating new solutions with current systems.<br>- Problems with spatial adaptation. |
| **Social barriers** | - Fear of change.<br>- Resistance and negative public attitudes to change despite growing environmental awareness.<br>- Lack of sufficient knowledge about new urban mobility technologies.<br>- Lack of awareness of the benefits of adapting new technologies.<br>- Lack of long-term experience in implementing sustainable and smart urban mobility solution.<br>- Personal beliefs and biases. |
| **Legal barriers** | - Regulatory and legal barriers.<br>- Difficulties in adapting regulations to new solutions.<br>- Lack of synergy and harmonization between new and existing regulations. |

Source: own elaboration.

## 2.4. Characteristic of the urban transport system in Bialystok

Bialystok is the administrative center of the Podlaskie Voivodeship and thus the largest city in northeastern Poland, even though it occupies only about 0.5% of the area of the entire voivodeship (102,13 $km^2$) (Bielawska et al., 2024).

The location of the city of Bialystok is very advantageous, as it is located at the intersection of major national and international transportation routes - primarily road, and in the future, railroads (Urząd Miejski w Białymstoku, *Diagnoza*…, 2021). The city also has many district and municipal roads, which have lengthened by 5.8% in five years since 2015. The situation is similar when it comes to the lengthening of streets that serve as the city's bypasses - these have increased by 25.5% over the same period under review (Urząd Miejski w Białymstoku, *Strategia*…, 2021). As a result of the city's progressive road infrasturcture, it is characterized by a radial-circuit system (Urząd Miejski w Białymstoku, *Diagnoza*…, 2021).

The urban transport system of Bialystok consists of such kinds of transport as public transport, bicycle and individual transport (Piórkowska, Szpilko, 2019). As it turns out, Bialystok is the only Polish city with a population of more than 250,000, and yet it has no alternative forms of public transportation other than bus transport (Public Transport Consulting Marcin Gromadzki, 2021).

Public transport organization in Bialystok is the responsibility of the Bialystok Public Transport Authority – in Poland is called Zarząd Białostockiej Komunikacji Miejskiej (BKM). This one, in turn, outsources the given transport tasks to three operators belonging to the municipal transport company, these are (Public Transport Consulting Marcin Gromadzki, 2021):

- Komunalne Przedsiębiorstwo Komunikacyjne sp. z o.o. (KPK).
- Komunalne Przedsiębiorstwo Komunikacji Miejskiej sp. z o.o. (KPKM).
- Komunalny Zakład Komunikacyjny w Białymstoku sp. z o.o. (KZK).

Thus, the transportation companies listed are only responsible for city bus service, which has a total of 56 lines, including (Komunikacja Białystok, 2025):

- 30 city lines (one- and two-digit designations),
- 17 suburban lines (designations 1xx),
- 3 municipal lines (designations 2xx),
- 6 night lines (designations from N1 to N6).

In terms of the fleet of public transport buses, it definitely stands out on the city's streets, as each vehicle has a distinctive white and green color scheme along with the BKM logo (Piórkowska, Szpilko, 2019). The current fleet of public transport buses, has a total of 267 buses, which are divided into two types: single-frame and double-frame (articulated). The number of vehicles of both types is quite equal, as there are 136 single-frame buses and 131 articulated buses (Zarząd Białostockiej Komunikacji Miejskiej, 2024). It is also worth noting that the vast majority (more than 95%) are low-floor buses, which allow for greater

comfort and safety of travel, especially for passengers with disabilities, parents with strollers, or the elderly (Piórkowska, Szpilko, 2019).

Equally optimistic is the fact that BKM is investing in environmentally friendly buses, although still not in large numbers. As of 2024, Bialystok's fleet consisted of 92 diesel buses meeting the latest Euro VI palin emission standard (including 6 hybrid buses) and 20 electric-powered buses. This represents 34% and 7% of the total fleet (Zarząd Białostockiej Komunikacji Miejskiej, 2024).

## 3. Methodology

The main objective of the study was to analyze the possibility of implementing autonomous buses in Bialystok.

The subject of autonomous buses is important, especially in light of the prevailing shortage of bus drivers in the region. As the research shows, there is a serious problem in the public transport sector in Bialystok County and the city of Bialystok, due to the very low number of people with the right qualifications. This is problematic because in this region of the Podlaskie Voivodeship the demand for specialized drivers is the greatest. The main reason for the deficit is the salary, working hours and the nature of the work, which is physically and mentally straining (Barometr Zawodów, 2025).

But it is still comforting to know that the city of Bialystok is open to change and following new technologies, as demonstrated by the moves made by local officials. The city's rulers are taking concrete steps to positively influence the development of Bialystok, including by planning a development strategy for the coming years. One of the goals of this plan is to introduce new forms of transportation by 2030, such as for example autonomous vehicles (Urząd Miejski w Białymstoku, *Strategia…,* 2021).

Therefore, the survey focused on finding out the opinions of Bialystok residents on the functioning of the current public transportation system and the possible implementation of autonomous buses. To verify this, a method of quantitative diagnostic survey was used, supported by the CAWI technique (Computer Assisted Web Interview). The technique is to conduct an interview by computer using a website (Strojna et al., 2022) – it was Google Forms ind this case. The link was share by social media, and feedback wac collected for 14 days.

The survey questionnaire consisted of 18 questions, appearing in several forms:

- Single-choice closed questions.
- Closed multiple-choice questions.
- Semi-open questions.
- Evaluation questions using Likert Scale.
- Matrix questions.

The opening questions were typically demographic questions, designed to collect information about the survey participants and to systematize information such as gender, age, education and type of connection to the city of Bialystok. Further questions focused on the frequency and purpose of travel on public buses, as well as the degree of satisfaction with current public transportation services in Bialystok. The next part of the survey was devoted to the issue of autonomous buses, where they were asked, among other things, about awareness of what autonomous vehicles are. Respondents had the opportunity to express their approval or disapproval of specific theses related to the implementation of autonomous buses, as well as to give their opinion on the appropriateness of implementing this solution in Bialystok.

The survey was directed primarily to residents of Bialystok and the nearby areas, and the condition for participation in the survey was to use Bialystok's public transportation at a minimum of once. The final group of respondents consisted of 103 people, including 55 women and 48 men.

## 4. Results

Apart from examining the typical characteristics of respondents, such as gender and age, it was decided to also pay attention to the respondents' education and type of connection to the city of Bialystok. Knowing the answers to these questions can help later understand the public's technical knowledge and general awareness of autonomous technologies and determine the strength of their relationship with Bialystok.

As for the educational level of the respondents, most of them (43%) have a high school education. On the other hand, slightly fewer, 40%, have higher education. The smallest percentage of people represents primary education, it is only 17%, or 18 respondents. This structure allows us to conclude that the majority of those who took part in the survey have completed secondary school (high school, technical school or vocational school) or are still pursuing undergraduate studies. However, it should be noted that a similar result is also represented by those who have already completed their university education and hold a bachelor's, engineer's, master's or doctoral degree.

Such results on the question of education are reflected in the answers to the question on the type of connection to the city of Bialystok. The majority of respondents (54%) declared that they live permanently in Bialystok. According to the level of education, the second most frequently chosen type of connection to the city was education, with nearly 36% of respondents indicating that they study in Bialystok. Just slightly fewer responded that they work in the Podlasie capital (32%). The least numerous group were those who declared that they do not live or study or work in Bialystok, but come to the city from time to time (12%). Importantly, the question was multiple choice, and the distribution of results is shown in figure 4.

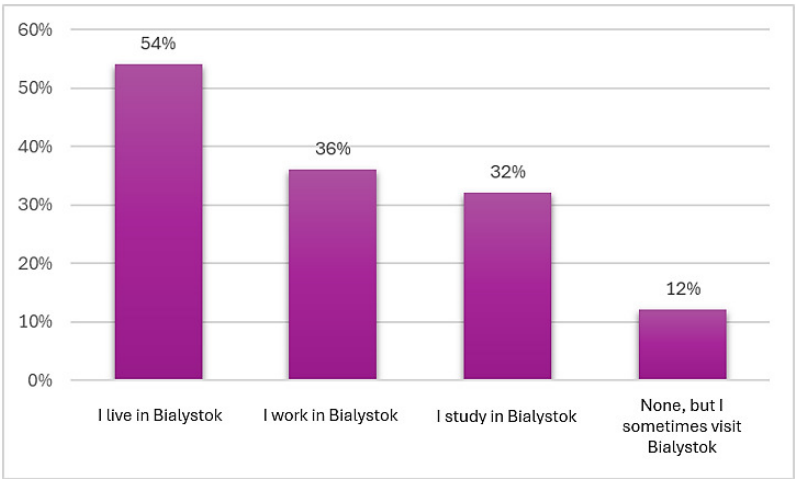



**Figure 4.** Respondents' answers to the question "What kind of connection do you have with the city of Bialystok?".

Source: own elaboration.

The next step was a series of questions examining the frequency of use of bus travel and respondents' attitudes toward the current way public transportation operates in Bialystok. First, respondents were asked how often they use public transportation. The responses were fairly balanced, although statistically the most common answer was "several times a month" chosen by 36 people (35%). In second place with a score of 27% was the answer "several times a week," and the last place on the podium was taken by the answer "several times a year," selected by 17.5% of respondents. It can be said that just as often as several times a year, public transportation is also used daily, with 16.5% of respondents declaring that they choose this mode of transportation every day. The least frequently chosen answer was "less than once a year" (4%), which means that each person participating in the survey travels by public transportation in Bialystok at least once a year. The distribution of responses is presented in figure 5.

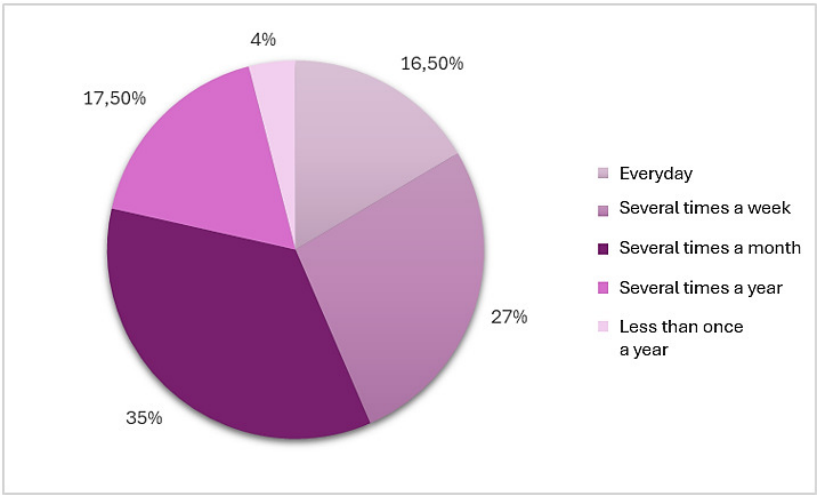



**Figure 5.** Respondents' answers to the question "How often do you use public transportation in Bialystok?".

Source: own elaboration.

As it turns out, respondents most often travel by public transportation in connection with the need to do things in the city, such as doing basic shopping, visiting a doctor, office or bank (42%). In second place were two responses that were equally indicated by 36% of respondents - this was to get to school or university, and to get to meetings with friends and family. Slightly fewer, 33%, also indicated commuting to work as one of the situations in which they choose to travel by bus. The fewest responses (11%) were for recreational purposes such as getting to the city beach or to a park. It turns out that young people, who are most likely still continuing their education, use public transportation almost as often as young adults attending work. Nevertheless, representatives of both of these numerous groups share one common purpose of travel, which was indicated most often - to run private errands in the city, which everyone confronts in their daily lives. The question allowed the choice of more than one answer, and detailed data is shown in figure 6.

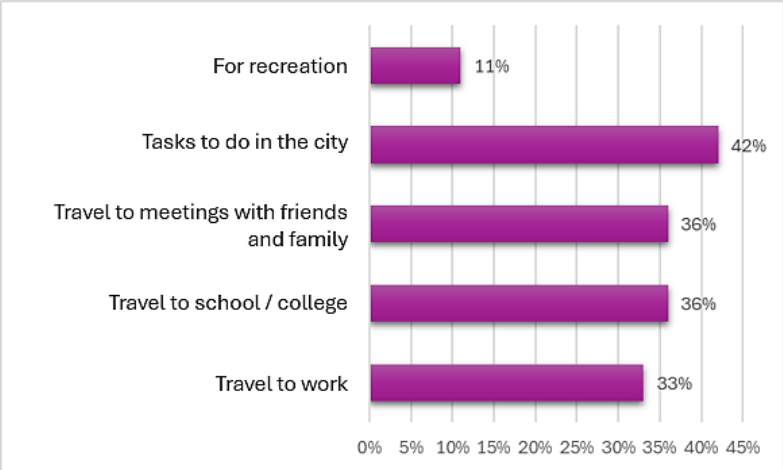



**Figure 6.** Respondents' answers to the question “In what situations do you most often use public bus travel?”.

Source: own elaboration.

Respondents were asked if perhaps there were other reasons for using city buses besides the specific situations indicated earlier. Only 8% responded that they were not guided by reasons other than those indicated above. The remaining responses, in turn, were quite diverse, as shown in figure 7.

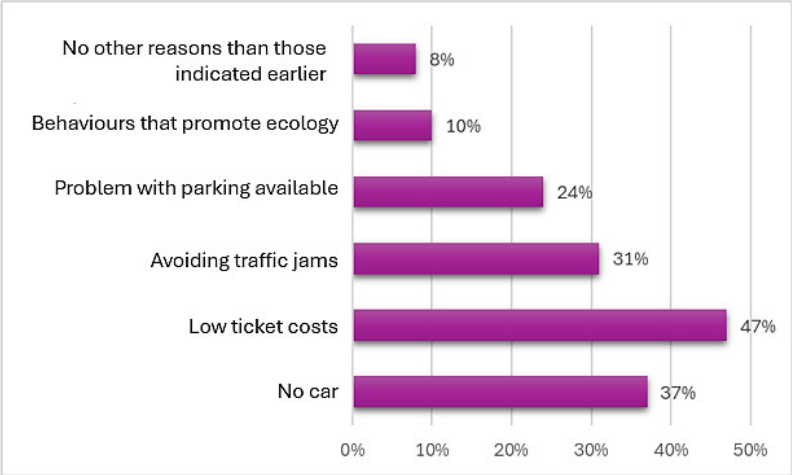



**Figure 7.** Respondents' answers to the question "What are your main reasons for using city public buses, other than the situations selected in the previous question?".

Source: own elaboration.

For the large majority, the most convincing reason for using public transportation is low ticket prices (47%). The current price list for public buses traveling in Bialystok is unchanged as of March 14, 2023, which passengers apparently appreciate.

The second most frequently cited reason is the lack of own car (37%) as a result of which travel by public transportation is necessary. Avoiding traffic congestion (31%) and the problem of finding a parking space (24%) were also relatively common responses. On the one hand, some respondents are somewhat forced to travel by public buses due to the lack of a private car, but still about 60% have a car, and there were nevertheless responses suggesting that public transportation works as a good alternative to car travel.

It may be worrying that only 10 respondents (about 10%) answered that they choose to travel by public transportation because they have an environmental awareness and need for eco-friendly behavior. This percentage of responses may be related to the low availability of green buses in the current BKM fleet. Of the 167 available buses, only 6 have hybrid power, the rest are powered by a classic diesel engine that emits pollutants into the atmosphere (Zarząd Białostockiej Komunikacji Miejskiej, 2025).

The final, and the key question closing this segment of the survey was "Are you satisfied with public transportation services in Bialystok?". The results are shown in figure 8.

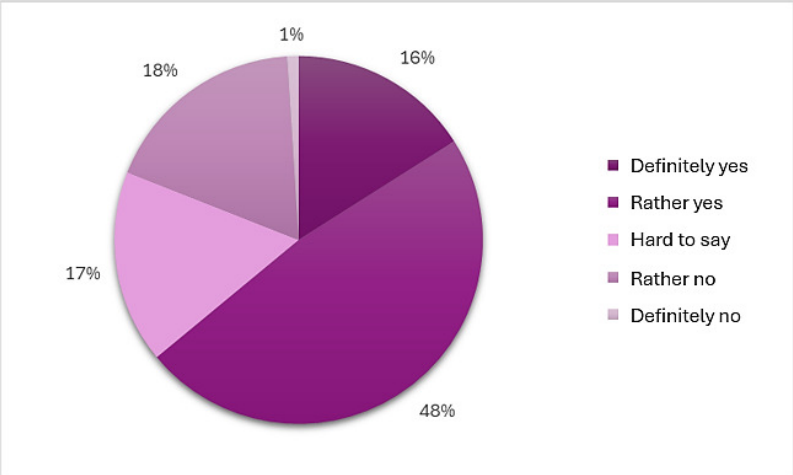



**Figure 8.** Respondents' answers to the question, "Are you satisfied with the public transportation services in Bialystok?"

Source: own elaboration.

The large majority of responses were positive, as 48% of respondents answered "rather yes" and 16% answered "definitely yes," for a total of 64%. Negative statements were made by 19% of respondents, marking "rather not" (18%) and definitely not (1%) in the survey. Nearly as many, with 17%, had trouble answering this question clearly and chose "hard to say". Without a doubt, the positive opinion of the majority and only 1 definite negative answer are reasons to be satisfied with the current operation of public transportation. However, it is worth thinking about how to change the opinions of the rest of the respondents, who are rather not satisfied with the services of Bialystok's public transportation or found it difficult to give a specific opinion on the subject.

The next questions in the survey already focused on the technological aspect, and were designed to examine respondents' attitudes toward autonomous vehicles. In this regard, the question was asked "Are you familiar with the concept of autonomous buses?" and its definition was included. More than half of the respondents answered yes (68%), while the rest announced that they were not familiar with the concept until now (32%).

In the following part of the survey, an attempt was made to determine the attitude of the public towards selected features of autonomous vehicles, such as travel safety, eco-friendly operation, and travel comfort.

So the first question was asked, "How far do you agree with the statement that autonomous buses can be a safer means of transportation than human-driven buses?". As it turns out, although there was a preponderance of affirmative answers - "definitely yes" (33%) and "rather yes" (23%), the second most frequently chosen answer was "hard to say" (30%). Therefore, it can be concluded that the public still remains distrustful of autonomous technologies and is not fully convinced of the safety of such a solution.

Next, the question was asked: "How far do you agree with the statement that autonomous buses are a greener alternative to traditional diesel buses?". A total of more than 80% of respondents said yes, and only 8% disagreed with the statement. Such a result may indicate that

even though the need for pro-environmental behavior is not the priority one when choosing to ride public transportation, public awareness of the benefits of green solutions is at a high level anyway.

However, the question of feeling comfortable on an autonomous bus is not as obvious as the aspect of the positive environmental impact of these vehicles. Respondents were asked "How much do you agree with the statement that you would feel comfortable traveling in an autonomous bus?". Although the majority of responses were still affirmative (72%), the overwhelming response was "rather yes" (50%), rather than "definitely yes" (22%).

The next step of the survey was to find out residents' opinions on the necessity of introducing autonomous buses in Bialystok and if they think that the current infrastructure is up to the modern technology.

The question was then asked, "Is it necessary to implement autonomous buses in Bialystok's public transportation?" It turns out that the public is unanimous on this question, as 42% answered "definitely yes" and "rather yes" 38%, giving a total of 80% support.

Despite the consensus on the need to implement autonomous buses in Bialystok, it appears that opinions are divided on the appropriate timing for the introduction of such vehicles in the city. Nearly 63% of respondents favored the introduction of the technology in the near future, with 35% voting for implementation as soon as possible, and 27% believing it should happen by 2030. Another 20% see such a possibility by 2040, and 16% even further in the future. Only 2% of respondents believe that autonomous buses should not be introduced to Bialystok at all. The results are presented in figure 9.

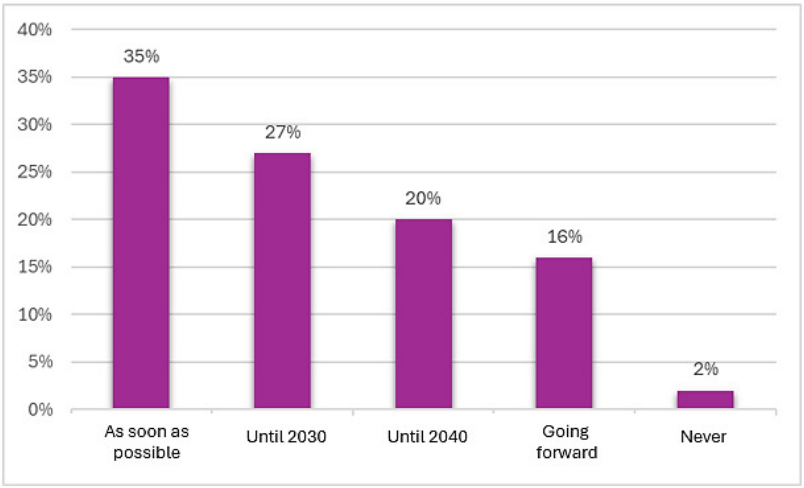



**Figure 9.** Respondents' answers to the question "How soon do you think autonomous buses should be implemented in Bialystok?".

Source: own elaboration.

While respondents recognize the city's potential to implement autonomous buses in the future, responses to the next question show that at the same time there is clear uncertainty about the actual readiness of the city's infrastructure for this project. Respondents were asked the question "Do you agree with the statement that Bialystok's infrastructure is ready for the

implementation of autonomous vehicles?". 42% of respondents answered "rather yes" and 29% answered "definitely yes," indicating that nearly half of the respondents believe that Bialystok is at least partially ready for the implementation of autonomous vehicles. However, the dominance of "rather yes" responses over the more certain "definitely yes" may suggest that there is some caution and incomplete conviction among the community about the readiness of Bialystok's infrastructure for modern technology. On the other hand, such responses may indicate people's high awareness that the implementation of autonomous vehicles requires diligent preparation, and that the current infrastructure, while at a good level, is not necessarily fully prepared for such advanced vehicles.

It also tried to study the public's attitude toward the technology, which some respondents were previously unfamiliar with. A positive finding of the survey is that, despite their low knowledge of the subject, the majority of respondents said they would be interested to try a ride on an autonomous bus if such means of transportation were available in Bialystok. Positive responses totaled 81%, with 36% saying "definitely yes" and 45% saying "rather yes". 15% of respondents marked "it is difficult to say," and only 4% said they would not even want to try such a ride. Detailed statistics are shown in figure 10.

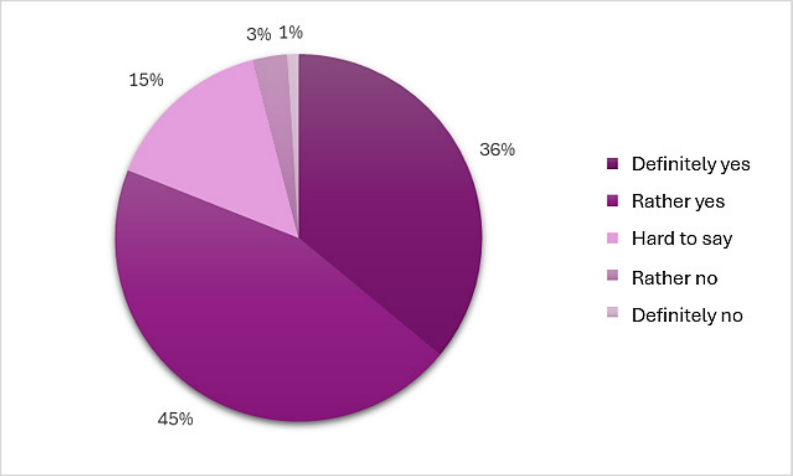



**Figure 10.** Respondents' answers to the question "Would you like to try a ride on an autonomous bus if it were available in Bialystok?".

Source: own elaboration.

The question was also asked, "Would the introduction of autonomous buses in Bialystok encourage you to use public transportation more often?" Nearly 37% of respondents said they would definitely use public transportation more often then, and 33% said this was probable. At the same time, about 19% of respondents felt that the presence of autonomous vehicles would not affect their frequency of riding public transportation, and nearly 9% had a difficult task to clearly define themselves.

It should be noted that a large number of respondents have had no direct contact with autonomous vehicles before, and some are also not convinced of the validity of introducing these vehicles into Bialystok's public transportation. It was therefore decided to confront the public with some ideas for taming the society with this technology.

The first question asked "Do you agree that public education about autonomous vehicles is key to their acceptance by the public?" Interestingly, this was the question with the highest agreement in the entire survey, as 92% were affirmative responses. 66% of respondents said they strongly agreed with the statement, while 26% "rather yes." As it turns out, effective educational campaigns are highly relevant to the public, and increased knowledge of how autonomous vehicles work could help eliminate fears and build confidence in the new technology among residents.

Respondents were also asked, "Do you agree with the statement that the government should support the development of autonomous technology in public transportation?". The responses indicate strong support, as 56% of respondents answered "definitely yes", and an additional 32% answered "rather yes", for a total of 88% support. It can be seen that respondents place high hopes on the role of the government in the implementation of autonomous buses in cities, and expect such support from them. Detailed results are presented in figure 11.

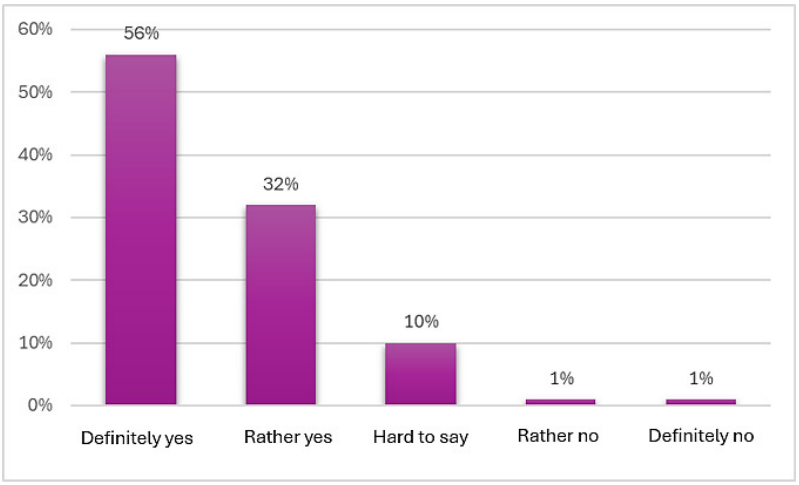



**Figure 11.** Respondents' answers to the question, "Do you agree with the statement that the government should support the development of autonomous technologies in public transportation?".

Source: own elaboration.

## 5. Discussion

The results of the survey indicate that the residents of Bialystok are positive about the solution of autonomous buses. Despite some uncertainty in front of the unknown technology, they still show interest and desire to learn about the functionality of driverless vehicles.

Respondents see several key advantages of autonomous vehicles in terms of safety, comfort and ecology, which is in line with the main benefit cateogories identified by Tomaszewska (2022). Respondents agreed that driverless buses could be a safer and more environmentally friendly alternative to traditional human-driven diesel buses (Crişan et al., 2021). Respondents also confirmed that these types of vehicles are a guarantee for more comfortable travel, although

with this question there were most unsure answers - “rather yes”. This may indicate the problem of the low level of education of the public about sustainable and intelligent mobility, which is reflected in a certain uncertainty about the solutions offered in this area (Krawiec et al., 2019; Schachenhofer et al., 2023).

Nevertheless, this attitude of the public towards new technologies is in favor of the plans contained in the City Development Strategy to 2030 published by the Urząd Miejski in Białystok (2021). Among other things, the strategy involves developing public transportation and investing in autonomous vehicles.

Unfortunately, despite respondents' frequent travel by public transportation on a daily basis, nearly half of them are unsure whether Bialystok's infrastructure is ready for the implementation of autonomous buses. As the literature review showed, this is a relatively common barrier to implementing autonomous vehicles in cities (Sadowski, Pasternak, 2014).

This is an aspect to look into, especially because the public would like to see such vehicles appear in Bialystok. Moreover, the respondents mostly admitted that driverless buses are needed in the city, and mostly declared that they would then probably use public transportation more often.

## 6. Conclusions

The study showed that there is a possibility for the implementation of autonomous buses in Bialystok. However, in order for successful implementation, it is necessary to analyze and modernize the current urban infrastrcuture and adapt it to driverless vehicles - for example, by reconstructing roads or tunnels built many years ago, which may not meet current mobility requirements. An excellent example and inspiration for Bialystok in this field could be the nearby Scandinavian countries, which especially in recent years, have stood out for their high standard of implementation of sustainable and intelligent urban mobility solutions.

Key to the successful implementation of the new technology in the city may also prove to be the education of the public, who themselves highlight such a need. The city's rulers could solve, for example, educational public campaigns, which in the era of the availability of numerous mass media are possible in many ways and could make a significant contribution to minimizing public distrust.

It can also be seen that respondents place high hopes on the role of the government in the implementation of autonomous buses in urban spaces, and expect such support from government. It is therefore worth finding out whether the state offers grants or programs to support the implementation of sustainable and intelligent urban mobility solutions.

Following the proposed recommendations may prove important in terms of sustaining residents' interest in autonomous buses and their positive attitude towards the technology. Certainly, social acceptance will be a welcome development if the city administration decides to implement driverless vehicles in the urban space of Bialystok.

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# CORPORATE SOCIAL RESPONSIBILITY VERSUS SUSTAINABLE PRODUCTION IN THE PROCESS OF IMPLEMENTING ECO-INNOVATIONS

Dagmara K. ZUZEK

University of Agriculture in Krakow; dagmara.zuzek@urk.edu.pl, ORCID: 0000-0002-7620-1621

**Purpose:** The purpose of the paper is to assess investments made to-date in the field of innovations introduced within the sector of small and medium-sized enterprises (SMEs) located in the Małopolskie voivodeship, including environmental initiatives.
**Methodology:** The research was conducted at the turn of 2023 and 2024. At the first stage of the research the selection of enterprises was intentional, namely, small and medium-sized enterprises that carried out their business in the Małopolskie voivodeship. Then enterprises were selected on a random basis (350 respondents). A statistical analysis of the results was made. The obtained results were subjected to a two-way analysis of variance (ANOVA) and Tukey's multiple comparisons tests, with a significance level of 0.05. Tukey's post-hoc tests allowed for a detailed analysis of the means by identifying statistically homogeneous groups. Confidence intervals for the means of the examined traits were calculated, assuming a confidence level of 0.95. The calculations were performed using the Statistica 13.1 statistical software package (StatSoft Inc., USA).
**Findings:** The results of the research confirmed that the SMEs are hardly interested in introducing eco-innovations (approx. 5% of respondents). The most frequent barriers that hinder environmental initiatives among the respondents included: insufficient financial resources and inexperience. Other responses included: lack of knowledge and qualified personnel.
**Originality/value:** The research on eco-innovations is a necessary activity in order to increase competitiveness of enterprises from the SME sector. An innovative approach to the analysis of this issue becomes necessary for current and future research in this field. The above is confirmed by the presented research.
**Keywords:** Corporate Social Responsibility (CSR), sustainable production, eco-innovations.
**Category of the paper:** Research paper.

## 1. Introduction

The concept of sustainable development involves developing a competitive economy that effectively relies on resources, including environment friendly solutions. The implementation of modern environmental technologies has become an important challenge faced by contemporary economies. Hence activities aimed at efficient utilization of resources are necessary, among other things, as part of activities that are an important element of economic, social and environmental challenges of contemporary economic systems. However, those processes require implementing innovative ecological activities. Taking into account factors specified in the paper, the paper presents the role of eco-innovations in the process of sustainable production. The nature of innovative ventures has been analyzed with a special focus on eco-innovations, opportunities of investing in eco-innovations as well as major factors being barriers resulting in reluctance to invest in environmental activities. A low level of innovativeness performance in the area of ecology is currently one of key problems experienced by any economy.

## 2. Corporate Social Responsibility – the essence

Corporate Social Responsibility (CSR) has become a very common concept in recent years. There has been a belief that CSR complements the principles of free market (Filek, 1999). CSR is a long-term approach to business with a dialogue as its underlying principle allowing to find solutions beneficial both to an enterprise such as profits, competitiveness on a local or global market as well as to its employees, a local community, business partners and cooperators, investors, suppliers and other stakeholders.

CSR plays a conscious role, has its place and function in the process of transforming a local community into an active, entrepreneurial and civic one (Stachowicz, 2007). That requires conscious recognition of values and doing business with trust, co-operation and loyalty as its underlying principles. CSR's clear definition is not an easy task as different aspects of that concept are emphasized (Gagacka 2006). Numerous definitions of CSR refer to economic issues manifesting in rationality and good intentions in a decision-making process to maximize profits and expand business activities. CSR should be considered in various areas, including (Rok, 2004):

- internal – related to the growth of human capital, HR management (ensuring equality of staff, fair pay, introducing programs for improving qualifications), introducing ethical programs for staff (codes of ethics, training in ethics), ensuring occupational safety and hygiene, as well as that targeted at owners (shareholders), managers (management board, senior and middle management), trade unions,

- external – oriented towards groups interested in the activities of a company in its closer and more distant surroundings, including introducing rules governing relations with trade partners, suppliers, competitors, financial institutions, investors, representatives of government and self-government administration, customers, economic organizations (traders' associations, commercial chambers), relations with a local community (teaming up with local NGOs, philanthropic activities, social investments), media and international institutions,
- activities affecting the natural environment – accounting for an environmental aspect in business, including environmental impact, taking care of the natural environment.

There are three phases in the development of the perception of CSR (Kietliński, Reyes, Oleksyn, 2005). The first one lasted until the 1920s and was the phase of managing profit maximization. Market observers, experts in management saw the need for corporate social responsibility, however, the society mostly believed in business's responsibility only in the context of its own interests. As a result of the activities performed by trade unions, entrepreneurs began to improve working conditions which then led to the next phase called "trust management". A belief emerged in the 1960s that businesses should be engaged in solving social problems which was then called the phase of managing life quality.

**Table 1.**
*The growth of CSR*

| Values | PHASE I MANAGING PROFIT MAXIMIZATION | PHASE II TRUST MANAGEMENT | PHASE III MANAGING LIFE QUALITY |
|---|---|---|---|
| Economic | What is good for me is also good for my country.<br>A profit maximization factor.<br>Management board responsibility pertains to owners | What is good for an organization is also good for a country.<br>A profit generating factor.<br>Management board responsibility pertains to owners, customers, employees, suppliers and other co-operators | What is good for the society is also good for our business.<br>Profits are needed but...<br>Management board responsibility pertains to owners, co-operators and society |
| Technological | Technology is very important | Technology is as important as people | People are more important than technology |
| Social | Employees must leave their personal problems at home<br>I am a strong individual and will manage business as I please.<br>Ethnical minorities are inferior to white people | Taking into consideration non-economic needs of the staff.<br>I am an individual but I get to learn the value of teamwork.<br>Minorities have their own place in the society but a worse one than mine | Taking into consideration all needs of an employee (meaning a human being).<br>Being a member of a group is of key importance to succeeding.<br>Members of minority groups have the same rights as any other people |
| Political | The best government is that which rules least | Government is a necessary evil | Business and government must work together to solve social problems |

Cont. table 1.

| | | | |
|---|---|---|---|
| Environmental | Natural environment controls the purpose of people | People can control and manipulate the environment | Environment protection is necessary to lead a high-level life |
| Ethical | Ethical values? What are they? | Ethical values are good but not for us | Ethical values need to be protected and we have been doing that |

Source: Żelazna-Blicharz, 2013.

## 3. Sustainable growth and corporate social responsibility

Over the past twenty years the concept of CSR has been increasingly frequently called sustainable growth of companies (Rok, 2003). Responsible business involves taking account of the following three areas in which businesses operate: economic, environmental and social.

Sustainable growth is a multi-dimensional category that is researched by representatives of numerous fields: economy, political science, law etc. It mostly refers to systems on a macro level: states, economies, international communities, however, its implementation in practice requires the implementation at the level of micromanagement. Sustainable growth is a political economy doctrine that assumes the quality of life at a level which is allowed by the contemporary civilization progress (Rutkowska-Podołowska, Pakulska, 2011).

The notion of sustainable growth is definitely a broader concept than CSR. The concept of sustainable growth refers not only to business activity but also to the attitudes of governments, units of self-government, any and all state institutions and the society as a whole.

Focusing on a given organization, CSR is both a certain philosophy and a set of tools that allows to attain the condition of sustainable business which, in the long run, guarantees a long-term increase of the enterprise's value as well as generating environmental and social benefits.

Sustainable growth is achieved thanks to meeting (Jabłoński, 2007):

- social goals - eliminating hunger, diseases, poverty, illiteracy, social orphanage, satisfying intellectual needs, safety and personal fulfillment,
- environmental goals – preventing the degradation of natural environment, eliminating environmental risks, increasing diversity of natural environment, efforts to use renewable sources of energy,
- economic goals – satisfying material needs, equalizing the speed of economic growth in individual regions, adjusting techniques and manufacturing technologies to meet the requirements of the protection of natural resources.

The analysis of said definitions allows to distinguish a few common elements:

- it refers to three major domains: economic, environmental and social,
- it makes human activities an integral part of the process of maintaining a nature balance,
- it is an intergenerational and a long-term initiative,
- it helps satisfy human needs world-wide.

CSR is an inseparable part of the sustainable growth strategy as the success of enterprises involves long-term growth that equally accounts for social, economic and environmental aspects. Recently a view has emerged that the formula of CSR is no longer valid and that goals of sustainable growth are now more important. According to Porter and Kramer (2011) transformative corporate social responsibility can be a response to such status quo being the highest stadium of that concept as part of which willingness to solve a social problem becomes a starting point for developing a company's business model.

## 4. CSR and sustainable production versus eco-innovations

Eco-innovations or in other words ecological innovations have played an important role in the process of reducing negative impact on the environment. Eco-innovations have been researched since late 1970s. They involve creating, adjusting or using a product, manufacturing process, a service or management methods, business practices which are innovative for the national market (being developed or implemented) that result in – throughout the entire life cycle – a smaller environmental risk, help reduce pollution and other negative impacts being the effect of using resources vis-a-vis alternative solutions.

Two basic features make eco-innovations different from classic innovations according to the OECD. The first one is focusing on the reduction of negative impact on the natural environment (regardless of whether such effect is intended or not). Another one is the fact that innovations are not limited in the area of the product, process and marketing methods – eco-innovations also include innovations in social and institutional structures (OECD, 2009). Ecological innovations are conditional upon many factors, including internal and external ones, such as those related to technological trends, natural environment policies, competitive activities, consumer attitudes and the company's potential. As part of the product's life cycle or as part of individual industries and sectors, co-operation with different entities has become increasingly important to creating and implementing eco-innovations.

Eco-innovations can be divided into two groups (Zwolińska-Ligaj, 2013):

- new products, services or manufacturing technologies that result in a small environmental impact vis-a-vis commodities produced to-date or manufacturing processes applied to-date (at the same time assuming higher effectiveness) as well as those being based on natural resources or those recovered as part of recycling,
- new services, devices and technologies that help reduce the impact of the manufacturing processes on the environment – which prevent pollution (sewerage treatment, reducing gas and dust emission into the air etc.) as well as those that are related to undoing damage caused or restoring it to initial condition.

Eco-innovations are aimed at reducing the environmental impact and their implementation also contributes to increasing competitiveness, innovativeness and economic growth (Foltynowicz, 2012). Eco-innovations should be considered not only from the perspective of the environment but also from the perspective of the economy as well as security (decreasing the dependence on the supplies of raw materials) (Szpor, Śniegocki, 2012).

The impact of eco-innovations on the environment can be determined by assessing whether a given technology, product or service helps reduce the environmental impact caused by a man, contributing to meeting objectives such as reducing the consumption of energy, raw materials and soil, reducing emission and waste and preserving bio-diversity and landscapes. Another method of indirect evaluation involves determining whether a given technology contributes to meeting ecological objectives as part of a sustainable growth strategy as determined by an environmental policy or the society (Lulewicz-Sas, 2011).

Another criterion of the division of eco-innovations can be the operations of the enterprise, with three groups of innovations that can be distinguished (Zuzek, 2011, pp. 563-567):

- ecological innovations in the product or services help reduce or prevent environmental pollution. Ecological activities are required in the whole production assortment. Each new proposal in the area of designing and implementing a new commodity needs to be verified from the perspective of the protection of natural environment protection;
- ecological innovations in the manufacturing and the auxiliary and manufacturing process. The first one should encompass both the purchasing of materials and the sale of the goods. Streamlining the technological process from the perspective of the quantity and quality of waste is a classic growth-related task of the enterprise. The enterprise that performs such task in a better and faster way will strengthen its market position. It should be borne in mind that it is less expensive and easier to apply new technologies than to look for ways of reducing pollution resulting from the application of outdated technologies;
- ecological innovations within the organization of the enterprise involve the development of such organizational structures that will integrate the protection of the natural environment into all tasks of the enterprise. The integration of an appropriate system of natural environment information into the enterprise's organizational structure is of vital importance.

## 5. The evaluation of investment activities in the area of eco-innovations in the Małopolskie Voivodeship

The analysis of the research results allowed to verify the activities of the enterprises in the area of innovations with a special focus on eco-innovations. To asses investment activities made to-date in that area a survey was conducted. From among all the surveyed enterprises (350 entrepreneurs) approximately 35% were the innovators, including only approx. 8% being eco-innovators. As regards plans to implement innovative solutions, approximately 40% entrepreneurs would be interested in implementing such solutions over the coming few years. However, on average 48% of the respondents are undecided in the area of introducing innovations.

Based on the results of the survey, approx. 46% of the surveyed business entities said that they have introduced technological innovations. Further positions in the ranking were occupied by the following: launching new products (approx. 26%) or ideas for starting a new business (approx. 10%). The entrepreneurs' awareness about the possibility of the existence and introduction of eco-innovations is still very low. Only 5% of the respondents invested in eco-innovations which helped improve the condition of the natural environment.

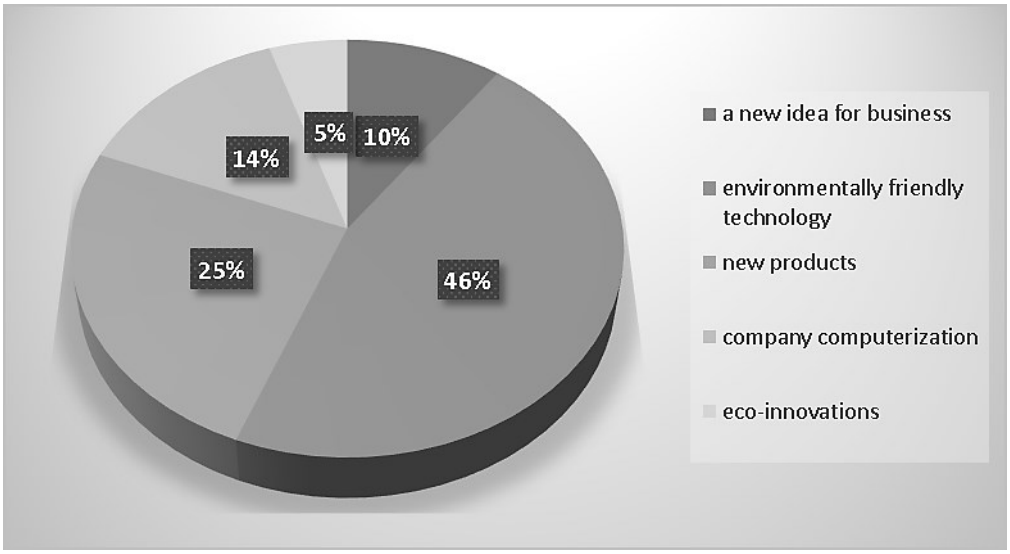



**Figure 1.** The nature of the innovations introduced by survey participants.

Source: own research.

Analyzing factors which make the entrepreneurs willing to invest in eco-innovations, it can be noticed that support programs such as subsidies to investments or supplement payments to green energy have become the most popular ones (almost 35% of all responses). They were followed by increases of energy prices (over 29%), and then by the popularity of green electricity (almost 16%).

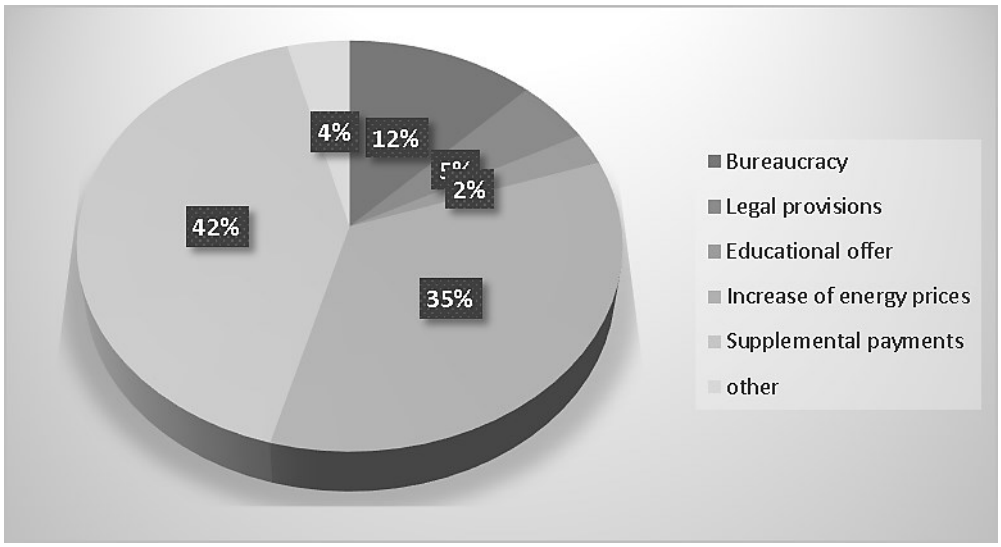



**Figure 2.** Determinants that impact the involvement in environmental activities (eco-innovations).
Source: Own research.

Major and most frequent barriers to the eco-investments as listed by the respondents included insufficient financial and technical resources, insufficient knowledge or lack of qualified staff. The shortage of staff qualified to implement innovations is one of major features showing the demand in the area of human capital.

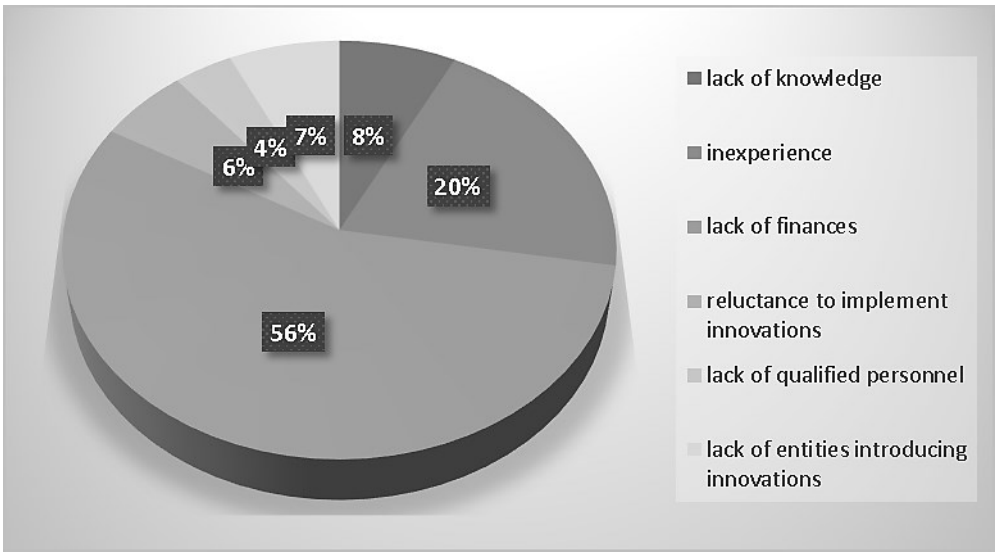



**Figure 3.** Barriers that result in the absence of eco-innovations.
Source: Own research.

## 6. Conclusions

Available reference books and empirical research allowed to analyze the determinants of investments in the area of implementing eco-innovative solutions by the SMEs. They validated an initial hypothesis that the entrepreneurs doing business in the Małopolskie voivodeship are hardly interested in eco-innovations (approx. 5% of respondents). The most frequent barriers that hinder environmental initiatives among the respondents included: insufficient financial resources and inexperience. Other reasons specified by the respondents also included the lack of knowledge or qualified staff. All those factors may be interpreted as low interest in eco-innovativeness being the element supporting sustainable growth of small and medium-sized entrepreneurs. Despite gradual increase of investments in technologies and environmental activities the entrepreneurs are not aware of the existence of alternative innovative solutions that comply with the concept of sustainable growth.

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# REVIEWERS

Prof. Wiesław GREBSKI, The Pennsylvania State University, USA
PhD Judyta KABUS, Czestochowa University of Technology, Poland
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