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FOREWORD

Presented number of Silesian University of Technology. Scientific Papers. Organization and Management Series. Contemporary management. Presented papers contain result of researches conducted by authors from USA, Slovakia and Poland. The number consists of 47 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, quality management, business models, leadership, project management, risk management, logistics, production management, technology management, public management, corporate social responsibility, process management, internationalization, customer relationship management, innovation management, the impact of COVID-19 pandemic on management, organizational culture and sustainable development.

Radosław Wolniak

THE COMPETENCIES OF A MANAGER AS A FACTOR CONTRIBUTING TO THE SUCCESS OF A COMPANY IN THE VUCA ENVIRONMENT

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Purpose: Change is nowadays becoming an intrinsic part of any organization's functioning. The concept of a learning organization that can meet the requirements of the VUCA principle is already common in literature. Since organizations are made up of people led by a leader/manager, thus requiring personal ability to deal with emerging problems. The aim of this paper is to present theoretical considerations and research analysis justifying its thesis that the diversity of a leader's competencies significantly affects the effectiveness of management and ultimately determines their organization's success.

Design/methodology/approach: The aim of this paper was achieved by conducting an argumentative review of the literature available on the subject, which served as the basis for designing the methodological assumptions and further research. Survey methodology was selected as the main research method. The research was conducted among managers/leaders of a group of selected building materials companies. Such targeted research allowed for proper understanding of respondents' position in relation to the subject matter and made it possible to draw conclusions.

Findings: The conducted research leads to the conclusion that the variety and universality of a leader's competencies affect the effectiveness of managing a team. The research has resulted in a proposal of a competency model of a modern manager able to effectively manage a company. The model considers the leading competencies as the basis for the proposed spectrum of skills. The leading competencies determining a manager's actions and allow for the emphasis of the multidirectional nature of the desired features include self-organization, self-improvement, openness to new ideas, strict principles, making correct decisions, and taking care of the team's relations and environment. The above-listed competencies can be used to generate further skills and traits, which can be used to create a complete competency model of an effective manager.

Practical implications: The results of the conducted research and the proposed competency model constitute a valuable source of information for those responsible for managing a team in a difficult VUCA environment. The proposed approach to managerial competencies and in particular to their diversity will contribute to managers' effectiveness and flexibility.

Originality/value: The assumed research position pertains to learning organizations operating in dynamic environments. The key role in such an organization is played by a manager able to

not only keep up with the changing conditions, but also anticipate them. The authors of this paper propose a model allowing managers/leaders to learn and evolve in response to emerging challenges, thus ensuring their company's effectiveness.

Keywords: competencies, leader, manager, VUCA principle, leadership roles.

1. Introduction

The constant change inherent to the economy and the crises that accompany it pose consistent challenges for the management of enterprises in both domestic and international economies. When describing this contemporary reality, one might use the VUCA acronym, which stands for an environment characterized by volatility, uncertainty, complexity, and ambiguity (SLP, 1998). The managerial cadre of any enterprise functioning within the modern market economy must have to react to its expectations as well as to the expectations of its employees. This new, complex, and ever-changing environment sets very high expectations for managers and, consequently, for their competencies. As a result, it is temporarily difficult to speak of any constant pool of managerial/leadership competencies able to ensure success. Consequently, the authors of this paper have assumed that the dynamically changing environment necessitates constant adaptation and development from a manager. This fact implies the need to alter the spectrum of competencies that should characterize a modern manager/leader.

The aim of this paper is to answer the question what competencies of a manager/leader should be considered crucial to effective team management. The authors undertook, based on a critical analysis of available literature, to present their own research including the opinions of managers/leaders in relation to the stated question.

2. Evolution of the term “competencies”

Literature closely related to managing human resources unambiguously states that competencies as a term lack any single, clear definition. It is clear however that the earlier definitions involve fewer aspects and variables than more modern ones, which are far more extensive although still not considered exhaustive (Czupryna-Nowak, 2018).

Nowadays, competencies are not only described as a particular set of skills, abilities, and knowledge. Multiple studies unequivocally indicate that the difference between successful enterprises and other organizations consists in focusing not only on the goal, but also on how to achieve it. The division of labor between group members in accordance with their competencies, is considered to be quintessential (Boyatzis, 1982).

The term “competence” is a combination of three qualities: skill, attitude, and knowledge. Together they describe a person who carries out their tasks efficiently and effectively, thus meeting the expectations of their organization (Spencer, 1993).

The term “competency” first appeared in the United States of America. Later, a different notion of the term “competence” arose in Great Britain. For this reason, there exist two different interpretations of the term: one American and one British (Winterton, 2009).

The main originator of the American approach to competencies was R. Boyatzis. Through his research, he determined that the employees’ successes do not depend on a singular factor, but on an entire array of various factors. Its key elements include (Sikorski, 1999):

- motive,
- behavioral characteristics,
- experience,
- personal traits.

According to R. Boyatzis, competency is a person’s ability to meet the requirements set for them in their position in relation to their organization’s environment, which in turn means being able to achieve expected goals. Moreover, R. Boyatzis pointed out the difference between threshold competencies, which constitute the fundamental qualities needed to perform a task, and differentiating competencies, which make it possible to categorize employees based on their results. Furthermore, R. Boyatzis introduced the so-called “areas of competence”, which include (Woodruffe, 1991):

- leadership,
- goal and action-based management,
- human resources management,
- managing subordinates.

The American approach to competencies was co-created by D. McClelland. His basic premise was to carry out any assessments in relation to a specific criterion. This criterion would then serve as the basis for evaluating the most important aspects of a single employee’s behavior, which determines their actions (Stabryła, 2012).

According to the British approach, the term “competence” is understood as the basic aspect of the development of the standards of Scottish Occupational Classification and national Standard Occupational Classification. They specify the minimum conditions that must be met to be allowed to carry out specific tasks, while also allowing certification after a process of observation and evaluation. In this regard, competence is the ability of employees to perform their job. The degree of competence is therefore left unspecified. Instead, the emphasis is put on personal skills, which indicate whether a person can do something or not. How the employee achieves this goal is less important than the goal itself (Armstrong, 2007).

In literature available on this topic, there exist two similar words used to describe competencies: “competency” and “competence”. These terms are often used interchangeably which, due to the slight difference in meaning, can cause misunderstandings. “Competency” is understood to mean “soft” competencies. In 1991 C. Woodruffe defined them as those of employees’ skills that are related to their behavior, emphasizing that said behavior is the basis for competent action. Competences are known as behavioral traits. “Competence”, in turn, is used to describe “hard” competencies, which C. Woodruffe associated with work fields in which an employee’s skills are adequate to their position. C. Woodruffe also assumed that a competent person meets any expectations related to the effects of their work. Competence describes those skills which make an employee effective. Moreover, it means being able to use one’s resources and knowledge to achieve the intended work goals. Competencies can therefore be finally defined as the employee’s knowledge necessary to perform their tasks (Furmanek, 1997).

The difference between “competency” and “competence” might seem obvious at first glance. Recent years, however, have brought about some significant changes to the meaning of “competency”. Nowadays this term is commonly used to refer to both “soft” and “hard” skills (Klemp, 1980).

The evolution of the term “competency” introduces some unclarities, the solution to which was published by L. Miller, F. Neathey and N. Rankin in 2001. They identified the differences between behavioral competencies (“soft” skills) and functional competencies (“hard” skills). The former describe the way employees should behave to efficiently perform their duties. Meanwhile the latter specify in detail what a person must know to perform a task. The difference between behavioral and functional competencies can be seen through the lens of competencies inherent to a person’s performed profession while considering the expectations set for the employee and the expected end results of their work. L. Miller’s, F. Neathey’s and N. Rankin’s solution lets us avoid the confusion caused by precise meaning of the considered terms, which might be an issue when trying to distinguish “soft” and “hard” competencies. The meaning of the term “competence”, however, remains unchanged – it is most often used when determining what the employees must know and be able to do to meet professional standards and effectively perform their job (Miller, Rankin, Neathey, 2001).

The issue of managerial competencies was also raised by V. Robinson. He claims that the structure of any competency model must be linked to a specific leadership model. Through this all skills, broadly understood knowledge, and openness to new ideas are combined. The aforementioned elements are the constituent parts of not only leadership competencies, but also those of various employees, and they result in increased efficiency of the organization as a whole (Robinson, 2010).

There are many different definitional approaches to competencies. The elementary approach presented by M. Dale is one of them. He believes that ability, education, knowledge, experience, practical skills, internal motivation, attitude, behavior, health, and ethical values and principles are essential components of competency (Dale, 1993).

S. Whiddett and S. Hollyforde claim that competencies are a set of personal traits characterizing a specific employee (manager). Among them one can point out skills, knowledge, motivation, and the ability to self-reflect (Whiddett, Hollyforde, 2003).

G. Mazurkiewicz even believes that the constituent what makes a leader competent is, among others, their achieved education and a set of qualities acquired through continuous work. Competencies should be thus primarily defined as traits that can be acquired by learning in preparation to fulfil a task (Mazurkiewicz, 2012).

It is perfectly reasonable to put the above-mentioned definitions under scrutiny. It is worth noting that being competent does not only mean possessing comprehensive and complete knowledge about one's field. In acquiring competency, it is crucial to consider all its aforementioned elements. Furthermore, it should be emphasized that when talking about a company's success and the positive impact of managerial skills, one cannot overlook the impact of managerial competencies and especially their development.

3. Competency-based company management process

Managing a company is considered to be one of its leader's most important tasks, requiring them, above all, to exhibit all the appropriate qualifications and experiences. Any leader beginning their managerial career lacks vital experience, and therefore is oblivious to the realities of managing an organization. To further discuss managing a company, we should first discuss the areas and factors playing into its operational effectiveness (Olekszyn, 1997).

Defining a company's vision, values, mission, and strategy is fundamental to its management process. Additionally, a manager directing and managing an organization can choose a specific managerial style, which implies its own, specific measures and approach to work. Some leaders prefer the managerial style based on rewarding employees for openness and resourcefulness, while others consider threat of punishment to be a better motivating factor. Some take into consideration their subordinates' suggestions regarding the company's goals, while others heed only their own experience and professional knowledge. In addition, one can easily get to know a manager by looking at their approach to the costs of performing a task. Some put emphasis on cooperation and healthy teamwork, while others consider achieving their goals, and the goals of the organization, to be of utmost importance (Żukowski, 1998).

The autocratic management style is characterized by the manager's independence as they choose the team's direction, define its goals, chooses functions for specific employees, and determines how to carry out tasks – all in a top-down fashion. An autocratic manager does not feel the need to justify their decisions and share key information with the team members. Moreover, they see punishment as more motivating than reward.

On the other hand, the democratic style is characterized primarily by the emphasis it puts on maintaining good relations between employees within a team. Its defining feature is striving towards coexistence by including all team members in the decision-making process. In a democratically managed team, a leader suggests different solutions to their coworkers and makes the final decision after consulting with the team. The work is assessed by them based on the actual state of a task's completion. In such a team the manager appreciates cooperation with their subordinate employees (they are an active member of the team, but simultaneously refrains from performing tasks assigned to other people).

The liberal style consists in members of a group making all the decisions. The group's leader takes part in this process, but their involvement is minimal. Their responsibilities include providing key information and guidance on the topic of methods of operation. A liberal manager is a person that keeps their influence over the team's workflow to the minimum, giving negative feedback reluctantly, if at all (Bugdol, 2021).

The management process is influenced not only by its style, but also the adopted management phases. W. Bańka pointed them out in the following order (Bańka, 2000):

- defining the task,
- delegating its realization to individual employees and outlining its realization,
- providing motivation,
- providing manpower and resources necessary to fulfill the task,
- supervision and control.

For the above-mentioned phases and the management process as a whole to be considered effective, the leader has to perform specific functions. P. Wojciechowski distinguishes them as (Wojciechowski, 2015):

- organizing work,
- setting goals,
- providing motivation and encouragement,
- communication,
- settling disputes.

Organizing work requires the ability to delegate tasks to individual subordinates. However, a leader must remember that this process will largely depend on the type of service provided and the employees' abilities. Considering these factors makes it possible to delegate tasks to people with specific competencies, while also increasing the team's effectiveness.

Any company's functioning is largely determined by its goals. It is impossible to determine management's effectiveness, if said goals have not been outlined by the manager. The goal has to be defined clearly and its constituent parts assigned to specific people so that they are responsible for their fulfilment. The ability to make plans is closely linked to choosing goals. It is plans that influence set goals and help reach them (Żeromski, 2020).

A good manager must be able to constantly provide motivation and encouragement. This not only improves the whole team's workflow, but also helps the development of individual employees, while fostering positive emotions. The manager's involvement in the realization of individual tasks has a direct impact on their quality and the timely fulfilment of the organization's goals. It is crucial for a good manager to not only know motivational techniques, but also to be able to use them in practice (Wojciechowski, 2015).

Communication is another key element of running a company. Open communication is considered to be the most effective. It is based on constructiveness and clarity of information and instructions. It is characterized by allowing every member of a group to speak their mind. The quality of communication has an immense effect on mood prevailing in a team (Olekszyn, 1997).

Leaving conflicts unresolved may lead to an increase in disdain between the parties. It is the leader's duty to find a way out of any situation threatening their team's functioning by agreeing with one of the parties or, if possible, solving the issue to the advantage of both (Wojciechowski, 2015).

The ability to lead is thought to be one of the most important aspects of a managerial position. A manager should not only perform his function effectively, but more importantly, be able to overcome any difficulties stemming from managing people. A competent manager should choose an adequate management style and take into consideration all factors that might cause him trouble while working with a team.

4. Manager and the company's success

Nowadays, leading and managing an organization requires of its manager the ability to choose appropriate goals and judge the effectiveness of undertaken actions. It is often argued that the ability to achieve its goals is the defining measure of a company's success since modern management style is based on defining a specific purpose and assigning resources appropriate to its fulfilment (Ducker, 1976).

To effectively run an enterprise, a manager needs the ability to (Penc, 1993):

- make decisions about introducing changes that will avoid unnecessary conflicts,
- identify, organize, and seize opportunities to reach new markets (company growth),

- observe trends, analyze results, and encourage employees,
- organize people with qualifications necessary to achieve the organization's goals and provide them with opportunities and resources allowing and helping them achieve these goals.

Only the appropriately prepared leaders can manage an organization. Such a leader can rapidly react to changes in their environment and effectively choose response strategies to achieve success based on their creativity (Ducker, 1976; Mrówka, 2010).

Considering multiple studies, it appears that a skillfully managed organization is characterized by achieving better results through the employment of specific strategy, which emerges thanks to talented leaders using appropriate management styles. The fundamental principles describing this strategy include (Peters, Waterman, 1992):

- absolute focus on the market,
- clear formulation of the company's goals, mission, and vision,
- improving used solutions through innovation,
- creativeness in managing employees,
- considering ecological requirements in managing an organization.

The above-mentioned principles indicate that the free market is not a lawless battlefield devoid of any rules. Companies operating with morals gain favor of the public, which boosts their brand's popularity and leads to success (Penc, 1997).

Achieving good results is always based on many factors (dependent and independent) that emerge and affect work simultaneously. The dependent factors include, among others: managing manpower and resources, achieving motivation, production methods, and management style, while independent factors include: production costs, taxes, exchange rates, and, broadly, the law (Griffin, 1996).

A company must be properly managed to achieve its intended success. Effective management process consists of planning, organizing, controlling, and motivating (Majewska-Opiełka, 1998).

The success of an organization is influenced by a multitude of factors, both internal and external. It has long since been believed that the basis of any company's results is the work of its employees. Some would claim that they are of paramount importance. A subordinate employee, however, expects certain actions from their manager in order to be able to fulfil their tasks and further their own personal development and, as a result, improve the company. A company's success depends mainly on its manager's abilities, since they, as a leader, motivate their employees, delegate tasks, set goals, give out functions, oversee work, and bind all these elements together. Every manager has to realize that it is with them that their company's success truly begins and that they need to provide the basic conditions needed by the employees to work not only for their own gain, but also for that of the company as a whole (Majewska-Opiełka, 1998).

5. Research methodology

Gathering the research material was preceded by an in-depth analysis of source material. A survey was conducted to obtain the opinion of respondents on the research questions. The research questions included in the survey were: Which skills are the most desirable in a manager of an organization? What competencies of a leader do you consider key when managing a team? Which of the roles played by a manager is the most important to managing an organization? The obtained results allowed the researchers to propose a competency model of a modern manager.

When implementing the research, a plan of activity was followed that included: identifying the research subject, the treatment of results and presenting them in the form of authorial conclusions, and, finally, applying the research in practice.

The research was carried out in two stages. The first was based on defining the research objective and the research questions, identifying appropriate tools and methods, and applying specific procedures. The second stage was closely linked to interpreting the gathered data and forming conclusion based on it.

The data was gathered in 2021 among employees of selected building material companies. The research sample included 144 respondents, all holding managerial positions in the surveyed organizations. Men and women constituted 60% and 40% of the studied group respectively. About 51% of respondents were aged 30 to 34, 18% were aged 35 to 39, 13% were aged 25 to 29, 11% were aged 40 to 44, and the other 7% were over the age of 50.

More than half of the respondents (52%) were people with 10-15 years of work experience, 20% were experts working for 4-9 years, 16% of respondents had 2-4 years of experience, 8% had 16-20 years of work experience, and the other 4% were employed in their profession for over 20 years.

6. Research results and analysis

The study analyzed in detail the aspects of identifying abilities, roles, and competencies that would be most desirable to a manager and have the biggest impact on the way a team (an organization) is managed. The vast majority of respondents considered interpersonal skills to be the most crucial for a manager. The results of other options are very similar. 88% of interviewees considered the role of a leader to be the most important for a manager. The other options were selected relatively rarely. The last question concerned managerial competencies, which, in the context of this paper, are the most important part of the research.

Table 1.*Skills most desired by the leader/manager in the opinion of the respondents [%]*

Respondents' opinion	Percentage
Decision-making skills	11%
Diagnostic skills	8%
Communication skills	11%
Interpersonal skills	70%

Source: own research.

Interpersonal skills, i.e., skills allowing the leader to acquire new interpersonal relations and develop existing ones, are considered to by the respondents to be key abilities of a manager. They were chosen by 70% of the respondents. 11% of the respondents chose communication skills, as in the ability to effectively share information. The exact same percentage of respondents selected decision-making skills, i.e., the ability to make correct, informed decisions. The fewest people (8%) chose diagnostic skills, which are understood as possessing the ability to effectively respond to specific situations.

Table 2.*Roles that, according to the respondents, are the most important in managing the organization [%]*

Respondents' opinion	Percentage
Leader	88%
Negotiator	3%
Observer	6%
Representative	2%

Source: own research.

The role of a leader focused on increasing their organization's effectiveness through motivation was selected in 88% of all responses. The role of a negotiator, who effectively conducts talks with external actors, was chosen by 3% of the respondents. 6% considered the role of an observer, a person responsible for, among others, monitoring the company's activity and analyzing reports, to be the most important. The least respondents (2%) chose the role of a representative – a person responsible for the company's image.

Table 3.*Key competencies of a leader in managing a team in the opinion of respondents*

No.	Competence	Number of occurrences
1.	Self-organization	17
2.	Self-improvement	15
3.	Openness to ideas	14
4.	Strong principles	12
5.	Making the right decisions	10
6.	Caring for the relationship and atmosphere in the team	10
7.	Humility	6
8.	Charisma	6
9.	Striving for the goal	6
10.	Empathy	6
11.	Communicativeness	5
12.	Business orientation	5

Cont. table 3

13.	Ethical behavior	5
14.	Personal culture and work culture	4
15.	Effective planning (task sharing)	4
16.	Motivating	4
17.	Responsibility	3
18.	Being trustworthy	3
19.	Professionalism	3
20.	Being an authority on others	2
21.	Strategic thinking	2
22.	Caring for the development of employees	1
23.	Introducing innovation (creativity)	1

Source: own research.

The table presented above shows competencies as ranked based on the respondents' answers. Those chosen most often included, in order of descending popularity, self-organization, self-improvement, openness to ideas, strong principles, making the right decisions, and caring for the relationship and the atmosphere in the team. The competencies associated by the researchers with the manager's effectiveness received a significantly lower number of votes. These included: striving for a goal, business orientation, effective planning (task sharing), responsibility, and professionalism.

It is also puzzling that in times of change, the respondents did not seem to value managerial competencies such as: strategic thinking, being an authority, caring for the development of employees, or introducing innovation (creativity). Competencies that would seemingly help an organization adapt.

A group of six key competencies has been selected based on the survey results. These competencies include: self-organization, self-improvement, openness to ideas, strong principles, making the right decisions, and caring for the relationship and atmosphere in the team. Analysis of the gathered data has prompted the researchers to propose a competency model of a modern leader able to effectively manage a company.

Self-organization, often associated with decentralization, is an integral part of any company's functioning. The multitude of tasks creates a need to delegate some responsibilities and tasks to lower-level managers. Numerous studies confirm the need to delegate powers, pointing at the effectiveness of organizations that assign smaller tasks to the relevant departments within the company.

The new requirements the managers/leaders face are results of the intensification and development of competition on the labor market. In such a situation the process of self-development is more than justified. One of the myriad of roles played by a manager/leader consists in striving towards new experience and knowledge as well as motivating their employees to expand their skills by organizing training courses.

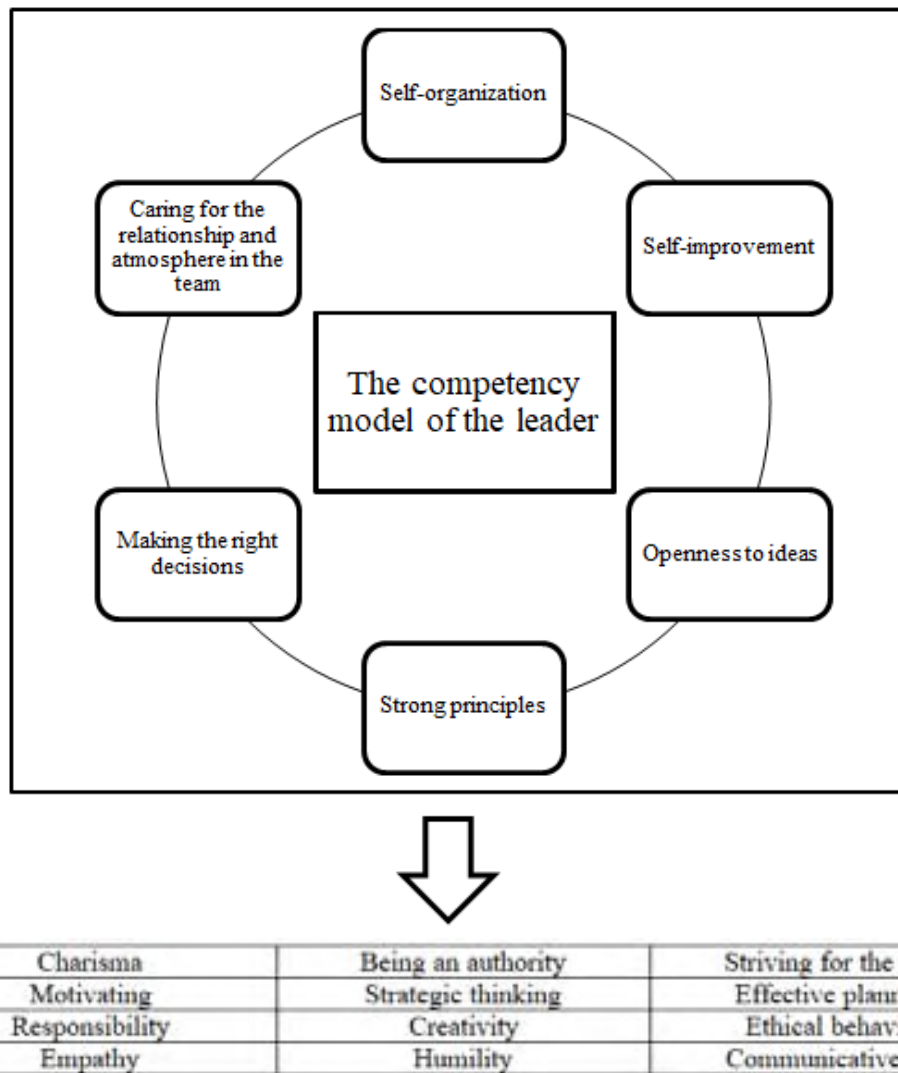


Figure 1. The competency model of the leader supplemented with additional attributes. Source: own research.

To make planning effective, a manager/leader should be open to the ideas of their subordinates. Taking advantage of the employees' knowledge and experience not only gives the manager more potential options, but also increases the staff's involvement in implementing the company's mission. Previous studies (Balcerzyk & Karczewski, 2021) show that many leaders are not only open to their subordinates' input, but also take it into consideration in the decision-making process, which is a sign of a relationship based on trust.

Having strong principles means both maintaining appropriate relationships between a superior and their subordinates and increasing the employees' effectiveness. Lack of faith in the principles their company operates on introduces uncertainty to the decision-making process, which might lead to doubts among the staff.

A leader is also responsible for caring for the interpersonal relations within their team and its work environment. A single person should not necessarily be blamed for any potential failure. It is vital to identify the factors that led to the lack of success and analyze the problem

with the whole team (the leader and the employees). Only then will the organization function as one and knowing the source of mistakes will help it succeed in the future.

These competencies are considered the most important by the proposed model. They are at its core and help identify other traits that a manager/leader should possess to effectively manage human resources, which makes the model universal, since it contains several various features.

7. Conclusion

The general analysis of literature and the survey's results allows to draw a conclusion that the diversity of a leader's competencies significantly affects the effectiveness of managing a company and determines the success of an organization.

It is worth noting that the competences and managerial roles considered in the cited literature largely depend on the research perspective of given publication's author (Balcerzyk, 2021; Czaińska, 2021; Simerson and Venn, 2010; Sus & Sylwestrzak, 2021). The large variety of approaches results mainly from the specificity of the research and the breadth of the management science that allows us to describe the issue. It is nonetheless undisputable that an effective leader must possess certain competencies and play various roles in a way that allows them to adapt to a multitude of difficult and unexpected situations.

The basic thesis of this paper concerned the assumption that management requires a diversity of competencies. The conducted research leads to the conclusion that diversity and universality of a manager's competencies affect the effectiveness of a team managed by them. The research has resulted in a proposal of a competency model of a modern manager/leader – one able to effectively manage a company. Said model includes key competencies around which a spectrum should be constructed, and which develop the spectrum of competencies. Such approach to competencies contributes to the diversity and flexibility of a manager's actions. The key competencies, that determine a manager's actions and allow us to emphasize the multidirectional nature of their traits, include self-organization, self-improvement, openness to new ideas, strict principles, making correct decisions, and taking care of the team's relations and environment. These competencies, in turn, allow us to point to other leadership skills and traits that outline a complete competency model of an effective manager/leader. It is important to remember that the assumed model in itself will not ensure a company's success. It can, however, serve as the basis for taking specific actions, as it suggests how to achieve satisfactory results.

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SELECTED ASPECTS OF CRISIS MANAGEMENT IN THE WORKPLACE WITH REGARD TO PANDEMIC CHALLENGES

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Purpose: Determining and discussing various aspects of crisis management in the organizations in perspective of pandemic challenges with particular emphasis on the workplace conditions.

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 in two exemplary enterprises. 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 various industries.

Practical implications: The results of the research discussed in the paper have a number of practical implications mainly for the management staff in terms of use of crisis management tools and improvement of crisis management strategies.

Social implications: Building awareness of crisis management issues.

Originality/value: The paper has cognitive value for the development of knowledge, science and quality in terms of crisis management in the light of pandemic.

Keywords: crisis management, pandemic, employees, working environment.

Category of the paper: research paper.

1. Introduction

The major concept of the paper is to examine the enterprise crisis management in the face of Covid-19 pandemic challenges and mostly focus on the workplace conditions. The above was carried out based on the case-studies of two selected companies that belong to different industries and markets, operate in different countries and which have different organizational structures. As the effects of the pandemic are visible in every aspects of life the analysis of its impact on working environment remains constant concern of today's reality in order to enhance

future preparedness on similar occurrences and development of effective measures in order to stay resilient and capable for adaptation.

Examination of soft aspects of managing human resources and challenges of leaders remain valuable in context of building the strong team of motivated employees thus raising the chances for the company to survive the crisis. The state of social responsibility of companies during pandemic have been analyzed as the concept supporting the development of whole markets, and mutual support on local level. Currently, the world is going through the phase of recovery and gaining new stabilization, thus it is a good moment to analyze the previous year of insecurities and struggles within markets to discover real bottlenecks of the situation and draw constructive conclusions.

Although there are numerous analyses of particular companies and markets within specific countries available, the author finds it important to present deeper analysis of the specific sectors and the consistent comparison of two different environments, with regard to the soft values of management, based on the opinions of target teams of employees. According to the theoretical goal of the paper the approach towards crisis management have been presented through the concept of good practices, strategic planning and analyses of enterprises' environments. Cognitive goal of the paper was to apply theoretical methods into chosen enterprises' analyses from the pandemic perspective and to examine the employees opinions on how the current global crisis situation influenced their well-being and organizational changes in company's management.

Through the following questions based on the research the condition of the pandemic market was explored:

1. Did the companies succeed in crisis management during pandemic and did not let the crisis to develop in the company?
2. Are the communication and motivation responsible for well-being of the employees during hard times?
3. Was the sector, range of activities, place of performed duties, type of contact among people and the size of the company crucial during current pandemic to continue the company's activity and preserve the feel of security of employees?
4. Is there any possibility that the company could benefit from crisis situation develop and improve?

2. Covid-19 pandemic crisis and its impact on enterprises

The global history is full of the critical situations of human life safety breach, variety of financial collapses and the situations especially of natural character which resulted in the overall misery. The situations which convulsed the world's or more local environments' safety and

economy refer to political including numerous wars and rebellions, economic with financial crises, and technological when errors occur on the way of human usage of technology and science, but also social crisis situation causing humanitarian problems and natural disasters wholly men independent (Khodarahmi, 2009).

Epidemics, according to classification of crisis situations, belong to social crises, influencing every part of human life, forcing enormous organizational changes and posing direct danger to human lives (Cai, Tindal, Tartanoglu Bennett and Velu, 2021).

At the end of 2019, the world was surprised by the new coronavirus called SARS-coV-2, causing the emergence of new disease named Covid-19, which was firstly recognized in Wuhan, China. On 11 March, 2020 the pandemic of Covid-19 disease was announced by World Health Organization (WHO), clarifying and confirming the severity of the worldwide situation (Zhong, Li, Ding and Liao, 2021).

Covid-19 pandemic crisis situation resulted in global crisis, as the virus failed to be scotched at the beginning and spread across the globe. Shortly after the emergence of the virus, people over the world suffered from the disease, experiencing fear for their own and relatives' health, for the very existence and the lack of means to live, and fear connected with the economic and political stability of the world. The safety means that have been implemented across the countries include the insistence on keeping the hygiene standards together with raising awareness about the hygiene, the control over the infected and exposed individuals in the form of quarantines, social distance restrictions, limitations of gatherings, lockdowns and closures of various institutions, borders closures and travel restrictions (Pallvi, Suri, 2020).

The pandemic uncompromisingly had strong impact on people's everyday life (Nowacki, Grabowska and Łakomy, 2020). To overcome the difficulties and problems during crisis situation, a set of steps needed to be applied to control and improve the situation. Also during Covid-19 pandemic, new practices had to be created to adjust to the needs of this specific situation, having available the resources of contemporary world (Wojciechowska-Filipek, Mazurek-Kucharska, 2019).

In times of strong digitalization which source goal remains to create virtual world from which we steer the physical world there are appropriate tools available to manage problems with help of technology (Mourão, da Silva Abbad and Legentil, 2022). The easy way of gaining information and using it for future researches became the privilege of nowadays healthcare. During pandemic the need of quick adjustment of the technology meant quicker reaction to the pandemic effects. The tracing application, controlling the state of infections became the new normal however posing the questions about the limits of interfering with people's privacy and collection of data. Not only the healthcare systems used the technology to improve their work. But also various organizations implemented the digital tools to develop and preserve relations with clients and as an alternative channel of communication. The storage of documents and remote office issues processing gained on time and money saving. Ecological issues can be also noticed through digital practices like using less paper and no need to travel to arrange issues.

Remote work is also a helpful fruit of digitalization, being beneficial during lockdowns, but also showing the potential of new solutions even after pandemic (Wang, Liu, Qian and Parker, 2021).

The Covid-19 pandemic can be considered crisis itself or crisis situation depending on the perspective. Looking globally, pandemic caused a crisis having universal mutual consequences (Kouzmin, 2008). From more internal point of view, it is the crisis situation whose effects are influencing the emergence of crisis in particular enterprises and environments which are most vulnerable (Fagel, 2013). In this case, the more environment is resilient to arise of crisis, the impacts of the pandemic will be smaller. Mentioned dimension for pandemic impacts refers to more serious damages in closed environments, and the outbreak of the internal crisis, in which the pandemic situation itself is only the motor power for crisis arising (Rautela, 2006). As long as the pandemic had an impact on more general spheres of public life it could bring smaller consequences within particular units, because the two spheres and the existence of their content depends and counts on different aspects. While the existence and security of public health depends on the availability of the protection masks, high quality of hygiene and the availability of the vaccine, the security and existence of the company depends rather on determinants like movement limitations specific for particular country or the aspects which influence the effectiveness of the branch like production temporary suspend or temporary lack of the workforce due to the high number of infections and quarantines. In fact, each crisis situation is complex, exceptional and novel (Fagel, 2013). Its complexity arises from the fact, that it can be fixed in many ways, variety of units are usually involved in the situation and there is possibility of emerging new problems. The same crisis situation having place in different organizations, involving different people will have completely different course and results (Haddow, Bullock, and Coppola, 2011).

The creation of internal crisis during Covid-19 pandemic depended on the position of the company on the market, affiliation to particular branch, the financial reserves, the individual health situation among workers and their specific life situation (Bierema, Laura, 2020).

Organizations due to high resilience dictated by good management and the favourable conditions like branch affiliation or the size of the company and high position on the market do not let their structures to develop internal crises (Barcik, Dziwiński and Jakubiec, 2015). In such examples pandemic, with its character, creating crises in general spheres, did not influence the well managed places directly and straightforward but it influenced only the basic and natural aspect of fear for human health and availability of employees able to work. This on the contrary, could influence everything, because any place with exemplary organization will lose everything while physically losing the human capital.

Considering various local environments, the effects of the pandemic may differ. To what extent they influenced the business and daily life depends on the level of particular environment's economic advancement, diversity of the market and the access to life convenience (Grocki, 2020).

Each environment, area, branch and organization must consider risks that may appear, having various roots. The risk of epidemic outbreak is dangerous and unknown, its character brings back to situations far-distant in time, and wakes very new instincts. Each crisis situation poses the businesses in a situation when the economic value goes to the background, and the safety of people becomes most important. Spreading a virus is not an instantly touchable problem of readymade hard solutions to implement. The reality shows that this process takes time, may change multiple times and the consequences may be irreversible or hard to fix (Mather, 2020). The core of the crisis management is to reconcile the people's safety with the safety of the business. Thus the biggest risk of conducting a company during pandemic is the possibility to bankrupt and end the activity.

The features of the enterprises that make them vulnerable on the impacts of the pandemic and which the same way define the level of resilience on the crisis situations and chances to survive on the market are: the size of the company, the position and successes of the company on the markets and the places of their activities from the international point of view, the branches the companies belong to, and the general demand on the goods and services in the scope of the company (Carnevale, Hatak, 2020).

Although the impact of Covid-19 pandemic varies among the countries due to the specific economic situation as well as the content of the market, the sectors which suffered most during pandemic are hospitality with food, accommodation, leisure services and tourism, reaching between 50% up to 90% decline of the activities in April 2020 (OECD, 2020). Those branches also experienced the biggest recovery in September 2020, after situation have been controlled to some extent. Transportation and admin with support services activity decline varied from 20% up to 40% in particular countries and the recovery in September 2020 was less significant (OECD, 2020). The difference between April and September was also noted at the level of 30-40% in retail and wholesale trade and also manufacturing. The best situation from the analysed sectors experience retail and trade, despite the strong decline after the time of first effects of pandemic in April 2020 (OECD, 2020). The demand for goods and services continues to be the motor of consumer spending, supporting the trading market during crisis situation (Aguinis, Burgi-Tian, 2021).

Some branches, although being vulnerable on radical environment changes, found the niche on the pandemic market and the chance for demand for the services they can provide among the branch they deal with, but also risking the requalifying to different branch. This demand services include remote working tools and software, e-learning equipment, entertainment in the boundaries of restrictions, virtual reality, pharmaceutical and medical devices, logistics and transportation as the online shopping and food delivery boosted, virtual healthcare, contactless technology and electronic transfers (Financial Management Magazine, 2020). Another sectors that in April 2020 were being predicted of increased interest during pandemic, were ecology supporting initiatives like air purification and biodefense, technological improvements like biometrics and cybersecurity, needs from chemical sector like sanitizing detergents and

diagnosing methods and online support of restricted branches like e-commerce and e-sport (Businesswire, 2020).

Analysing the opportunities which sectors gain during current pandemic, crisis situation not necessarily brings only the worst consequences but may result in good experiences and success. Crisis possesses the building feature, which in specific cases can lead to the changes in the company that have positive impact. The increased speed in transformations of the systems and organization along with sales processes was noted among companies along with introducing remote work on daily basis (Deltra, 2021). In such critical situations, the organization can benefit in the final report of the whole situation and find the improvement in building the team and sense of the community as well (Forbes. 2020).

3. Selected research results

The first enterprise which example have been used for the purpose of analysis of pandemic market's condition, places its services in the international transportation and storage sector. The headquarters of the company is located in Spain, and the international operations of the company are focused on operation logistics between Spain and Central Europe countries through the road transport and distribution of goods. The company within its internal departments consists in transport department, providing managing and monitoring over the freight round-the-clock; administration department which provides contact in many languages; and sales department which deals with offers.

The second enterprise which was analyzed in respect of pandemic challenges, concentrates its operations in the sector of wholesale and retail trade. It is a French origin, sports products trading corporation, present in many countries around the world and hiring almost 90 thousand employees, thus it is classified as large company. In one of the company's stores located in Poland, which is the subject of analysis, the corporation employs 60 people, who work on managerial and non-managerial positions, on daily basis staying in direct contacts with clients. Except direct retail, the company also conducts sales through online store, and provides variety of additional services connected with the directional type of products. Except the activities performed at the stores, there are warehouses and headquarters of the company in countries around the world, with own supporting departments of different kind, dealing with logistics, production, customer service, etc.

First three questions in the survey concern metrics data – gender, period of employment in the company and the type of position filled in the company.

In both companies the survey was answered almost by the same proportion of men and women. In enterprises A and B, the amount of women engaged into the answers represent about 54.5% of all answers, while the amount of men represents about 45.5%. In case of enterprise A

all team answered the survey, thus women pose the majority of employees at the office. In case of enterprise B, only half of the team answered on the survey, and the interest was higher in the group of female respondents.

Similar situation with almost the same proportions among the respondents as in previous question, concerns the period of employment in the companies. In enterprise A, 81.8% of employees work in the company more than a year, and 18.2%, less than a year. In case of enterprise B respondents, 77.4% work in the company more than a year, and 22.6% less than a year.

The results of analyzing managerial and non-managerial positions in the company presents that in enterprise A, 63.6% of employees work on non-managerial positions, 27.3% are managers and 9.1% preferred not to answer. In case of enterprise B, 77.4% of respondents work on non-managerial positions, while 19.4% are managers.

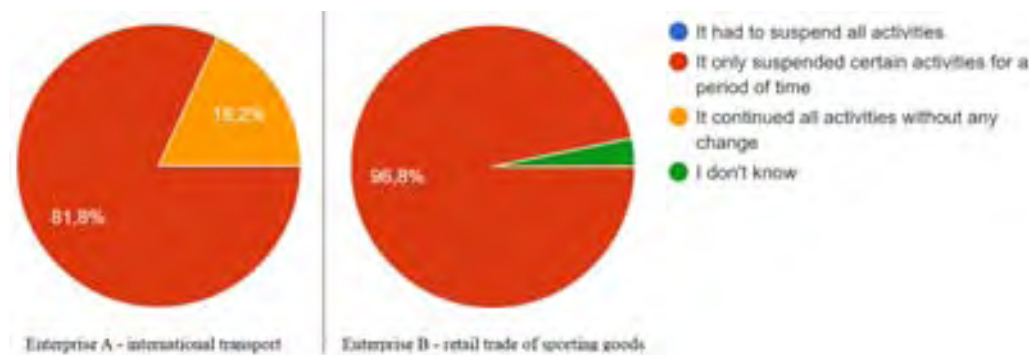


Figure 1. Suspending of the operations. Own study.

The next question concerned the information about suspending the companies' operations due to the outbreak of the pandemic (Figure 1). In the international transport company 81.8% of the respondents claim that the company suspended certain activities for a period of time, however 18.2% respondents provides information that the company continued all activities without any change. This percent is equal to the percent of people employed in the company for less than a year, so the employed who were not employed in the company at the pandemic outbreak, and at possible suspension of activities. In the retail trade sporting goods company, 96.8% of the respondents provide the information that the company suspended certain activities. Comparing both companies, and based on the fact that some percent of employees were hired in the middle of pandemic, it can be concluded that international transport sector came back to normal functioning quicker, than in case of retail trade.



Figure 2. The impact of pandemic on the internal crisis in the workplace. Own study.

The Figure 2 shows, how according to the employees, the pandemic contributed to the internal crisis in the companies. The majority of respondents from enterprise A (in total 81.8%) claim that the pandemic slightly contributed or significantly contributed to the internal crisis. One more time, the same percent of the employees who work in the company less than a year, claim that the pandemic had no influence on the company's internal crisis, which may be interpreted as the quick recovery of the company from the critical situations from the beginning of the pandemic. In case of enterprise B, in total 77.5% of respondents claim that the pandemic had slight or significant impact on the internal crisis creation, while 19.4% of respondents claim that the pandemic did not had an impact on internal crisis. The answers depict that the industries were not prepared on the pandemic outbreak and they characterize in vulnerability to crises to some extent.

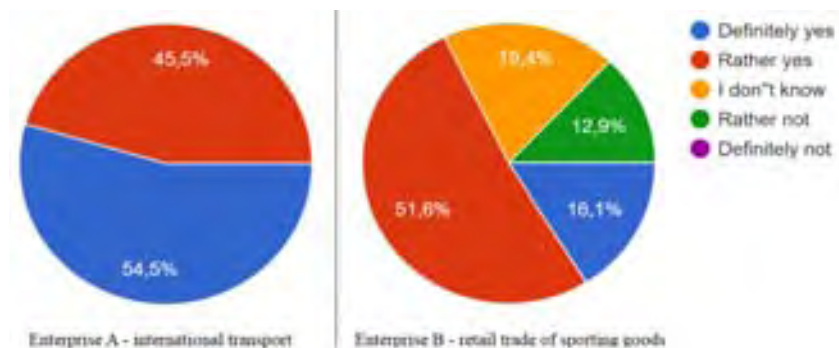


Figure 3. Safety at the workplace in times of the pandemic. Own study.

Being asked about the feeling of safety at the workplace (Figure 3), the respondents of enterprise A who work in the office or have no contacts with other people besides the colleagues during work, in total 100% of employees feels definitely safe, or rather safe. In case of enterprise B, respondents at daily basis work with more people and have direct personal contacts with customers. In 66.7% they feel definitely or rather safe, while 19.4% have no opinion, and 12.9% rather feels unsafe.

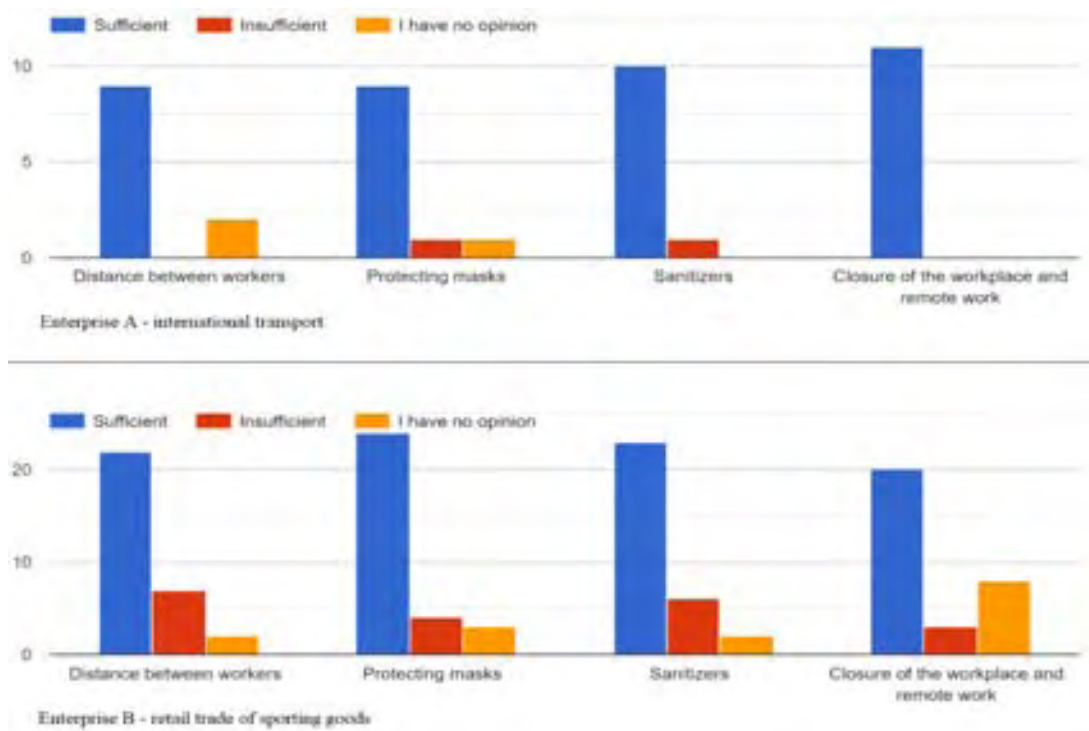


Figure 4. Measures and procedures supporting safe work during the pandemic. Own study.

Figure 4 presents which of the measures and procedures supporting safe work during a pandemic are sufficient to stay safe in the opinion of respondents. According to the surveyed employees of enterprise A, distance between workers, the usage of protecting masks and sanitizers, but also closure of the workplace and remote work are enough to stay safe. Minority of the respondents claim that they have no opinion of the efficacy of distance between workers as the only safety measure. The majority of the respondents from enterprise B claim that mentioned safety measures are enough to stay safe. However, compared with enterprise A, they feel more concerns about the safety measures or insecurity about them – 7 employees claim that the social distance is not enough, 4 that the masks are insufficient and 6 that the sanitizers are insufficient as well. 3 people claim that the closure of the workplace and remote work are not sufficient, which may be interpreted that they consider also external insecurities after working hours.

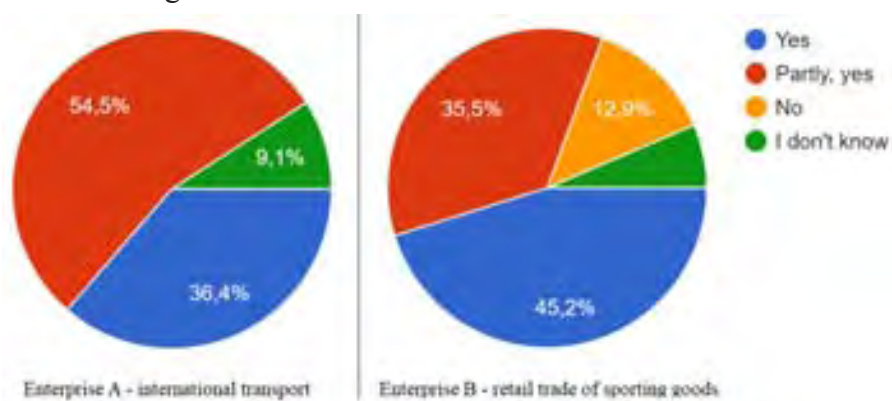


Figure 5. Implementation of remote working at the workplace. Own study.

Another question refers to the implementation of the remote work to the working mode of enterprises (Figure 5). In case of enterprise A, 90.9% of the respondents claims that remote work was implemented in the company, and 9.1% claim that they do not know, thus these group may consist in people who work in the company shorter than others who experienced working remotely at the beginning of pandemic. In case of enterprise B, 80.7% of respondents claim that remote work was implemented in the company, while 12.9% and the rest claim that it was not implemented or they do not know. The percent's can be interpreted in the way, that enterprise B hired more people after first waves of the pandemic, or the exchange of the employees is on higher level than in enterprise A.

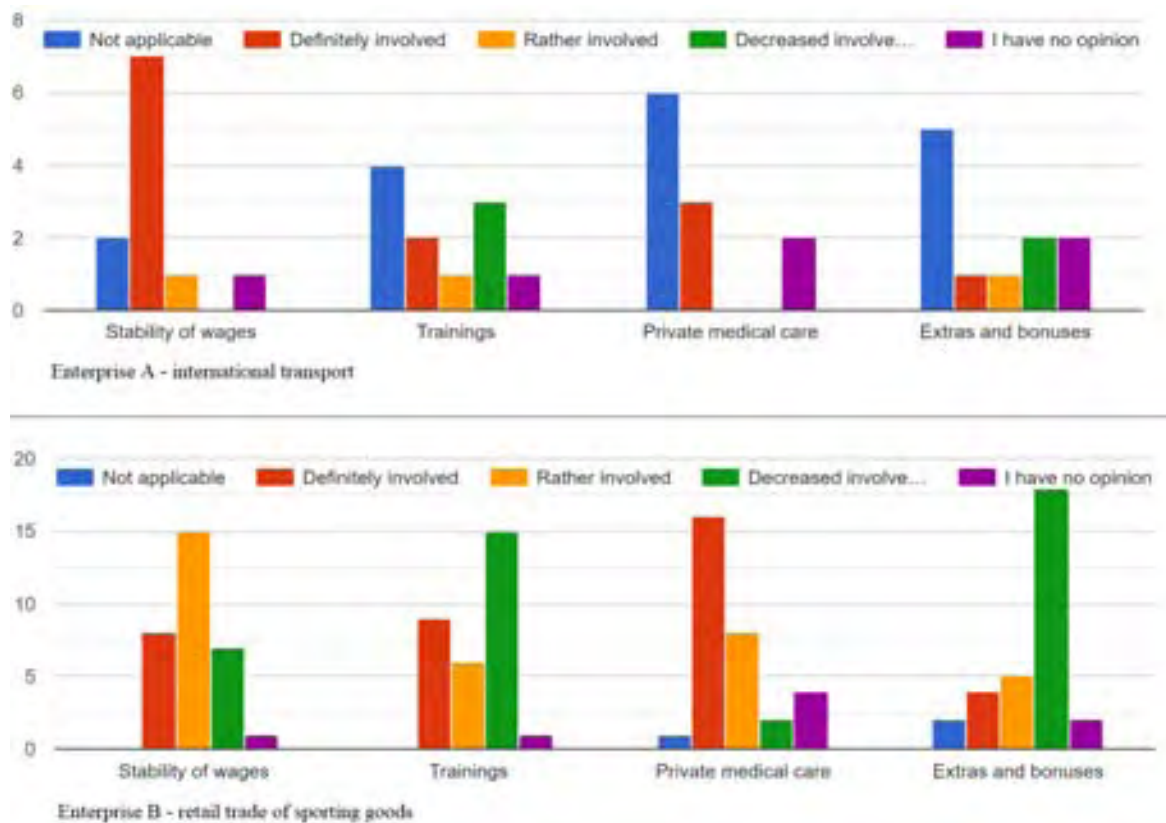


Figure 6. Rate of company's commitment to maintenance of following standards. Own study.

Figure 6 and Figure 7 depict employees answers to the question on the rate of commitment of the company into maintenance of following standards. In terms of stability of wages, both companies present significant involvement. In terms of trainings provided to the employees, answers of the enterprise's A respondents are various, however majority claims that they have no trainings. Respondents of enterprise B claim that the company is definitely involved into providing trainings, but the involvement decreased during pandemic. Enterprise A seems not to provide private medical care to their employees, while in case of enterprise B, the involvement into providing private medical care is definitely continued despite the pandemic. In terms or bonuses and extras, enterprise A seems not to practice such rewarding and motivation, as distinct from enterprise B, which in turn seems to provide such benefits, however the involvement decreased during pandemic.

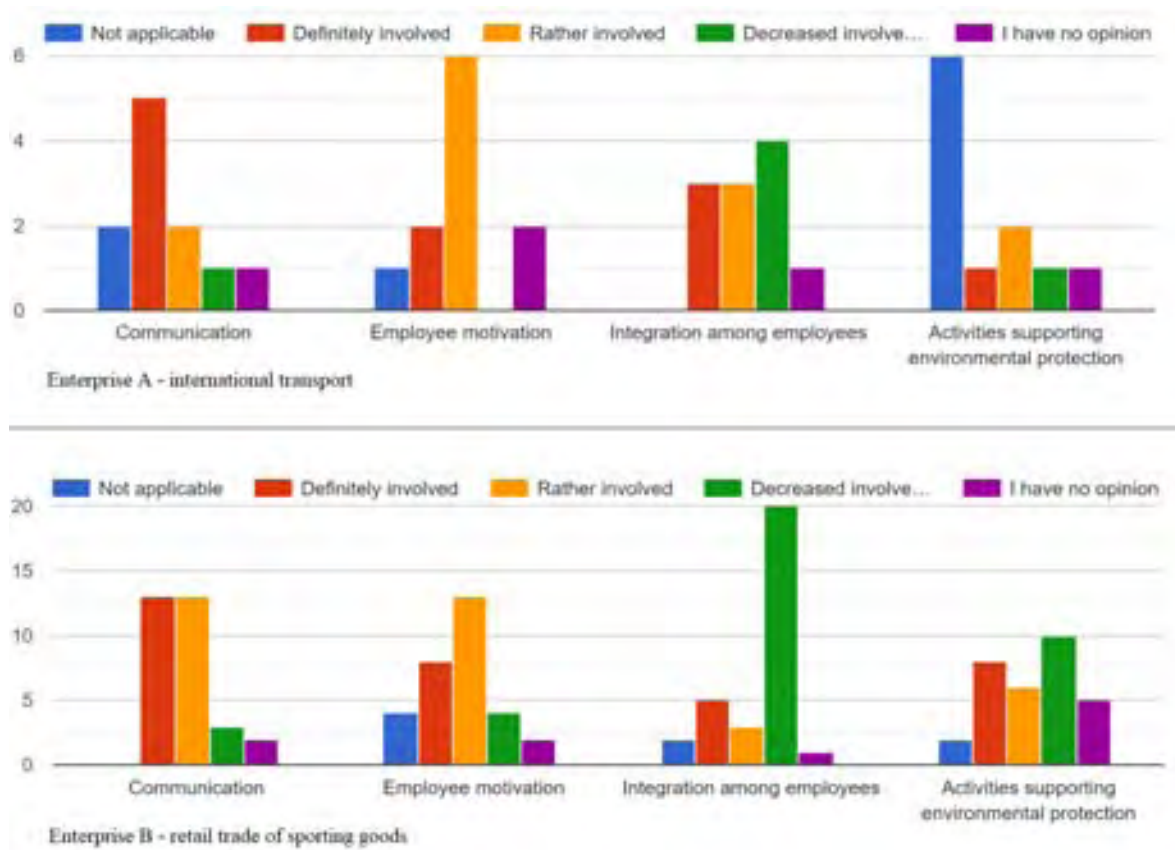


Figure 7. Rate of company’s commitment to maintenance of following standards. Own study.

The respondents of both companies claim that their employers and definitely or rather involved into good communication, which is similar in case of motivation which employees gain from the employer. According to respondents from enterprise A, the company involves into integration among employees however the involvement decreased during pandemic. Respondents from enterprise B, in majority claim that the company decreased its involvement into integration of employees during pandemic. In terms of supporting environmental protection, the majority of answer from enterprise A depict that the company is not involved into such activities. In case of enterprise B, respondent point the decreased involvement during pandemic, along with being involved in such activities in general.

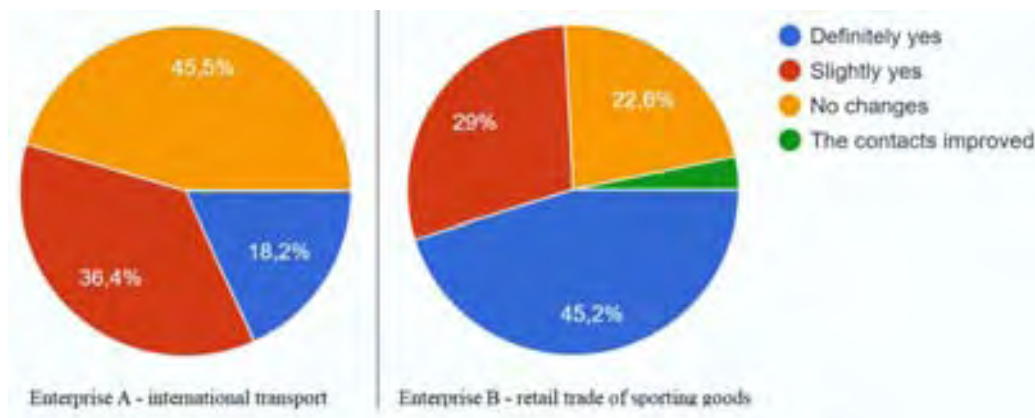


Figure 8. The impact of pandemic on contacts between colleagues. Own study.

Another question refers to the pandemic impact on contacts between colleagues (Figure 8). In case of enterprise A, the answers are 54.6% for change in the contacts, and 45.5% for no changes in this sphere. 74.2% respondents of enterprise B claim that the contacts changed, while 22.6% claim that the pandemic brought no changes in this sphere.

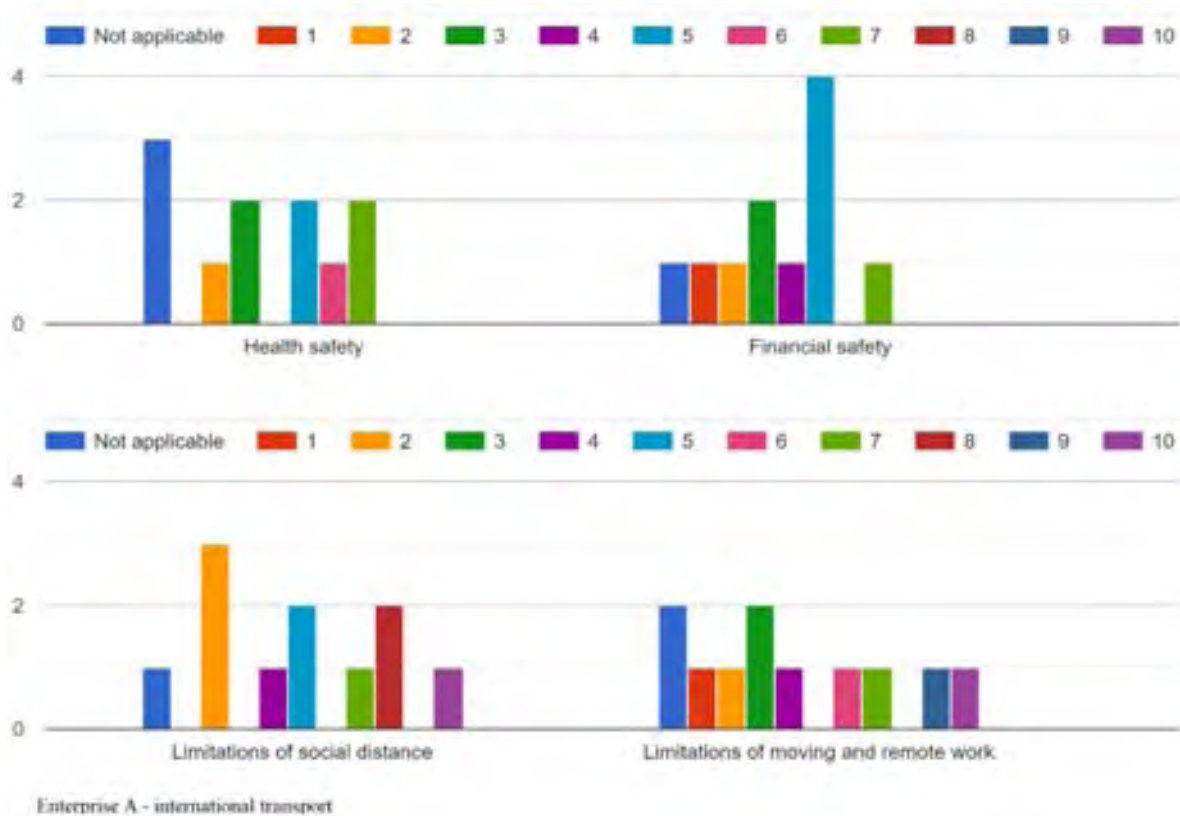


Figure 9. Experience of stress related to the aspects listed below where 1 means little impact and 10 means huge impact. Own study.

Figures 9 and 10 present the pandemic impact on employees well-being and how it evokes stress connected with pandemic concerns. The scale from 1 to 10 have been applied in the question, to estimate how much the problem influenced people's well-being, where 1 means little impact, and 10 means huge impact. In case of respondents from enterprise A, the concern on the health safety was quite low, only 2 employees estimated it on 7 points, the rest opted for below and even 3 people did not feel such stress. Financial safety received 4 answers with score 5, thus this concern is not crucial for the employees. Limitations and social distance evoked average concern, and only 1 person scored it on 10 points, and 2 respondents on 8 points. Limitations on moving and remote work is quite divided, as almost each point on the scale has just one follower.

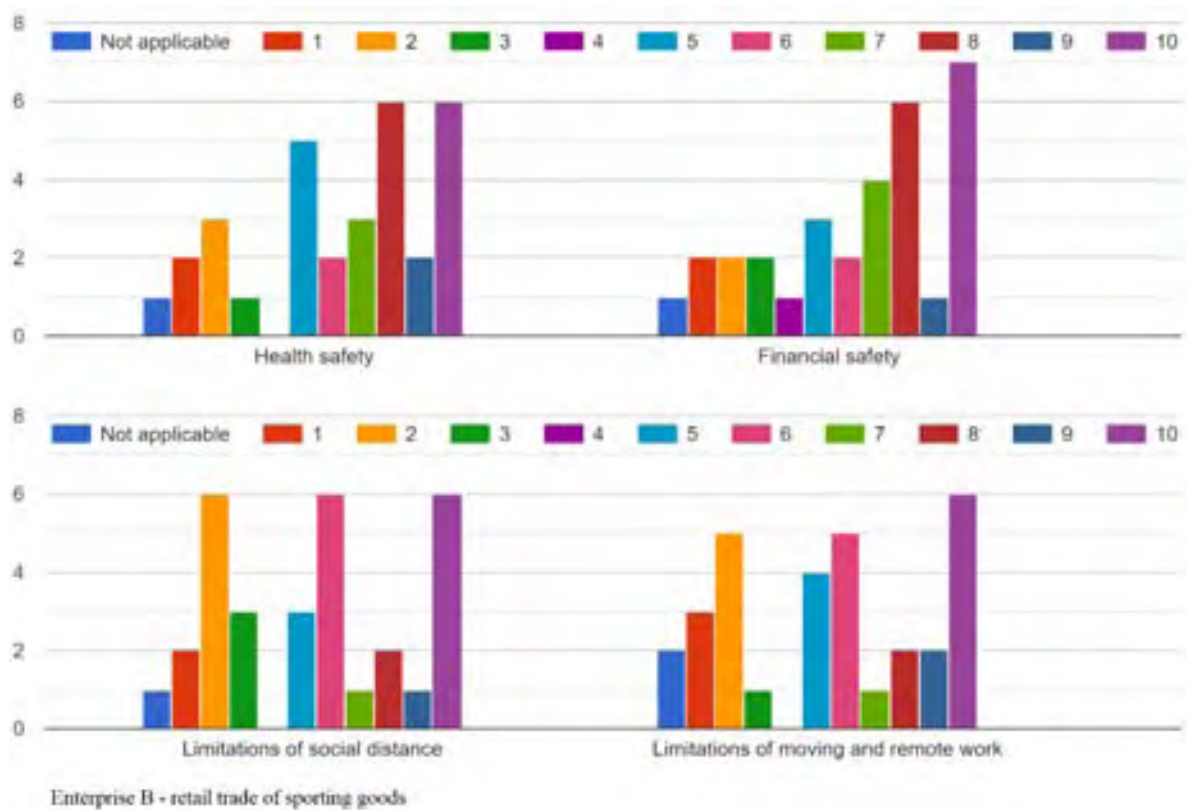


Figure 10. Experience of stress related to the aspects listed below where 1 means little impact and 10 means huge impact. Own study.

The majority of respondents from enterprise B feels that health safety issue evoked quite strong concern, however there is a group of people who did not care much about this factor. 24 people scored their concern from 5 to 10 points. Financial safety similarly to health safety was quite serious concern for the respondents, while 23 people estimated it on points between 5 and 10. Limitations on social distance received various marks – 6 people opted for each 2 points, 6 points and 10 points. Comparing, the stress connected with limitations on moving and remote work was divided. 5 people opted for each 2 and 6 points, while 6 people considered this stress having huge impact on their well-being.

To compare both companies, respondents of enterprise A seem to bother less about the pandemic concerns, while respondents of enterprise B, seem to feel more stress connected with mentioned aspects. This may be caused by the type of contacts their job relies on, the wages rate and the overall stability of the job place and individual material condition along with approach towards pandemic.

Respondents were asked also about what are the most significant effects of a pandemic in their industry.

Employees of enterprise A, which belongs to international transport sector, pointed following aspects:

- No access to products for society due to production limitation and shutdown of big factories especially in automotive industry,
- Less shipments and lower incomes,
- Delays of payments and cash flows,
- No drivers available to cover ordered loadings,
- Delays in deliveries,
- Decline in orders and higher prices,
- The fact that the work can be done remotely.

Employees of enterprise B, which belongs to retail trade of sporting goods sector, pointed following aspects:

- Sales decline, smaller revenues, production limitations – no stock, no workers due to quarantines and the malpractices due to lower number of workers available during pandemic wave,
- Higher prices of products, low raises of payments or lower wages, decrease of satisfaction from work,
- Huge amounts of clients in short time straight after loosen restrictions, thus no ability to serve everyone, overloaded workers. Clients do bigger shopping,
- Restrictions in social contacts which influences the working efficacy, no integration,
- Closed sports clubs,
- Fear of doing shopping in person, increased online sales,
- No recruitment of new people, unstable employment due to closures of stores, the fear of losing the job, firing due to the store closures and no recruitment when they open again, suspension of activity during lockdowns,
- Misinformation, poor communication,
- New tools of working with clients, digitalization, raising competitiveness on the market in the sports industry,
- Company's economy in danger, as well as social interests of employees, financial problems, no bonuses, insecurities.

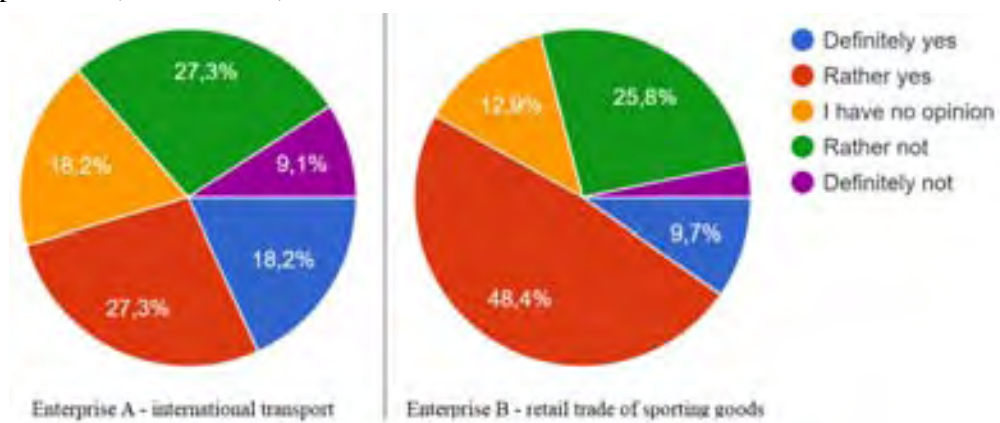


Figure 11. Perception of industry's resistance to the crisis during pandemic. Own study.

Being asked about the resistance of the industry to the emergence of crisis during pandemic (Figure 11), 45.5% respondents of enterprise A claimed that the industry is definitely or rather resilient, while 36.4% opted for vulnerability of the industry in face of crisis emergence. 18.2% of the respondents have no opinion, which once more confirms the theory of new team members who do not suffered much from the effects of pandemic at the company.

58.15% of the respondents from enterprise B opts for industry being definitely or rather resilient, 29% claims that the industry is vulnerable on the crisis arise, while 12.9% of the respondents have no opinion.

Being asked about day-to-day functioning of the workplace and what changed most during pandemic, the respondents of the examined enterprises answered in the following way:

Enterprises A: hygiene and distance restrictions, remote work, less work, working hours, protecting masks, finishing earlier, new security measures, stability, organizational changes. Couple of answers suggested that besides hygiene standards nothing else changed.

Enterprise B: more remote conferences and online contacts, conscience on hygiene and distance, protecting masks, sanitizing, no stock, relations with colleagues, no integration, exaggeration in keeping distance between workers, restrictions from the government on the number of clients on particular area, and controlling the limits of customers in at the entrance to the store, company's finances, remote work possible, knowledge of employees about the online sales, more work, atmosphere, change in contacts, new procedures, employees care about others, increased communication. However, the respondents claimed also that after more difficult periods, everything is back to normality.

The last question in the survey concerned the possible positive practices that the workplace developed as the result of pandemic.

The answers of employees from enterprise A included new channels of communication, cleanliness, hygiene, distance, temperature control, ventilation, the structure of the working day, finishing earlier, remote working if required and possible. 5 people claimed that nothing much changed.

The answers of enterprise B included hygiene standards, enabling of remote and online possibility to manage issues, however not practiced anymore, information flow, new technologies and sanitizing systems, no need to physically attend meetings due to online forms of contact, organizational and communicational changes, employees safety, awareness on ecological issues and the value of eco products, boost of new sales channels, reorganization of strategic point of the store to be more effective, actualization of systems, new ideas to work better and more pleasant, quicker adjusting to the changes, e-sport, new organization of settling the working period. There appeared concerns that nothing else besides the pressure on hygiene standards and development of digital sales will remain from the positives. On the contrary, some answers however pointed, that there is nothing positive that comes from pandemic.

4. Conclusion

The following conclusion have been reached from the analysis and research.

1. The results of the survey presented that employees of both enterprises felt safe in the companies' environments (enterprise A – 100%, enterprise B – 66.7%). Unlike the office workers of international transport industry, employees of second enterprise working in the industry of retail trade of sporting goods, and whose contacts with wider group of people are personal and direct, felt some insecurities (12.9% of respondents from enterprise B did not feel safe).
2. According to the answers of respondents, both companies suspended only some of the activities for a period of time, coming back to normality (81.8% respondents from enterprise A, and 96.8% from enterprise B), thus their resilience to the internal crisis creation have been confirmed. Transportation sector however seemed to recover from restrictions and inconveniences quicker than retail trade.
3. Communication and motivation came out to be strong sides of both enterprises according to employees answers, thus they are possibly aware of the values during the pandemic and the support which these aspects of leadership provided to the well-being and of employees (63.6% and 72.7% of respondents from enterprise A, and 77.4% and 64.5% from enterprise B, claimed that the company was involved consecutively in the communication and motivation).
4. Employees of corporation seemed to feel more committed to company's issues which might be possible natural reaction of gaining bonuses, as opposed to smaller and private business which do not provide bonuses, extras or private medical care. On the contrary, analysing the concern of the financial safety, despite more involvement into bonuses and extras of the bigger enterprise B, people's stress was higher than in smaller company which does not provide additional benefits. It brought the conclusion that the company in transport industry provides more stable and higher wages, than the company operating in retail trade. This observation might also pose the difference between countries as Spanish environment seemed to care less about particular concerns than Polish environment.
5. On the example of enterprise B, the commitment showed through the answers of respondents to the open questions, presents the interest in the company's functioning and the amount of information available for employees. It depicted how organizational culture influences the moods in a company and mutual goal during crisis situation. In turn, employees performing managerial activities in the companies, seemed to have more expanded analytical opinions on the company's condition during pandemic and what measures are beneficial to its constant development.

6. The character of the work and the differences in working in smaller and larger company, were observed to be determinants of the well-being and the feel of security. The employees working at the office in smaller company seemed to feel less concern connected with health security, than the employees from bigger company in which they are exposed to numerous direct contacts with colleagues and customers.

The major assumption in the paper was that as long as the proper tools are implemented in the company's management and approach toward employees the company will be able to conquer the crisis of pandemic character and even benefit from positive changes. Thanks to the open questions which were supposed to extract the main changes in the industries the main impact on functioning of the company and the possible changes within the companies' practices, following conclusions have been made:

- Crisis management means observed in both enterprises are the implementation of safety measures like hygiene standards, social distance, sanitizing and masks, but also the remote work, and temporary closure during the most dangerous periods. The strategical and communicational changes concerned the realization of the use of online ways of communication at work, enabling online conferences and possibility to perform work remotely, but also adjustments of the work organization according to the needs.
- The leadership supporting employees' issues, through caring about their motivation, the flow of information and involvement into providing the bonuses, enhances the human capital well-being. Financial security plays a big role in times of crisis thus appropriate earnings in relation to performed responsibilities and their risks, are crucial.
- The pandemic was observed to carry the building and developing features to some extent. According to the respondents it caused the quick development of needed means and implementation of beneficial systems and practices in the form of respecting the hygiene standards, being more effective thanks to new digital means, possibility to work remotely, organizational changes and boost of innovative ideas. Crisis helped to cherish spheres people forgot about in modern world, like the possibility to physical direct contacts which people were suddenly deprived of. (74.2% of respondents from enterprise B claim that the relations with colleagues have been affected; to compare – 54.6% of respondents from enterprise A marked the change in the relations between colleagues).

From the perspective of two different European countries the companies preserved high quality of sense of security, stability and care towards the employees. However the course of the events was highly depended on how dangerous the situation would have turned out and on the hard to predict factors specific for particular organization. The current state of economic situation, human resources and very unique epidemic situation, influencing the ability to performing a work are also important determinants of the situation.

CSR and ecological approach of companies may build the world of possibilities thank to open-mindedness and set on creating the unity and cooperation towards world environment security, thus the personal suggestion of the author is to contribute even more into mutual sustainable development of the various organizations and environments. Contemporary world being filled with high technology development, digitalization, globalization, cooperation, knowledge, consciousness and the information flow through various channels, have enormous impact on reducing the time of crisis situation phases and gaining quick stabilization. Contemporary mankind is lucky to live in the world of such possibilities, because experiencing similar disaster could be far more difficult without a help of modern accomplishments.

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THE IMPACT OF DIGITAL TRANSFORMATION ON CHANGES IN BUSINESS MODELS. WILL COVID-19 ACCELERATE CHANGE?

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Purpose: Technological changes determined by the development of Industry 4.0 significantly change the business models of modern organizations. The Covid-19 pandemic is also influencing changing organizational systems and dynamic progress in technological transformation. The main purpose of the paper is to present the impact of digital transformation on changes in business models and to answer the question if Covid-19 will accelerate change.

Design/methodology/approach: The paper contains the literature review on business model concept, Industry 4.0, Digital Transformation and Covid-19. In this paper the empirical study is also presented. The main research problem was to determine the impact of the digital transformation (technological progress) following the Covid-19 pandemic on changes in the business models of Polish enterprises and public sector institutions.

Findings: A research confirmed that the digital transformation (processes connected with digitization, automation, robotization and artificial intelligence) resulting from the Covid-19 pandemic has had an impact on the business models of both Polish enterprises and public sector institutions. The research also confirmed a discrepancy between the opinions of experts and management when it came to assessing the impact of technological progress associated with Covid-19 on the business models of the surveyed organizations.

Originality/value: The presented work is an important contribution when it comes to the post-pandemic economic reality. Paper assesses the impact of technological progress induced by Covid-19 on changes in the functioning of individual processes, which can be an important guide for management practitioners, helpful in implementing modern technological solutions in organizations.

Keywords: digital transformation, management, pandemic, managerial change.

Category of the paper: Research paper.

1. Introduction

The unprecedented pace of technological change (Liu & Vasarhelyi, 2014), progressing digitalization and “datafication” (Lycett, 2013) in the business world, the confluence and fusing of digital and physical technologies (Baheti & Gill, 2011; Poovendran, 2010; Schwab, 2016) and the growing interconnectivity of tools and machines (Lee, Bagheri & Kao, 2015; Strange & Zucchella, 2017) that shape the present business landscape have created a broad range of challenges and opportunities that are transforming firms, business processes and the very nature of competition (Kagermann, Wahlster & Helbig, 2013; McKinsey, 2015). The scale, scope, depth and pace of changes are viewed as revolutionary (Schwab, 2016) and have been labeled ‘the fourth industrial revolution’, or Industry 4.0.

Nowadays, innovations, especially those related to digitization, automation and robotization, are becoming the main driving force of economies and enterprises. According to A.G. Lafley and R. Charan: "The best way to be successful in the current business environment is innovation" (Lafley, Charan 2008, p. 13). Its fruit is "a sustainable and profitable increase in revenues from core activities" (Lafley, Charan 2008, p. 13). Enterprises implementing innovations are often presented as market leaders, while enterprises that fail to implement innovations are treated as market laggards.

In recent years, digital transformation and process automation have accelerated at a tremendous rate, and leading companies are rapidly innovating. Research by McKinsey & Company shows that 80 percent of companies believe their business models should be digitized to remain economically viable” (McKinsey & Company 2020).

These processes are of particular importance during the current Covid-19 pandemic. According to a report from the United Nations Industrial Development Organization (UNIDO), “Covid-19 is a catalyst for digital transformation. Covid-19 is becoming the unexpected accelerator of the digital transformation. The disruptions caused by the crisis are having a profound impact on the world’s mindset, which is nowadays more open to embracing change so as to curtail the effects of the pandemic and to return to normality. In fact, due to these disruptions, the world has arguably experienced the most astonishing digital transformation in a few months that we have seen in the last decade” (UNIDO 2020).

The above-mentioned factors prompted us to study the impact of Covid-19 on changes in an organization's business models. We noticed that a research gap exists in this area as well as in relation to the impact of the Covid-19 pandemic on technological progress resulting from digitization, automation and robotization. We conducted research aimed at determining the effects of the Covid-19-related digital transformation on the business models of Polish enterprises and public sector institutions. In particular, we analyzed processes connected with the use of digitization, automation, robotization and artificial intelligence, the basis of which is, *inter alia*, software and the use of the Internet. We examined the impact of these processes on

the business models of the surveyed organizations by conducting quantitative research of the opinions of representatives of enterprises holding managerial positions and experts employed in public administration.

2. Literature review

2.1. Business model concept

Research on business models in the management sciences is conducted from three perspectives - the perspective of choices, the perspective of the activities undertaken by an organization, and the normative perspective. Each of these perspectives imposes a specific understanding of a business model and its components. From the perspective of choices, a business model is the logic underlying an enterprise's operation and the way it operates; from the perspective of an action system, a business model is a system of activities heavily focused on creating value; from the normative perspective, a business model is a general pattern or guideline, and its main function is to enable description and classification (Grzywa, 2015). The term business model first appeared in the academic literature in the late 1950s. However, it was not until the massive diffusion of the Internet that it gained wide recognition in managerial literature and among business professionals. Since then, it has been conceived of and conceptualized at different levels of abstraction, from various perspectives and often for the idiosyncratic purposes of individual studies (Zott, Amit & Massa, 2011). A business model has been referred to as a kind of architecture, a design, pattern, plan, method, assumption, a statement (Morris, Schindehutte & Allen, 2005), a tool (Baden-Fuller & Haefliger, 2013, Chesbrough & Rosenbloom, 2002; Magretta, 2002) and a managerial philosophy (DaSilva & Trkman, 2014). Despite the popularity of the term, there is no consensus on its meaning (Falencikowski, 2013). Put simply, business models are stories which describe how firms work (Magretta, 2002). Another interpretation is that they function as abstract representations of businesses (Al-Debei and Avison, 2010). For Timmers (1998), a business model is the architecture of a product, service and information flow, encompassing various business actors and their roles, and a description of revenue sources and potential benefits for individual business actors.

The business model is a simplified picture of the most important elements of a company's operations and their mutual relations. The type of approach and the underlying theory of economic activity determine which elements are important for describing the reality of an enterprise and in what relation to reciprocity they remain. It is important to distinguish between static and dynamic approaches to business models. In static logic, a business model is "considered at an abstract and conceptual level – it is a general pattern, even a guide, and its

main function is to enable description and classification. Thus, it is understood as a simplified image of creating and capturing values” (Grzywa, 2015, p. 25). This trend does not "consider the interactions between individual elements of the business model, but rather focuses on their observation". In the dynamic trend, the understanding of the business model is based on the links between the choices and their consequences, between individual elements. In this article, we assume that a business model is a simplified, synthetic presentation of the business logic of a specific company, a description of how the company operates on the market. This description can be made via many different elements defining what the company offers to its clients, how it reaches them, how it maintains contact with them, and with what resources, activities and partners it does so, etc. Johnson, C.M. Christensen and H. Kagermann (2009) proposed a business model diagram consisting of the following four elements:

- a value proposition for the client – defining the target audience and determining how the organization creates value for them,
- a profit formula – defining how an organization creates value for itself and includes such components as a revenue model, a cost structure, a margin model and the rate of consumption of resources, – key resources – an asset that creates value for both the buyer and the organization.
- key processes – activities, including the rules, measures and standards of the organization that are key to creating value for the recipient and the organization.

There is an extensive scholarly literature dealing with the search for a model that perfectly reflects the real parameters of a business. The elements that are used to describe and characterize it are most often treated as equal driving factors, which have the same power of impact on the company's success and universal (i.e., independent of the type of organization, industry or development phase) application. In practice, however, we encounter a huge variety of business models, and these differences "occur not only between various sectors, but also between individual companies within the same industry" (Afauh, Tucci, 2003, p. 87).

The above considerations regarding business models allow us to make the following comments:

- the business model is an attractive concept for both practitioners and scientists, as it is a business story (Magretta, 2002),
- it should be noted that this concept is widely used by managers of both organizations operating for profit and those not operating for profit. Therefore, the understanding of a business model should be extended to cover a broad range of organizations,
- despite great interest in issues connected with business models, the amount of in-depth empirical research relating to business models is limited, which in turn restricts the cognitive aspect. This applies in particular to the issue of changes in business models as a result of digitization, automation and robotization.

The rapidly increasing focus on business models in recent years (Foss & Saebi, 2017) may have been spurred by strategic discontinuities and intense global competition (Doz & Kosonen, 2010). Johnson et al. (2008) link the growing need for business models with a shifting competition base, Voelpel, Leibold & Tekie (2004, p. 264) point to “major and unpredictable changes in the business environment” and their accelerated pace. Finally, a number of scholars (Pateli & Giaglis, 2005) find key antecedents of the business model in new opportunities brought about by advances in information and communication technologies. The advent of the era of Industry 4.0 can thus be expected to generate further interest in the topic.

2.2. Industry 4.0 and business models

Over the last few years, the concept of Industry 4.0, also known as the fourth industrial revolution, has attracted the growing attention of scholars, practitioners and politicians (Jarosz et al., 2020). Despite its popularity, however, no generally accepted definition of the term exists (Hofmann & Rüscher, 2017). Working definitions comprise a variety of technologies, applications, and processes. The term itself appeared for the first time at the Hannover Fair in 2011 in the context of the German government’s new high-tech strategy aimed at promoting the automation and computerization of industry (Karabegovi, 2018).

In the nine years that have passed since the definition of the main assumptions, numerous interpretations and guidelines for industry 4.0 have appeared. The core idea is reflected in a passage from the 2013 publication "Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0" (H. Kagermann, W. Wahlster and J. Helbig), namely: "In the future, companies will establish global networks of machinery, storage systems and production facilities in the form of cyber-physical systems. In a production environment, such systems will include intelligent machines, storage systems and production equipment capable of autonomously exchanging information, triggering actions and controlling each other...".

Industry 4.0 is presented in the literature as the fourth consecutive industrial revolution, preceded by (Drath & Horch, 2014; Schwab, 2016):

- the introduction of water and steam-powered mechanical manufacturing,
- the development of electrically powered mass production technologies and the introduction of the division of labor,
- the use of computers to support further automation of manufacturing.

The vision behind Industry 4.0 consists of smart manufacturing, smart logistics, smart grids and smart products, and the increasing use of the Internet of Things in manufacturing. These processes are inevitably leading to changes in business models and the emergence of new business models (Kagermann, Wahlster & Helbig, 2013). Advancing digital and physical technologies and their coalescing into new CPSs enable a wealth of technology ecosystems, where multiple applications communicate with each other as a network (Desmet, Maerkedahl & Shi, 2017). Thus, digital technologies extend, complement and optimize physical operations. Schwab (2016) notes that the “fusion” of previously separate technologies has led to

a confluence of emerging technology breakthroughs. The process covers such fields as artificial intelligence, robotics, IoT, autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing. These technologies can grow out of each other and feed each other, thereby mutually amplifying their impact.

It can therefore be concluded that the transition to an industry 4.0-compliant enterprise model adds significant value to new and existing products, business models and processes.

2.3. Covid-19 vs Digital Transformation

Covid-19 is a disease caused by a new coronavirus called “SARS-CoV-2” (Prescott and Wiersinga, 2020). The World Health Organization first learned of this new virus on December 31, 2019. Covid-19 has had the most significant impact of any disease in the twenty-first century in terms of the population infected, number of deaths, and socio-economic consequences. The virus has evolved to easily infect humans, spread between them and survive.

Virus affected every side of our lives, also many organizations and industries (Szeiner et al., 2021). In the era of Covid-19, the challenges were exposed, and it is fundamental to accelerate the pace of digital transformation, i.e., the adoption of digital technology to transform services or businesses by replacing non-digital or manual processes with digital processes or replacing older digital technology with newer digital technology involving the entire organization and stakeholders in this process. Digital solutions may enable – besides greater efficiency via automation – new types of innovation and creativity, rather than simply enhancing and supporting traditional methods. What is more important organizations had to adapt to these conditions regardless of their previous positioning and experience in digital transformation processes (Almeida, Durante Santos & Augusto Monteiro, 2020).

Almost overnight, the Covid-19 crisis has widened the productivity gap between large-scale technology innovators and those that have long resisted digitization. In the new reality, in order not only to survive, but also to expand their business, companies cannot simply reduce costs and limit investments. This is the best time to increase the pace of digitization to meet the new expectations of customers and adapt to the challenges posed by the "new normality". Many companies see the pandemic as a major accelerator of digital transformation, opening up new opportunities for many industries. In contrast to pre-pandemic digitization, digitization of enterprises must nowadays take into account new challenges. These include, for example, the implementation of remote services and remote management in every process, where possible, as well as securing the company against unexpected circumstances, increasing efficiency, and ensuring sustainable development.

The changes occurring in business models as a result of digitization were confirmed by the aforementioned research conducted by McKinsey’s team of experts (McKinsey & Company, 2020). These studies suggest that companies will now invest in the development of new on-line products and services. This applies to both small and local businesses as well as market tycoons. In fact, every market participant is currently wondering how to join this accelerated digital

revolution. Companies with the simplest business models are trying to adapt quickly to the new conditions. For companies with more complex business models, the existence of which depends on many factors, McKinsey's experts suggested navigating within five action horizons that may ensure a business a safe landing in the era of coronavirus:

- The first horizon of operations involves defining the scale, pace and depth of actions that need to be taken.
- The second horizon involves solving cash flow problems in the short term and trying to ensure the company's financial stability.
- The third horizon is virus recovery. Here, too, everything is based on a good plan that the company should outline in order to quickly get back to running a large-scale business.

Taking into account the actions indicated by the McKinsey experts, the key issues appear to boil down to decision-making processes and planning.

To sum up, the Covid-19 pandemic and the resulting crises, regardless of their nature, have resulted in major changes in both company strategies and business models, and this requires some reflection. During the epidemic, companies from many different branches of industry realized that in order to survive, they had to digitize and adapt so as to be able to provide services remotely, treating online platforms as an alternative to traditional services. In the next stage, changes await practically every industry. Companies will start looking for new solutions not only in order to adapt to the existing reality, but also so as to create new development strategies that will take into account changes on the market.

3. Research methodology

The main research problem was to determine the impact of the digital transformation (technological progress) following the Covid-19 pandemic on changes in the business models of Polish enterprises and public sector institutions. The research problem thus formulated implies the main goal of the research, which is to assess the degree to which the digital transformation has changed the business models of the surveyed organizations. This study takes into account the results of quantitative research based on the opinions of public administration experts and representatives of enterprises holding managerial positions. Our research also aimed (as a sub-objective) to verify the assessments made by the expert management team and to identify gaps in these assessments.

To perform a linear regression, we adopted two directional hypotheses:

H1. *Processes related to the use of digitization, automation, robotization and artificial intelligence result in changes in the business models of Polish enterprises and public sector institutions.*

H2. *There is a discrepancy (gap) between the opinions of experts and management regarding their assessment of the impact of the digital transformation on the business models of the surveyed organizations.*

Because we believe that the impact of Covid-19 is a contextual variable, we also assume that the digital transformation (technological progress) following the Covid-19 pandemic will lead to changes in the business models of Polish enterprises and public sector institutions. In our research, we equate technological progress with digital transformation and understand it as processes connected with digitization, automation, robotization and artificial intelligence, which in turn are based on, inter alia, software and the Internet. It involves gathering information and transforming it using modern technologies. To carry out our research, we conducted two surveys:

1. a questionnaire addressed to enterprise and public administration representatives holding managerial positions. We 230 responses;
2. a survey of experts employed in Polish universities, incl. academic teachers and representatives of universities responsible for cooperation with business. In this case, the study sample comprised 150 experts. The purpose of both surveys was to determine the role of the pandemic in triggering technological changes in Polish companies and public administration. The study focused both on identifying best practices implemented in response to the current pandemic, as well as on identifying challenges arising from digital transformation. We used a linear regression model to develop the survey results.

The general linear regression model can be written as follows:

$$Y = \beta_0 + \beta_1 X + \beta_2 \cdot \text{sex} + \beta_3 \cdot \text{seniority} + \beta_4 \cdot \text{position} + \varepsilon,$$

where:

Y – is an assessment of changes in the functioning of the analyzed industry or process.

X – is the implementation of a given form of progress, or all forms together.

β_1 – parameter showing the influence of X on Y.

β_2 , β_3 and β_4 – parameters constituting the control variables.

Y is coded on a scale of 0-4, where:

- for managers: 0 = small impact; 1 = medium impact, 2 = difficult to say, 3 = significant impact, 4 = very significant impact,
- experts: 0 = no impact; 1 = minor impact, 2 = don't know, 3 = major impact, 4 = very significant impact.

X for a given form of progress is coded with one zero (the answer "not applicable" was coded as 0, and the remaining answers as 1). X is the sum of the codes for 14 forms of technological progress: X1 – Automation, X2 – Robotization, X3 – Digitization, X4 – Artificial Intelligence, X5 – Big data, X6 – Social networks, X7 – Mobile Internet/Applications, X8 – Broadband access to The Internet, X9 – Cloud for storage, X10 – Internet of Things,

X11 – Online store, X12 – Remote maintenance/monitoring, X13 – Virtual reality, X14 – Augmented Reality.

This is a number in the range 0-14, which tells us how many of these 14 forms of technological progress the expert / manager considers to be candidates for implementation.

4. Results

4.1. The impact of digital transformation induced by Covid-19 on the functioning of individual industries

First, we examined the extent to which changes are expected in the way companies operate/ in the business model following the end of the Covid-19 pandemic in the indicated industries. In this case, we determined the impact of technological progress (including all forms x1-x14) on business models in different branches of industry. We studied 15 industries: agriculture, mining, industrial processing, municipal services, construction, wholesale and retail trade, transport and warehousing, accommodation and catering, telecommunications, finance and insurance, real estate services, professional, scientific and technical activities, and education. The results of the research are presented in Table 1. We have presented a summary of the research results for managers and experts.

Table 1.

The impact of Covid-19-induced technological advances on business models by industry

Industry	β_1	
	Managers	Experts
Agriculture	-0,176 *	0,009
Mining	-0,187 *	0,018
Industrial processing	-0,031	0,296 *
Utility	-0,132 *	0
Construction	-0,059	0,123
Wholesale and retail trade	-0,066	0,53 *
Transport / storage	0,184 *	0,073
Accommodation and gastronomy	0,061	-0,101
Telecommunication	0,11 *	0,104
Finance and Insurance	0,038	0,071
Real estate market services	-0,011	0,065
Professional, scientific and technical activity	-0,234 *	0,028
Education	-0,123 *	0,104
Administration	0,115 *	-0,014
Healthcare and social assistance	-0,054 *	-0,27 *

* - statistically significant relationship ($p < 0,05$).

Source: own study.

An analysis of Table 1 shows that, according to the managers, individual forms of technological progress will have an impact on the functioning of business models in 9 industries (Agriculture, Mining, Municipal Services, Transport and Storage, Telecommunications, Professional, Scientific, Technical Activities, Education, Administration, Healthcare, and Social Welfare). In 6 (Agriculture, Mining, Municipal Services, Education, Healthcare and Social Welfare) of these industries, this impact will be negative. In turn, according to the experts, the impact will be visible only in 3 sectors, and negative in only one (Health Care and Social Assistance). Only in the case of one industry, i.e., Healthcare and Social Services, did the experts and managers agree on the impact of (negative) technological change on the business model. The managers predicted that this impact will be most pronounced in Professional, Scientific, and Technical Activities, while experts saw the most significant changes occurring in Wholesale and Retail Trade.

4.2. The impact of technological progress induced by Covid-19 on changes in the functioning of individual processes

Next, we examined the extent to which Covid-19 will affect particular functional areas in a company's operations in the post-pandemic world. Thus, we examined the impact of technological progress (including all forms x1- x14) on particular processes. We analyzed the following areas: Research and Development, Purchasing, Logistics, Production, Marketing, Finance and Accounting, and Administration. The results of the research are presented in Table 2.

Table 2.

Impact of Covid-19-induced technological advances on changes in business models by process

Process	β_1	
	Managers	Experts
Research and Development	-0,113 *	-0,11
Purchasing	0,073 *	0,102
Logistics	0,215 *	0,011
Production	0,195 *	0,191 *
Marketing	0,251 *	0,32 *
Financial and accounting	0,071	0,788 *
Administration	0,244 *	0,033

* - statistically significant relationship ($p < 0,05$).

Source: own study.

According to the managers, the technological progress triggered by the Covid-19 pandemic will influence business models in 6 out of 7 of the analyzed processes. The study showed that such changes will not be limited solely to financial and accounting processes. Only in one case (R&D) will this impact be negative. In turn, according to the experts, such an impact (always positive) will be visible only in 3 processes (Production, Marketing, Finance and Accounting). In only two cases (Production, Marketing), did the experts and managers agree on the (positive) impact of technological changes on business models in certain processes as a result of

Covid-19. Managers expect these changes to be most pronounced in Marketing, while experts predict the biggest impact will take place in Finance and accounting processes.

4.3. Assessment of implementations in both groups

Table 3 provides a comparison of the assessments given by the managers and experts. An analysis of Table 3 shows significant differences in the responses of managers and experts. As a consequence, there are considerable disparities in opinions between the two groups. This results from the fact that the experts only rarely gave the answer "not applicable". They assume the existence of an impact, and as such the variable X in this group is almost always 1 (and when all forms of technological progress are analyzed, it is almost always 14 in total). The correlations are less significant in the case of the experts, due to the fact that almost all the experts believe that such an impact will occur (11 out of the 14 analyzed cases).

Table 3.

Assessment of the impact of technological advances induced by Covid-19 in both groups

Form of technological progress induced by Covid-19	% of answers other than "Not applicable"	
	Managers	Experts
Work/process automation	100,00%	100,00%
Robotization	98,26%	100,00%
Digitization	99,13%	100,00%
Artificial intelligence	98,26%	100,00%
Big data	96,52%	100,00%
Social networks	100,00%	100,00%
Mobile Internet/Applications	99,13%	100,00%
Broadband Internet access	90,43%	100,00%
Cloud storage	89,13%	89,12%
Internet of Things	92,17%	100,00%
Online shops	100,00%	100,00%
Remote maintenance/monitoring	92,61%	100,00%
Virtual reality	67,39%	86,39%
Augmented Reality	61,74%	76,19%

Source: own study.

An analysis of Table 3 shows that in some situations involving Covid-19-induced technological changes (11 cases among the experts and 3 cases among the managers) the response rate was 100% other than "Not Applicable". This means that in these situations assessing the impact of a given form of technological progress on other variables is impossible. As a consequence, these cases were omitted from further analyses of the impact of Covid-19-induced technological changes on business models.

4.4. The impact of various forms of Covid-19-induced technological progress on business models

Table 4 shows the results of research on the impact of various forms of technological progress under the influence of Covid-19 on business models. The results below take into account the opinions of the managers and experts.

Table 4.

The impact of various forms of technological progress induced by Covid-19 on changes in business models

A form of technological progress induced Covid-19	β_1	
	Managers	Experts
Robotization	-0,393	---
Digitization	3,314 *	---
Big data	-0,075	---
Broadband Internet access	-1,128 *	---
Cloud storage	0,929 *	-0,046
Internet of Things	-0,861	---
Remote maintenance/monitoring	-0,795	---
Virtual reality	0,31 *	-0,156
Augmented Reality	0,369 *	0,898 *

* - statistically significant relationship ($p < 0,05$).

Source: own study.

According to the managers, the functioning of companies will be influenced by such factors as digitization, cloud, VR and augmented reality (positive impact) as well as broadband Internet (negative impact). In turn, according to the experts, only augmented reality will have such an impact (positive).

Table 5 shows the combined impact of specific forms of technological progress induced by Covid-19 on business models. Only the experts envisage a positive impact. An analysis of managers' opinions showed that this relationship is statistically insignificant.

Table 5.

The impact of Covid-19-induced technological changes on business models

A form of technological progress induced Covid-19	β_1	
	Managers	Experts
All together	0,048	0,34 *

* - statistically significant relationship ($p < 0,05$).

Source: own study.

5. Results

Our research confirmed our hypothesis that the digital transformation (processes connected with digitization, automation, robotization and artificial intelligence) resulting from the Covid-19 pandemic has had an impact on the business models of both Polish enterprises and public sector institutions. We examined the impact of Covid-19-induced technological progress on business models both by industry (Table 1) and by process (Table 2). With regard to variable Z1 – industries, our research revealed this impact in the 15 analyzed industries:

- according to the managers, it will have an impact on 9 industries, and negatively in 4 of these;
- according to the experts, it will have an impact on only 3 industries, and negatively in only one. When it came to specific industries, the managers and experts agreed on only one sector: Healthcare and Social Services. According to the managers, technological progress will have its biggest impact on Professional, Scientific, and Technical Activities, while the experts pointed to Wholesale and Retail Trade in this respect. The technological consequences of the pandemic are also visible in the case of variable Z2 – processes;
- according to the managers, 6 of the 7 examined processes will be impacted (negatively in the case of Research and Development);
- according to the experts, such an impact (always positive) will only be visible in the following processes: Production, Marketing, and Finance and Accounting. The managers and experts expressed similar opinions in the case of Production and Marketing processes. We also analyzed the impact of various forms of technological progress associated with Covid-19 on business models. We examined the effects of each form separately (Table 4) as well as the effects of all forms taken together (Table 5). Our research has confirmed this impact in the following areas;
- according to the managers: Robotization, Digitization, Big data, Broadband Internet Access, Cloud Storage, Internet of Things, Remote Maintenance / Monitoring, Virtual reality, Augmented reality;
- according to the experts: Cloud Storage, Virtual Reality, Augmented Reality.

However, in certain areas the impact will be negative. For example:

- according to the managers: Robotization, Broadband Internet Access, the Internet of Things, Remote Maintenance/Monitoring,
- according to experts: Cloud storage, Virtual reality.

The analysis of all forms together (Table 5) showed that only the experts envisaged a positive impact.

Our research also confirmed a discrepancy (gap) between the opinions of experts and management when it came to assessing the impact of technological progress associated with Covid-19 on the business models of the surveyed organizations. The responses of both the managers and the experts indicate their awareness of technological advances. A comparison of the managers' and experts' assessments indicates a gap (a significant difference) in their responses. Most of the experts believed there had been such impact (100% in 11 cases). A slightly lower percentage of managers shared this opinion.

Our research leads to the following conclusions:

- the existing situation (including the restrictions introduced by governments) is forcing companies to change their business models. We are currently witnessing a period of intense re-evaluation regarding the needs and expectations of consumers in many industries. According to both managers and experts, most industries will begin operating on new principles;
- The crisis triggered by the Covid-19 pandemic will affect most of the ongoing processes. It will mainly result in greater differentiation in terms of products and services, customer service, as well as in the levels and types of quality of products and services offered;
- we will witness the development of many, hitherto unknown business models, and enterprises will develop radically new ways of meeting needs, some of which are already widely recognized.

We believe that while Covid-19 will not change the foundations of doing business, it will bring to the fore the need for flexibility and adaptation. In an economy under pressure, there is a need for greater awareness, efficiency and sustainability. To build these foundations, not only will companies and partnerships need to be more resilient, but they will also require widespread digitization. In addition, we argue that extensive automation of production processes and robotization will enable companies to continue operating during the most severe restrictions introduced to combat the pandemic.

We are aware that it is impossible to assess in any adequate way how current events will affect our future, be it at the microeconomic or the mesoeconomic level, i.e., what will happen in particular industries, and how business models will change. However, our conclusions have also been confirmed by other researches. For example, the recent Dell Digital Transformation Index studies show that more and more companies operating in Poland are embracing digital transformation. Poland was the third highest ranking country in the report in terms of digital maturity. Data for the 2020 report was collected after the outbreak of the coronavirus pandemic and based on a survey sent to approximately 4,300 people – directors and managers representing companies from 13 industries and 18 countries, including Poland. Globally, 80% of the respondents replied that their organizations had managed to implement digital transformation plans at least partially this year – most often by strengthening the security of their ICT infrastructure and extending remote work opportunities.

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QUALITY OF SCRUM TEAM MANAGEMENT USING FUZZY NUMBERS

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Purpose: This paper is a continuation and development of the same authors two papers which have been published recently, and have been devoted to the Quality of Project Team in classical – in the project management methodology sense – approach. The presented paper pertains to the notion of quality of project team in Scrum project management framework. A paradox is observed in the state of art of the project team quality in project management. All specialists recognize the exceptional importance of the parameter “quality” for the final result of the project. On the one hand, one can easily find definitions of project quality, quality of product of the project, quality of the project management processes, and so on. On the other hand, a huge majority of bibliographical sources consider the project team functioning, as a *sine qua non* condition of the project success. The notion “Scrum Team Quality” appears seldom in the literature. In this paper an approach is proposed to fill in this gap.

Design/methodology/approach: In this paper an approach is proposed, by the proposal of the model, based on fuzzy numbers, which defines the Scrum Team Quality, its measure, and the processes of such quality management. The process of Scrum Team Quality Management building consists of: Scrum Team Quality definition, methods of such quality measurement, and three phases of Scrum Team members selection: processes of MBTI – first pre-selection, Belbin – second pre-selection, and Scrum Team Quality standards complying as a final selection of the Scrum Team, insuring its optimal content.

Findings: The appropriate model of Scrum Team quality management using fuzzy numbers is developed.

Originality/value: The originality of the paper consists in: defining the Scrum Team management quality, the manner of its measurement using fuzzy numbers, and exemplary simulations of Scrum Team members selection using Belbin method, equipped with fuzzy numbers apparatus.

Keywords: Scrum Team, model of Scrum Team Quality Management, Scrum Team Quality measure, fuzzy numbers.

Category of the paper: research paper, conceptual paper.

1. Introduction

We are witnesses of an interesting phenomenon in the project management science. All experts recognize and claim the exceptional importance of the parameter “quality” for the final result of the project. On the one hand, one can easily find numerous definitions of project quality, product of the project quality, or quality of the project management processes, managing quality in project and project quality management. On the other hand, a large number of bibliographical sources consider the human factor – project team functioning especially – as a sine qua non condition of the project success. Favourite subjects are: leadership, team work, relations, cooperation, synergy effect, team climate, project team structures, motivation, psychological abilities of the team members, and so on. Extremely seldom appears the term “quality” with reference to the project team. In the literature of the subject, in relation to the team, the concept of the quality appears only as “relationship quality among team members” or “teamwork quality”. This phenomenon is incomprehensible in juxtaposition with the statements above.

This paper is a continuation – development, of two recent papers of the authors, in which an attempt has been made to fill in this gap – at least partially – in the form of a proposal of the process, which define the project team quality and allows to measure this quality, for projects managed according a traditional methodology, like PMBok or Prince2 (Betta and Iwko, 2019a; 2019b). Two mentioned papers have a conceptual character. Their objectives consist in show the possibility to define the project team quality process, which ensures not only the optimal level of the team quality, but also undertake valuable managerial decisions during the project life cycle, using fuzzy numbers apparatus.

It is evident the interest and necessity to propose and analyse the analogous model of team quality management for projects managed according to agile philosophy (Manifesto, 2001), whose the notion, role, working and responsibility system, as well as the culture of the project team are different from these in classical approach. In the present article let us limit to Scrum Framework, being absolutely the leader of agile methodologies family (Agile247, 2017). The development of previously elaborated model (Betta and Iwko, 2019a; 2019b) should take into account not only the commonly recognized methods like Myers-Briggs Test Indicator (MBTI) (Frame, 1995; MBTI Basics) or Belbin (Belbin, 2008), universal for every team building and management, but also the specific requirements recommended by Scrum’s fathers (Schwaber and Sutherland, 2017). This specificity of Scrum Team requires new definition of its quality. This quality must be measured; use of classical, quality measure methods could not be based on real numbers. The quality of team depends of many parameters of psychological nature, which are not representing by ordinary numbers, but require the fuzzy approach (numbers) (Zadeh, 1965; Kuchta, 2001).

In respective sections are presented:

Section 2 – main results of earlier articles (Betta and Iwko, 2019a, 2019b), Section 3 – Scrum, Section 4 – Scrum Team Quality Measurement, Section 5 (central one) – Quality of Scrum Team Management Model, Section 6 – Discussion, Conclusions, Section 7 – Recommendations.

2. Background for the Project Team Quality Model Development

In two previous papers (Betta and Iwko, 2019a; 2019b), the Guidelines for the Quality Model of the Project Team are presented: general assumptions, quality of project team definition, quality of team measure – classical and with use of fuzzy numbers, based on Myers-Briggs method and Belbin test, and finally, an impact of the quality required of the project team on team management are discussed (Betta and Iwko, 2019a; 2019b). The Guidelines are briefly presented (cited below). It is necessary to show and understand the development of the model, being the goal of this article.

The standards of the project management have some reference to quality management systems, but much less attention is given to this issue than to processes in the project life cycle. The reason for this is largely in the uniqueness of project management (Wawak, 2018). „Quality” is of the exceptional importance for the final result of the project. In the literature there are many definitions of project quality, quality management in projects, managing quality in project and project quality management (Heisler, 1990; Anderson, 1992; Chang, and Ishii, 2013; Basu, 2014). Secondly, many publications are devoted to the human factor (a project team) as a necessary condition for the project success. In publications from the area of the project team, quality appears e.g. in issues as teamwork quality and relationship quality among team members (Ling et al., 2013; Lindsjörn et al., 2016). From the very beginning, the quality management gurus emphasized the importance of the human factor as a quality dimension (also for the manufacturing and service sectors) (Feigenbaum, 1983; Deming, 1986; Juran 1989; Bank, 1992; Crosby, 1992). In ISO 9000:2015 standard quality is defined as “the degree to which a set of inherent characteristics of an object fulfils requirements” (ISO, 2015). The definitions of quality used in project management literature are often also based on this definition. For example PRINCE2 uses the ISO definition of quality that sounds like: “the totality of features and inherent or assigned characteristics of a product, person, process, service and/or system that bear on its ability to show that it meets expectations or satisfies stated needs, requirements or specification” (Prince2, 2009). Project management uses the philosophy of Total Quality Management, which can be defined as:

- a holistic management philosophy which strives for continuous organizational improvement (Kaynak, 2003),
- a management approach for improving organizational performance that encompasses a variety of both technical and behavioral topics (Rahman and Bullock, 2005),
- the application of tools and techniques to understand, manage and meet customer expectations (Darnall, 1996).

The special characteristics of projects require special tools and techniques or applications of those tools adapted to projects. To be able to successfully implement Total Quality Management in project management, a project must be client-focused, goal-directed, and people-oriented.

The differences between applying TQM to projects and applying TQM to the manufacturing reflect the differences between project management and general management. Management skills are very important and necessary in both the manufacturing and project environment. A good project manager (PM) can adopt quality management approaches and techniques to project. Projects offer some challenges that require different skills, tools and techniques. There are many differences between quality in project management and in manufacturing. According to Darnall they are related to customer, time (improvement process and team building), focus, measurement, roles and responsibilities (Darnall, 1996).

The project team doesn't have the structure and organization of a plant and this is why it needs to develop a way to focus the project. It is very important to define very clearly what the project team wants to achieve, who is responsible for the various parts, and track progress toward goals so the project manager knows if the project team is making the right kind of progress. Defining what the project team wants to achieve is focus and tracking progress toward goals is measurement.

One of the basic assumptions of an ideal agile team – see sec. 3 – is that the team is to be self-organizing, multidisciplinary and not have so many named roles: business analyst, developer, tester, etc. In addition, **agile** teams should not constantly ask for outside help, remaining self-sufficiency. The Development Team should have a dual function, i.e. implement requirements and ensure quality at the level it will be able to. The team structure is to be diverse and include all skills that allow for effective repetition of product backlog elements in working increment. Quality assurance and testing activities become the responsibility of all team members thanks to the uniqueness of design roles and sharing of skills. The diversity of the team enables building mutual respect and supports a sense of stability (Zmitrowicz and Stańczak 2018).

Using the definition of quality contained in the ISO 9000:2015 standard (ISO, 2015), the quality of project team can be defined as “the degree of adaptation of the quality level of psychological profiles of the members of the project team to the requirements of particular phases of the project and requirements of Project Manager (PM), taking into account the nature

of the project”, (Betta and Iwko, 2019b). This is a refinement of the definition of quality taken from the ISO 9000 standards (Betta and Iwko, 2019a).

In (Betta and Iwko, 2019b), requirements for the project team are primarily the responsibility of the project manager, who is responsible for the level of project management quality, which is affected by the level of quality of the project team and the level of quality of relations between the project manager and the team. The requirements for the project team are also defined in cooperation with a psychologist and PR expert. Together with PM, they decide on the optimal proportions of roles at each stage of the project.

It is worth adding that if the quality cannot be defined, it cannot be measured, and if it cannot be measured, it cannot be controlled and improved. The quality of project team measurement in traditional approach to project management has been proposed as a process, described below as the sequence of two steps. First of them is based on Myers-Briggs Test Indicator (MBTI), which allows find optimal personal quality level for each of sixteen psychological types (Frame, 1995; Kopczewski and Szwarc, 2009). In this step, the quality is measured classically, with real numbers (Betta and Iwko, 2019b). This step makes possible three main applications of MBTI in development of the project team (Frame, 1995; Betta and Iwko, 2019b). It is used for the personnel recruitment independently for five stages of classical project’s phases, diagnosis of the psychological sources of conflicts and improvement of interpersonal relations PM - project team (Betta and Iwko, 2019b). The second, final step relays on Belbin method, and quality parameters are measured using fuzzy numbers apparatus. The nine roles of Belbin are: Leader, Practical Organiser, Locomotive, Plant (strategist, visionary), External Coordinator, Judge-Evaluator, Team-worker, Completer Finisher, Specialist. Every role is described by different psychological characteristics (Betta and Iwko, 2019b) Belbin team roles can be assigned to persons as a result of special Test Belbin (Pracownia Talentów). Belbin method recommends the equal distribution of the roles among the team members. However, not all are always required at the same time, e.g. in consecutive phases of the project team lifetime. The decision about the optimal proportions of the roles in respective stages of the project is undertaken by PM, Psychologist and HR expert (Betta and Iwko, 2019b).

3. Scrum

3.1. Scrum Methodology

The content of this subsection is a quasi literal quote of the previous author’s paper (Betta et al., 2019), as being necessary to help a lecturer follow the content of the article. The Scrum methodology was formulated in 1995 by Ken Schwaber and Jeff Sutherland

(Standish Group). Scrum is a framework designed to overcome complex adaptive problems and to deliver a product with the greatest possible value for the customer. Scrum is based on empiricism, which builds:

- clarity within each process,
- inspection to detect problems in the project,
- adaptation to changes.

Scrum consists of four main elements: Roles, Events, Artefacts and Rules (Schwaber and Sutherland, 2017).

There are following **roles** in Scrum (Betta et al., 2019). Scrum Master is the person responsible for the understanding and use of the values and rules of Scrum by the Development Team and Product Owner. The main task of the Scrum Master consists in serving the Scrum Team in order to achieve project goals and to ensure that the values of Scrum are applied correctly by the Scrum Team. The Product Owner is the person who is familiar with the business associated with the project and responsible for maximising the value of the product. The main duties of the Product Owner are to control and manage the Product Backlog (Elements in Scrum, The Artefacts). The Development Team is the team responsible for developing the product according to requirements. The Development Team is ‘self-organising’, which means that it has a high degree of autonomy. The Scrum Team is composed of Scrum Master, Product Owner, and Development Team.

Events in Scrum are important in order to provide regularity in Scrum (Betta et al., 2019). Events in Scrum are Sprint, Sprint Planning, Daily Scrum, Sprint Review and Sprint Retrospective. The Sprint is a limited time interval oriented towards an increment in functionality of the project product. The Sprint usually lasts about 30 days or less and consists of the following events: Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective. The Sprint Planning - the main goal of this event is to establish the scope of work to be done during the iteration. During Sprint Planning, items from the Product Backlog are selected; these items will be implemented to ensure the creation of product increment. The Daily Scrum is a daily 15-minute meeting of Scrum Master and the Development Team. The Daily Scrum is vital for monitoring progress in Sprint and for detecting problems that may threaten achievement of the goal of the Sprint. The Sprint Review is an event at the end of every Sprint to inspect the delivered functionality (Increment) and implement the Product Backlog. The Sprint Retrospective consists of reflections on the completed Sprint with some projection for the next one.

Artefacts are material or immaterial results of the work, which enable inspection and adaptation in Scrum methodology (Betta et al., 2019). The Product Backlog determines the scope and sequence of a list of features which should be implemented during the project. The document is open and changes can be introduced at any stage of the project. The Sprint Backlog is a part of the Product Backlog. It is created from Product Backlog items selected for the Sprint; the Sprint Backlog is created and managed by the Development Team.

The Increment defines the complete components of the Product Backlog completed during the Sprint and other previous Sprints. The Definition of Done focuses on clearly understanding when the element from Product Backlog can be accepted as finished.

Rules are defined as being linked with the method; they define relationships between Roles, Events and Artefacts (Betta et al., 2019).

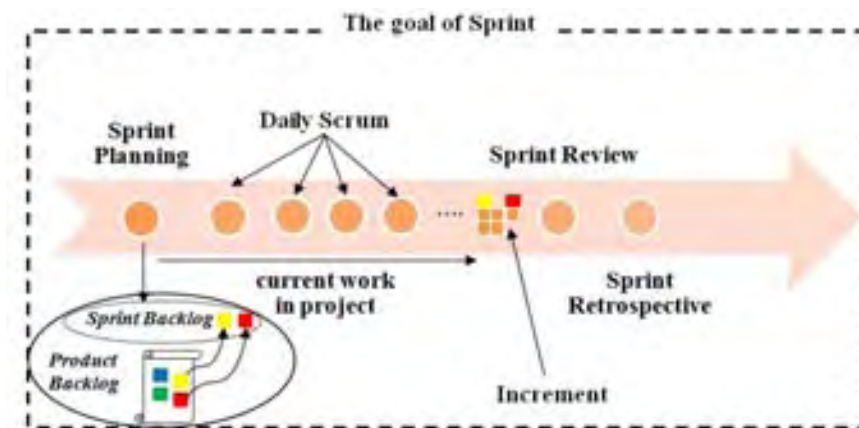


Figure 1. The Sprint. Adapted from: Betta et al., 2019.

Fig. 1 presents an iteration in Scrum methodology. Scrum is characterised by a specific development process based on incremental growth of the product and iterations that are fixed in time (Standish Group; Spalek, 2004). The first step is to create a Product Backlog, where all requirements for the project are kept. During every Sprint, elements from the Product Backlog which are compatible with the aim of the Sprint are selected for the creation of the Sprint Backlog. The Sprint is a fixed period of time during which the Development Team works to provide new functionality for the customer. The Sprint begins with Sprint Planning. In this Event, the Development Team selects tasks for the Sprint Backlog and evaluates them. During the Sprint, the Daily Scrum, or daily meeting of the Scrum Master and Development Team, is held. The total number of finished tasks from the Product Backlog make up the Increment, which should be usable by the customer. The Sprint Review and Sprint Retrospective are conducted by the Scrum Team at the end of each Sprint (Standish Group).

3.2. Scrum Team

Scrum Team – summary based on the Scrum Guide (Schwaber and Sutherland, 2017).

The Scrum Team, working together to deliver the required product increments, is self-organizing—i.e. the team chooses how best to accomplish their work, rather than being directed by someone outside of the team—and cross-functional—i.e. all competencies necessary to accomplish the work are found within the team, without the need to depend on others outside of the team. At the heart of the framework is an iterative and incremental approach to managing the workload that maximises opportunities for feedback and ensures that a potentially usable version of the working product may be always available. This model encourages a high level of communication among the team working towards a common goal and is “designed to

optimize flexibility, creativity, and productivity” (Schwaber and Sutherland, 2017). The Scrum Team consists of the Product Owner, the Development Team, and the Scrum Master, whose roles are summarised in turn.

The Product Owner is an individual responsible for maximising the value of the product that the team delivers and serves as a link between the team and other stakeholders. How this is done varies across organizations, Scrum Teams, and individuals. The Product Owner is responsible for managing the Product Backlog—including expressing Backlog items, ordering them, and making sure the Development Team understands these items and are clear on what the Scrum Team will work on next. While this work may be done by the Development Team itself, the Product Owner remains accountable for it. Product Owner’s personal features, according to the Scrum Guide, are: comprehensibility, logicalness, self-assertion, team work ability (O_i : $i = 1, 2, 3, 4$) (Schwaber and Sutherland, 2017).

The Development Team consists of professionals (Developers) who do the technical work to deliver an increment of a “Done” product at the end of each Sprint. Development Teams are to be “structured and empowered” by the organisation in a way that allows them to organise and manage their own work. In addition to self-organisation, their key characteristic is the collective ownership of the workload – that is, while team members may have specialised skills and focus on certain parts of the task that correspond to these skills, the accountability for the work rests with the Development Team as a whole. Further, the Development Team does not have sub-teams and individual Development Team members do not have titles, regardless of the work each person performs. The optimal size of the Development Team, which needs to be small enough to remain nimble and large enough to complete significant work within a Spring using only within-team skills, is generally three to nine members (Schwaber and Sutherland, 2017). Development Team’s features, according to the Scrum Guide, are: team-work ability, self-organizing, cross-functional (N_i : $i = 1, 2, 3$) (Schwaber and Sutherland, 2017).

The Scrum Master is responsible for ensuring that the Scrum framework is followed, including by helping all Scrum Team members understand the theory, principles, and practice of Scrum, sometimes facilitating key sessions, and removing potential external impediments to the team’s work. The latter involves helping those outside of the Scrum Team understand which of their interactions with the Team are unhelpful and to change these. The Scrum Master serves the Product Owner by, among others, “ensuring that goals, scope, and product domain are understood by everyone on the Scrum Team as well as possible”, finding techniques for effective Product Backlog Management, assisting the Product Owner’s understanding of product planning in the context of Scrum, and promoting agility. The Scrum Master serves the Development Team by, among others, coaching them in self-organization and cross-functionality, as well as in the general tenets of the Scrum framework where needed, and removing impediments to the team’s progress. At the level of the Organization, the Scrum Master serves by leading the organization in its adoption of Scrum, planning the framework’s implementation, helping employees and other stakeholders understand it, and working to

increase the productivity of the Scrum Team. Scrum Master's personal features, according to the Scrum Guide, are: leadership, sense of promoting, sense of teaching, sense of coaching, team work, helpfulness (I_i : $i = 1, 2, \dots, 6$) (Schwaber and Sutherland, 2017).

4. Scrum Team Quality Measurement

As we will see in the Section 5, the Scrum Team Quality Fuzzy Model is consisting of three parts – groups of processes, with necessity to measure the Scrum Team quality. Two first have preliminary character and have been presented earlier (Betta and Iwko, 2019a, 2019b). For the first of them, the authors admit as possible and sufficient a use of ordinary real numbers. For two next groups the authors judge as necessary a refinement, by introducing fuzzy numbers measure.

4.1. Real numbers measurement

Let us imagine a project starting in a company. The first challenge for the Project Manager (PM) and one of principal factors of the project's success is a valuable project team building (Frame, 1995). The model concerns psychological aspects only, much more sophisticated and equipped always with some level of uncertainty greater than the technical aspects of the problem. The authors did not find any attempt, how the project team quality could be measured. In the paper, the quality of project team measurement is proposed as a process, described below as the sequence of three steps.

1st Step. Let us use Myers-Briggs Test Indicator MBTI (Frame, 1995) as the first tool of a preliminary Scrum Team members selection. From among the set of all employs dispositional, the group is selected, according to criteria: all sixteen types of MBTI are represented, if possible equilibrated, each of them represented by the people with his highest score of his leading feature (in percent), of the MBTI test. Such group will be called a Reference Resource Group (RRG), ensuring the best quality of the project team, taking into account existing people availability. Let us denote such ideal level of the group quality as RQPT (Reference Quality of Project Team). Let $BPIQ_i$ denotes the Best Personal Individual Qualities levels ($i = 1, 2, \dots, 16$) for all sixteen psychological types. Then let us define the RQPT level by (1) (Betta and Iwko, 2019b):

$$RQPT = \frac{1}{16} \sum_{i=1}^{16} BPIQ_i \quad (1)$$

There are three main applications of MBTI in development of the project team (Frame, 1995). It is used for the personnel recruitment, diagnose of the psychological sources of conflicts and improvement of interpersonal relations PM – project team.

Project personnel recruitment. Every project is more or less specific; there exist many different types of projects. Moreover, in classical project management approach, the project is divided into five stages: 1. initialisation, 2. planning, 3. execution, 4. control and 5. Closing (PMBOK, 2017). Each of these stages has its specificity and requires people with different psychological MBTI. So, for each stage, a specific recruitment should be done, taking into account stage's specificity and specificity of the project itself. Such recruitment should be done by Project Manager, Psychologist and HR expert, and the candidates be grounded in RRG. For example, in the stage of planning, the dominant types should be ENTJ or INTJ (extravert or introvert, intuitive, thinking, judging), and so on, for other stages of the project. For a stage k ($k = 1, 2, 3, 4, 5$), such team should be composed with the people owning psychological types in proportions defined by PM, Psychologist and HR specialist. Let ST_k be a specific team for a project's stage k ($k = 1, 2, 3, 4, 5$). Its reference quality – $RQST_k$ – is given by (2).

$$RQST_k = \frac{1}{n} \sum_{i=1}^n BPIQ_i, \quad (2)$$

where $BPIQ_i$ is the Best Personal Individual Quality of the person i , and n is the number of members of the specific team for the given stage.

The real quality of such team is in reality inferior, because of resources really available for a given stage. It is calculated according to the formula like above, but the (Best) Personal Individual Qualities ($BPIQ_i$) are not the best, but the real ones (Betta and Iwko, 2019b).

Diagnosis of the psychological sources of conflicts. MBTI method is useful to diagnose reasons of conflicts, inevitable during the life cycle of the project. There can be many different sources of such conflicts and different people involved with them – e.g. PM, his superiors, his workers, customers. More the conflict's reason is of psychological nature, more effective turns out MBTI method to prevent and often solve it. Such prevention and solution of conflicts should be done using $RQST_k$, by PM, Psychologist and HR specialist (Betta and Iwko, 2019b).

Improvement of interpersonal relations PM-Project Team. The PM duties and scope of activities are different than those of the project team members. Usually, the tasks of the project team members are much more precisely defined than those of PM. That's why, very often the psychological type of PM and his team members are essentially different. Project Manager must know his own type, know the types of his people and absolutely be conscious of their differences. It allows him to understand better the differences, propose to the team and undertake common actions which contributes to partially compensate these divergences (Betta and Iwko, 2019b).

These roles are attributed to the members of a specific team (ST_k) for a project's stage k ($k = 1, 2, 3, 4, 5$) by PM, Psychologist and HR specialist. Such team – T_k is optimal, and its quality level is a reference – RQT_k . Each other composition of T_k (in the case of inaccessibility of all people desired), has a lower then reference final level of quality – FQT_k , calculated as a correction, which is a result of non-optimal distribution of the roles. All three (PM as leader, Psychologist and HR specialist) discuss the style and manner of management of the team T_k

with non-optimal distribution of the roles. This situation is discussed in the next section (Betta and Iwko, 2019b).

4.2. Fuzzy numbers measurement

For some reasons, probabilistic methods are not always sufficient for modelling unknown values. Two situations can occur while estimating an unknown value of a parameter:

1. An expert, estimating an unknown value \tilde{A} , gives different degrees of possible realization for different, potentially possible intervals.
2. Among several experts estimating an unknown value \tilde{A} , there are some who admit larger intervals of the estimating value realization, and another ones propose the intervals narrower.

In both cases, the estimation of an unknown value is not an interval, but a set of intervals, called a fuzzy number (Zadeh, 1965). For this paper objective, let us adopt definitions, properties and dependencies below (Kuchta, 2001).

Definition 1

A fuzzy number \tilde{A} is a set of real closed intervals $\{A^t\}(t \in [0,1])$, accomplishing the following conditions:

- a) $t < r \Rightarrow A^r \subseteq A^t$,
- b) $I \subseteq [0,1] \Rightarrow A^{\sup I} = \bigcap_{r \in I} A^r$.

Definition 2

For a fixed $t \in [0,1]$, the interval A^t is named t -level of a fuzzy number \tilde{A} .

The level A^{1-t} corresponds to the opinion of the expert, cautious at the degree t . If $t < r$, A^r is the estimation of an expert less reserved or better informed than the author of the estimation A^t (Betta and Iwko, 2019b).

2nd Step – use of Belbin method for the next pre-selection of Scrum Team members. Our object of interest are the parameters, essential for correctness of this second pre-selection. The situation ii. will only be taken into account. There are three experts – PM, Psychologist and HR specialist, who estimate the levels of nine parameters of Belbin (Belbin, 2008). The parameters, defining respective roles, are in fact a mix of various psychological features/predispositions, and it is impossible to attribute to each of them an exact value. The solution is offered by fuzzy numbers apparatus. Let us denote the parameters, defining respective roles, as fuzzy numbers below, (Betta and Iwko, 2019b).

Table 1.

Belbin roles and their parameters as fuzzy numbers

Belbin role	Parameter (fuzzy number)
Leader	$\mathfrak{R}1$
Practical organiser	$\mathfrak{R}2$
Locomotive	$\mathfrak{R}3$
Plant (strategist, visionary)	$\mathfrak{R}4$

Cont. table 1

External Coordinator	$\mathfrak{R}5$
Judge-Evaluator	$\mathfrak{R}6$
Team-worker	$\mathfrak{R}7$
Completer Finisher	$\mathfrak{R}8$
Specialist	$\mathfrak{R}9$

Source: own work.

Example: Let us admit the percentile scale of all possible estimations of – for example – fuzzy number $\mathfrak{R}1$ values. For the given person, expert1 (PM) can, for instance, state that his estimation of this parameter is [40%-70%] with level 0.8. Expert 2 (Psychologist) can see another possibility – [20%-80%] with level 0.5. The third one (HR specialist) estimates this value as [20%-80%] with level 0.7. So, PM defines the parameter Leader rather exactly ([40%-70%]), but with relatively small degree of caution $1 - 0.8 = 0.2$. It means that he estimates $\mathfrak{R}1$ relatively exact, but with a big possibility 0.8, of mistake. The second (Psychologist's) estimation is less exact ([20%-80%]), but with average degree 0.5 of caution. Finally, the third expert (HR specialist) proposes the same interval as the Psychologist, but with caution 0.3. The final estimation could be the result of these three experts consensus meeting. This procedure could be of course done also for other eight parameters $\mathfrak{R}2$ - $\mathfrak{R}9$.

In the same manner can be proceeded thirteen parameters characterising members of the Scrum Team: \tilde{O}_i : $i = 1, 2, 3, 4$; \tilde{N}_i : $i = 1, 2, 3$; \tilde{I}_i : $i = 1, 2, \dots, 6$ (sec. 3.2), respectively. The appropriate simulation is made in the Sec. 5.

5. Model of Scrum Team Quality Management

The model is based on six assumptions:

- The model does not take into account technical competences of the project team members; they are supposed fulfilled.
- The model considers currently recognized psychological aspects of the Scrum Team quality only.
- Project quality level depends growing on the project management quality level.
- Project management quality level depends growing on the Scrum Team quality level as well as on the quality level of relations Scrum Master – Scrum Team.
- Scrum Team quality level as well as the quality level of relations Scrum Master – Scrum Team, depend growing on the quality level of the members psychological profiles, set down using MBTI and Belbin methods, and on the level Scrum Team requirements fulfilment (Standish Group).
- One part of quality parameters (MBTI) are measured classically (in real numbers). Other (Belbin, Scrum Team characteristics) – using fuzzy numbers apparatus (Betta and Iwko, 2019a).

Using the definition of quality contained in the ISO 9000:2015 standard and the definition of quality of project team in classical approach of project management, **the authors quality of scrum team** can be defined as “the degree of adaptation of the quality level of psychological profiles of the **Rules** in the Scrum Team (the Scrum Master, the Product Owner and the Development Team) to the requirements of the type of the **Events** in Scrum and requirements of the Product Owner (which is responsible for maximizing the value of the product), taking into account the nature of Scrum Teams which are self-organizing and cross-functional, designed to optimize flexibility, creativity and productivity”.

In order to define the quality of the Scrum Team, the parameters resulting from the specificity of the Scrum Team should be taken into account, i.e. features of roles of the team: the Scrum Master (\tilde{I}_1 – leadership, \tilde{I}_2 – sense of promoting, \tilde{I}_3 – sense of teaching, \tilde{I}_4 – sense of coaching, \tilde{I}_5 – team work, \tilde{I}_6 – helpfulness), the Product Owner (\tilde{O}_1 – comprehensibility, \tilde{O}_2 – logicalness, \tilde{O}_3 – self-assertion, \tilde{O}_4 – team work ability) and the Development Team (\tilde{N}_1 – team-work ability, \tilde{N}_2 – self-organizing, \tilde{N}_3 – cross-functional).

This is a refinement of the definition of quality taken from the ISO 9000 standards, quality of project team in traditional project management (Betta and Iwko, 2019a; 2019b) and guidelines of the Scrum Team included in Scrum Guide.

The process of Scrum Team Quality Management building consists of: Scrum Team Quality definition, methods of the quality measurement, and three phases of Scrum Team members selection: processes of MBTI – first pre-selection, Belbin – second pre-selection, and Scrum Team Quality standards complying as a final selection of the Scrum Team, insuring its optimal content. The total number of quality parameters is 38 – MBTI sixteen, Belbin nine and Scrum Team standards – thirteen. Two first of these groups were applied to the project team in a classical project management (Betta and Iwko, 2019a; 2019b), and are presented below. In this article, these two phases stay valuable in Scrum approach also, because of universality of both methods for the team construction – MBTI as well as Belbin test.

First Step (MBTI): Reference Quality of Project Team level, calculated by the Eq.1., should be permanently keep at the highest level possible. From point of view of PM it means that at this stage, he should monitoring this level, and in the case of its decreasing, react by adequate personnel decisions, by substitution – if necessary – some members for another ones.

ST_k is a specific team for a project’s stage k ($k = 1, 2, 3, 4, 5$). Its reference quality – $RQST_k$ – is given by the Eq. 2. Its monitoring and reaction of PM are necessary, as above.

Second Step (Belbin): Nine roles are attributed to the members of a specific team (ST_k) for a project’s stage k ($k = 1, 2, 3, 4, 5$) by PM. Such team – T_k , is optimal from point of view of necessary roles proportions, and its quality level is a reference one – RQT_k . Each other composition of T_k , in the case of inaccessibility of all people desired, should be quickly detected by PM, who should undertake adequate decisions, concerning substitutions. In fact, intending make proportion of roles in T_k the nearest possible to the ideal – the RQT_k , PM would like fulfil the necessary, but not sufficient condition of the best level of the team management. The main

disadvantage of this step are, arbitrary enough proposed by three managers, the personal roles in T_k . The roles depend of many factors; in practice, each of the decision-makers estimates the ability of every of team members to play a most appropriate role in T_k , taking into account not only the Belbin tests results, but also his own experience and personal acquaintance of members. Their estimations can differ between them. It could be very difficult to achieve a consensus on the roles attribution, because of the fact that Belbin roles are based on different, non-measurable and non-comparable, psychological features. As useful appears fuzzy numbers apparatus. Let us observe that Scum Team is the same for all Sprints of the project; there are no project stages requiring the Scrum Team composition.

Second Step (Belbin, fuzzy numbers measurement)

Let us come back to the example, sub-section 4.2. The estimations of three experts of the role of leader, are defined by three levels of a fuzzy number $\mathfrak{R}1$. The situation is shown in the Table 2.

Table 2.
Estimations of parameter $\mathfrak{R}1$

	Estimations of $\mathfrak{R}1$	Caution level	Comments
PM	[40%-70%]	0.2	Focused on small interval, little cautious or well informed
Psychologist	[20%-80%]	0.5	Big interval of estimation (inexact), cautious average
HR Specialist	[20%-80%]	0.3	Big interval of estimation (inexact), cautious little

Source: own work.

The differences between estimations could result from two factors. First, from very equilibrate two or more leading roles of the person (Belbin test). Secondly, from personal differences between experts: professional experience, personal acquaintance and subjectivity of perception.

The authors proposal is to organise a consensus meeting of three experts. The consensus meeting consists in substantial argumentation, using facts only (Ortsman, 1995). It creates an opportunity to explain the nature of differences between estimations of the values of the fuzzy number $\mathfrak{R}1$, representing the role of the leader. Let us notice the same intervals of Psychologist and HR expert in the analysed example, but different levels of caution. HR expert can e.g. explain, that he knows well this person, because of common work in several projects in the past. So, he is less cautious than Psychologist and his estimation could be considered as more valuable. The PM interval is twice smaller than two other, but his experience as PM says that his Belbin test result is sufficient to attribute him such precise estimation of the role Leader. So, the final, optimal result of such (simulated) consensus meeting should be: the interval [40%-70%] and caution 0.3.

Let us suppose that an exemplary Team contains five persons, so, we have nine roles of Belbin to distribute among five people; it should be necessary to define eight of them as jointed (double) for four persons and one role for the fifth one. Let us suppose a candidate with high evaluation of fuzzy features: equilibrated, dominant, extrovert, with medium capability to

undertake decisions and negotiator. The analysis of necessary features (Belbin roles) shows a possibility to accomplish efficiently both roles: leader and external coordinator as well. In a similar way PM, Psychologist and HR Specialist could proceed to attribute nine roles for five people.

Third Step (Scrum Team characteristics, fuzzy numbers measurement)

The basic assumption, according to Scrum rules, says, that roles of Product Owner and Scrum Master cannot be combined one with other, neither with role of Development Team member.

Let us make a simulation of a measuring of one selected item of thirteen features of the Scrum Team; e.g. Development Team members feature \tilde{N}_2 – self-organizing ability. Let us proceed the analyse similar as in the Table 2. The same three experts do this estimation (Table 3).

Table 3.

Estimations of the parameter \tilde{N}_2

	Estimations of \tilde{N}_2	Caution level	Comments
PM	[10%-70%]	0.5	Focused on big interval, average cautious
Psychologist	[30%-60%]	0.4	Little interval of estimation, average cautious
HR Specialist	[30%-80%]	0.8	Big interval of estimation (inexact), very cautious

Source: own work.

As in the case of Belbin parameters (Table 2), the authors proposal is to organise a consensus meeting of three experts, in order to explain the nature of differences between estimations of the values of the fuzzy number \tilde{N}_2 , representing the self-organizing ability of the Development Team member. Let us notice very similar intervals of \tilde{N}_2 , estimated by Psychologist and HR expert in the analysed example, but really different levels of caution. The PM interval is the longest of the three, and his caution level is approximately the same as that of Psychologist, and the interval of HR specialist long with a high caution level. The consensus meeting of three experts should be engaged. It's final, optimal result will probably be: the interval [30%-70%] and caution 0.6, or very similar.

6. Discussion, Conclusions

Both methods – MBTI and Belbin – were developed to insure the optimal composition of the project team, but taking into account different criteria. According to MBTI, optimisation is done in the triple sense: personnel recruitment, diagnosis of the psychological sources of conflicts and improvement of interpersonal relations PM project team. Application of MBTI as the tool of a preliminary selection, allows to create the Reference Resource Group (RRG), which is a set of people, potentially the best fulfilling the psychological criteria of the method (step 1, subsection 4.1), and based on the RRG, ST_k – specific teams for each of five project's

stage k are selected. It allows to diagnose the reasons of conflicts and undertake managerial decisions to prevent them. Moreover, the first step encourages PM to make efforts to neutralise, for the project, differences between his profile and the profiles of his team. The second step – Belbin method, facilitates the next, very important decision of optimal proportions of the roles in respective stages of the project. It is impossible to attribute to each role a real value. Therefore, the application of fuzzy number apparatus makes possible to model the parameters, defining respective roles, which depend on various psychological features/predispositions. One can say that fuzzy numbers apparatus opens the space of consensus deliberations among PM, Psychologist, HR expert and other specialists, if need be, on psychological aspects of team work. Finally, the third step allows to measure thirteen parameters characterising the Scrum Team members. On each stage, in the case of decreasing of quality level, PM should be open and creative to try raise this level. At all stages, managerial decisions are undertaken by PM, assisted by Psychologist and HR expert.

Summarising, for Scrum Team quality management, the following steps should be done:

- acceptance of quality standards (definition proposed and 38 parameters defined),
- providing of these standards maintaining (tests MBTI, Belbin and evaluation of these thirteen features to work in Scrum Team),
- Control: measurement: real numbers for the Step 1. (MBTI), fuzzy numbers for the Step 2. (Belbin) and the Step 3. (Scrum Team members features).

7. Recommendations

Quality is a very large notion, affecting many objects – products, services, processes and other forms of human activities. In technical area, definition and measure of quality are evident and easy to formulate. In social sciences, the challenge is much more sophisticated, because of the higher level of differentiation/variation of social systems in comparison with technical ones (Ortsman, 1995). The project team is a social group of affiliation, with its complicated structure, processes, and interpersonal relations. The significant role of such team in the project success or failure has inspired the authors to develop an idea of project team quality. This development has been presented in sections: 1-6.

Guidelines are presented in the form of the process. This process is described by: general fundamentals of the project team quality, assumptions of its validity, methods of quality measurement, and impact of the quality of the project team on team management. The process is based exclusively on psychological parameters of MBTI (real numbers measurement) for the preliminary selection of the project team members, and Belbin method for the second stage (fuzzy numbers measurement) of pre-selection of them. For the final selection of the Scrum Team members, the fuzzy approach of quality measurement has been proposed and justified.

This paper, in line with authors knowledge, is the first attempt to the quality of Scrum Team. The authors are conscious of its shortages. So, further research should be done. Theoretical, focused on enrichment of a set of quality psychological parameters by the new ones, analysis the quality using particular cases of fuzzy numbers (triangular, trapezoidal), and introducing also fuzzy numbers of type 2 or higher. Practical – research to test and improve the proposed guidelines.

Nowadays, quality is omnipresent in all areas of human activities. So, in “projects age”, quality of project team is entirely worthy of researchers and practitioners interest.

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HEALTH SAFETY OF BREAD IN SMALL BAKERIES

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Purpose: The aim of the article is to present the safety and health risks in the production process of bread, supported by research in small bakeries located in the Pomeranian Voivodeship.

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: Health safety of bread is one of the features that decide its quality. This paper additionally presents other determinants influencing the quality of bread. It also demonstrates opinions showing food safety as a separate attribute of quality. The paper cites Polish domestic and EU legislation in the areas of food safety, as well as competences of sanitary inspection bodies. The major part of the paper is devoted to the identification of types and potential sources of health threats in the production process of bread and the prevailing prevention system, i.e. HACCP. The research on the structure of the bread and the level of implementation of HACCP was performed in Pomeranian small bakeries, which form 89.4% of the overall Pomeranian bakeries.

Practical implications: Practical implications include taking into account the indicated determinants that affect the quality of bread 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: Proper implementation of the principles of bread health safety as one of the features that determine the quality of the product, as well as the determination of other determinants that affect the quality of bread, allows to build and maintain a long-term competitive advantage in small bakeries in the bakery industry. Natural identification of the types and potential sources of health risks in the bakery production process and the applicable systems of counteracting these risks, e.g. HACCP, will have a major impact on the long-term process of innovative management of managers and owners of small bakeries

Keywords: bread quality, health safety of bread, health threats of bread, small bakeries, sanitary inspection competences, HACCP.

Category of the paper: research paper.

1. Introduction

The interest in initiatives towards protecting the food safety has been on an increase since the late 19th century. Additionally, this is no longer the domain of the wealthiest countries – safe and high-quality food is currently important to consumers worldwide.

The basic component of each Pole's diet is bread – with rational approach it can regulate the human digestive tract and constitute a major portion of the daily intake of calories required by a human body – 25-30%. Currently, with the noticeable technological advancement and the human nutrition becoming a separate discipline, bread is still a basic component of the human diet and there is no other food product that could replace it (Dziwkosz, 2012; 2018; Gambuś, et al., 2011). Bread was, is, and most likely will continue to be of foremost importance in Poland (Ceglińska, Cacak, Pietrzak, Haber, 2003; Mielcarz, 2004).

Based on a 2021 study in small Pomeranian bakeries, such that employ up to 50 staff and have an annual turnover of less than 10 million PLN, the structure of the bakeries' output was as follows:

- bread: 69%,
- bread rolls: 15%,
- other, i.e. sweet rolls, doughnuts, small pizza rolls, burger buns, baguettes, hot-dog buns, cakes: 16 %.

According to the Law of State Sanitary Inspectorate, food quality is understood through properties and/or features of the product (Law of March 14, 1995).

Based on subject literature (Ambroziak, 2002; Balon, Dziadkowiec, Sikora, 2016) and the authors' observations in small bakeries, it has been determined that bread quality is decided upon based on the following features:

1. Nutritional value, derived from overall chemical composition.
2. Taste, determined chiefly by the composition and quality of the components.
3. Health safety, defined as lack of threats to the consumer's health.
4. Attractiveness, derived from the shape, colour, and packaging.
5. Durability, allowing to store the bread for prolonged time without quality losses.
6. Freshness, derived from external look, smell, crust, inside texture.

The above definition of bread quality has been positively verified within small Pomeranian bakeries.

At all the stages of baking bread, proper quality levels need to be assured, including health safety of the final product. Safe bread does not induce harmful effects on the consumer (Górniak, 2004; Zymonik, Hamrol, Grudowski, et al., 2013).

Subject literature contains a variety of views on quality in connection with food safety. Is the latter an element of the former or does it constitute a separate entity? For instance, according to S. Kowalczyk, J. Spink, and D.C. Moyer (Kowalczyk, 2016; Spink, Moyer, 2011),

food safety is a separate matter. The authors of this view also claim that the mission of the whole system of food safety is to protect and improve public health by assuring that food meets safety norms that are the result of joint activity of the public and private sectors.

Polish subject literature mainly uses the notion of “health safety of food”, an element of product quality. Such view is expressed by e.g.: U. Balon, J.M. Dziadkowiec, T. Sikora, D. Kołożyn-Krajewska, Z. Ambroziak (Ambroziak, 2002; Balon, Dziadkowiec, Sikora, 2016; Kołożyn-Krajewska, 2015). Level of health safety is defined by the health quality of food.

Regardless of the views presented above, the authors of this paper received positive opinion of small-scale Pomeranian bakeries on the subject of treating health safety of bread as one of the features that decide its quality.

Perhaps in case of other food products, produced in other global locations and in different production, sanitary, and social regimes, different views about separating food safety from quality considerations are justified. Quality of bread in Poland, however, cannot be separated from its health safety. Therefore, one of the features that decide the quality of bread is health safety. Polish subject literature acknowledges this approach.

2. Food safety in EU legislation

Quality and safety of food are referenced in a common document by FAO and WHO on strengthening national systems of food control. The two organisations consider food quality to be the properties that create value for the consumer. These are positive values, such as origin, taste, colour, composition, or methods of production, and negative: dirt, impurities, spoiling, discolouration, or improper (atypical) smells (Assuring Food Safety And Quality, 2003).

Food safety is an element of national security. Contemporarily, the issue of health safety is related to individuals, institutions, the state. Therefore, safety of bread is the domain of bakeries. The mission of the whole system of food safety is to protect and improve public health by assuring that food meets safety norms (Czupryna, Maleszka, 2006; Drozd, 2020; Miśniakiewicz, 2007).

Issues related to food safety have been of foremost importance to EU legislation. Directive WE/852/2004 on the hygiene of food products (Regulation WE/852/2004, 2004), which forms part of the so-called hygienic package, provides the key determinants to safety of food. These are:

1. Legally binding minimal hygienic norms.
2. State inspections in food industry companies.
3. Established and practiced programmes and procedures for food safety within companies, such as HACCP.

In the baking industry, fundamental systems of assuring health safety, ones that are also present in overall food production are:

1. Good Hygienic Practice – GHP.
2. Good Manufacturing Practice – GMP.
3. Hazard Analysis and Critical Control Points – HACCP.

Minimal requirements for hygiene have been included in one of the health quality assurance systems, Good Hygienic Practice. Its scope is chiefly (Staszewska, 2002):

- maintaining hygiene around the manufacturing facility as well as in manufacturing halls,
- hygiene of machines and devices,
- state of health and hygiene of staff,
- securing the manufacturing facility against pests,
- plan of controlling the execution of cleaning, washing, disinfection,
- trainings for personnel on manufacturing hygiene.

The implementation of GHP as an obligatory system in ensuring health quality of bread ought to be documented at each bakery that implements the system. The records are proof that the manufacturer exhibited due diligence in assuring proper health quality of their products.

Good Manufacturing Practice (GMP) is synonymous to meeting all the fundamental requirements for main assumptions in the area of buildings, technology, equipment, operational practices, and manufacturing methods that results in the appearance of high-quality food that meets the requirements of the consumer (Kijowski, Sikora, 2003). GMP encompasses the basic areas of activity of bakeries with a level which is sufficient to claim that the resultant bread is of high health quality and is safe for the consumers' health.

Small businesses, including bakeries that were studied for the purpose of this paper, need to introduce GMP and GHP. These systems are reflected in the national legislation.

Polish system of food quality control, called “food safety system” is a dispersed system. Also, it is very static, as the recent change was brought to the system in 2003. S. Kowalczyk claims that changes to Polish and global economy in recent years, and even decades, are not reflected in the structure and functionality of the system. Food safety system in many cases does not reflect the needs of Polish food system which underwent some changes e.g. after Poland's accession to the European Union. One weakness of the system is non-existence of investigation authorisation as well as insufficient performance of control authorities.

Competences of individual inspection bodies in the Polish food safety system are as follows (Kowalczyk, 2016):

1. Farming and Food Articles Goods Trade Quality Inspectorate oversees trade quality in manufacturing and foreign sales.
2. Trade Inspectorate oversees trading goods quality in retail.

3. State Sanitary Inspectorate oversees food conditions and health safety, and has the widest areas of competence, as it processes manufacturing, foreign trade, and retail trade.
4. Veterinary Inspectorate oversees hygiene of animal-derived products as well as animal health and protection.
5. State Inspectorate for Protection of Plants and Seeds researches the residual presence of pesticides in food production and foreign trade.
6. Customs Delivers Customs procedures when trading with foreign states.

As can be seen, bakeries can be controlled by Farming and Food Articles Goods Trade Quality Inspectorate as well as State Sanitary Inspectorate. The State Inspectorate for Protection of Plants and Seeds works in favour of the quality of materials delivered to the bakeries. Trade Inspectorate and State Health Inspectorate control quality of bread in retail trade.

Within the EU, HACCP is obligatory for member states as of December 14, 1995 following the directive 93/43 EEC of June 14, 1993 related to hygiene of food. In Poland, HACCP can be found in companies that manufacture and sell food, with the exclusion of small- and medium-sized businesses, as of January 1, 2004, following the law of May 11, 2001 on the health conditions of food (Kowalczyk, 2016).

Small and medium businesses, including bakeries surveyed for this study, are obliged to implement and apply HACCP. However, there is no obligation to maintain documentation of the system. Maintaining HACCP-related records and procedures is required for certified companies. Voluntary, from the legal perspective, certification of small bakeries becomes necessary if they want to cooperate with major retail chains. Such chains expect that the producer of bread will guarantee, apart from health safety, repeated quality of their products.

For this reason, the authors concluded a 2021 study across 67 small bakeries within the Pomerania area, who responded positively to questionnaires. Despite the HACCP system being voluntary, eight of the bakeries have implemented it. The implementation of the system in small and medium-sized companies requires the introduction of the following rules:

- perform a threat analysis,
- define critical control points,
- set up critical limits,
- set up monitoring procedures,
- set up corrective actions,
- set up verification procedures.

In this paper, the authors identified potential health risks which are very likely to occur in bread production.

HACCP is a specific system of assuring food quality. It is a preventive system that relies on defining all possible and actual consumer health threats throughout the manufacturing process and afterwards, developing preventive actions. If required, critical control points are

defined. HACCP is a preventive-preemptive system (Kowalska, Werpachowski, 2008; Piwnik, Drozd, 2019).

Critical control points are indicated in the analysis and are: place, material, or production stage where a health threat may arise, and where such a threat ought to be controlled. It is necessary to prevent the threat, minimise it or eliminate it, before the product reaches the consumer.

HACCP, unlike the previously applied random internal checks of the finished product, runs all along the production process, from raw materials to the finished goods (Kot, 2010).

The idea of HACCP is a conversion from searching for product deficiencies to prevention of the said deficiencies. It is obvious that monitoring all production stages, including raw materials, is not feasible. However, with the definition of critical control points and focusing on monitoring these points, it is possible to prevent the threats in time and to undertake potential corrective actions.

HACCP checks are based on simple measurements, e.g. of temperature or observations, which is an undoubtable advantage of the system (Malinowska et al., 2012).

The basic premise for implementing HACCP is guaranteeing food safety. Poisoning and food-induced infections are a serious threats to people in today's world.

Not only the consumer but also the producer ought to be interested in obtaining food of high quality. When implementing HACCP, the producer guarantees that their products are safe for the health of the consumer. This is especially important in the light of the producer's legal responsibility for losses caused by food that does not follow quality food standards. The consumer gets a guarantee that the food they buy is safe for their health. Therefore, HACCP meets the requirements of the producer and the consumer alike.

In recent years, a shift in quality systems could be observed, from a detection system with elements of corrective activity, towards preventive systems (Wiśniewska, Grudowski, et al., 2014).

3. Food safety in Polish legislation

The definition of food safety in Polish legislation first came in 2001. It was introduced by the May 11, 2001 law on health conditions of food. Safety of food, according to this law, is "all the conditions that need to be met, and activities that need to be undertaken, at all the food production and sales stages so that human health and life can be assured."

The definition was further detailed in the law of food safety of August 25, 2006. According to this law, food safety is the overall list conditions that need to be met, especially related to:

- additives and flavourings,
- levels of impurities,

- pesticide residuals,
- conditions of food radiation,
- organoleptic features

and activities that need to be undertaken at all the stages of food production or sales so that people's lives and health can be assured. The same wording was maintained for further amendments of the law (Law of October 8, 2020).

Among numerous views on the importance of food safety for different people and consumer groups, Aigner's seems especially valuable. Aigner is a former Minister of Agriculture of Germany and she claimed food safety to be a large and indispensable good, as we reach for food every day. For this reason, we face daily risks of reaching for food which is unsafe for our health, life, or material situation (Strategien der Lebensmittelsicherheit, 2013). Bread is one such daily need food article.

4. Health risks in baking bread

Lack of threats is defined as a state of safety (Rosicki, 2010). Safe bread brings a variety of benefits for individual consumers but also for the society as a whole. Health safety of bread primarily translates to fewer people that suffer from health loss due to ingestion of bread of low quality, lower health system costs, lower production capacity losses. All this leads to a conclusion that in Poland, safety of bread, among other bakery products, in the context of higher consumption compared to other countries ought to be treated as one of the most important issues (Nierzwicki, 2013).

Health risks that may be found in bread production are of three major categories, i.e. physical, chemical, and biological (microbiological and microbiological alike) (Staszewska, 2002). The summary of health risks in bread production can be found in Table 1.

Table 1.

Health risks in bread production

Health risks in bread production		
Physical (foreign objects, dust, filth, humidity)	Chemical	Biological
Source	Source	Source
1. Raw materials 2. Environment 3. Production process 4. Staff	1. From raw materials: - pesticide residues - micro-toxins - harmful metals 2. From the production process: - detergent and disinfectant residues, - machine maintenance agent residues - illegal additional substances - overdoses of allowed additional substances	1. Macrobiological: - storage-residing pests (mites, weevils) - insects (flies, cockroaches) - rodents (mice, rats) - birds and their feces 2. Microbiological (risk factors): - pathogenes - microorganisms causing the spoiling of bread (oxygen bacteria)

Source: own work.

The first category is composed of physical threats, namely foreign objects, dust, dirt, humidity, overheating due to atmospheric conditions.

The presence of foreign objects in bread not only makes consumers averse and causes loss of faith in a bakery but also may pose actual health threats, such as damages to the oral cavity or the oesophagus. Sources of foreign objects in bread baking process are varied, from raw materials through the environment to the staff. From among all the threat categories, foreign objects are most often identified by the consumers. Currently, most bakeries have installed X-ray machines at their premises which detect foreign objects.

Another type of physical threats are dust and dirt accumulating on equipment, packaging or raw materials due to negligence in maintaining order and cleanliness. It is a threat that borders on biological one, as microorganisms causing the spoiling of bread or pathogens tend to accumulate on surfaces together with dust and dirt.

Unfavourable atmospheric conditions – snow, rain, excess sunlight – on materials or finished bread, e.g. when they are left on the loading ramp, may cause changes that are harmful to health. For instance, carton packaging getting wet may cause the emergence of mould – a possible source of mycotoxins.

In the course of baking bread, it is difficult to oversee physical threats. The hardest part is preventing foreign objects migrating from the production staff. Prevention in this range of threats comes from observing rules of hygienic behaviour.

The second category of threats in the bakeries is of chemical nature. Bread safety is threatened by the existence of residues of pesticides, mycotoxins, and harmful metals that migrate into the production process with the raw materials. Threats within the manufacturing process are related to the residues of cleaning, disinfection, and machine maintenance agents, illegal additional substances, or overdoses of allowed additional substances.

The level of residue of pesticides, preventing the spreading of plant diseases and pests, is one of the major criteria of assessing materials for bakery use.

Mycotoxins are products of metabolism of a variety of moulds. So far, about 100 mycotoxins of various effects have been described. Some of the more dangerous and better-known ones are aflatoxins and ochratoxin A. Aflatoxins can be found in grains, rice, corn, cocoa seeds, and seasoning (black pepper, paprika, dried fruit, figs, raisins). They are chiefly found in Africa, in Latin America, and China. Ochratoxin A is most often detected in grain and its products. Its presence was also detected in wine, beer, grape juice, and coffee after the seeds have been roasted. The appearance of ochratoxin A is typical of cool and humid climate. Complete elimination of ochratoxin from bread is not possible, therefore steps should be taken to limit its presence to acceptable levels. Ochratoxin A cannot be identified organoleptically and therefore cannot be detected when materials are accepted for the production process. To limit the threat, proper selection of suppliers is advised – ones that are top-noted in national rankings.

The primary source of harmful metals in grain is the environment. Pollution is dependent on the source of emission of metals and usually comes from the industry. Presence of harmful metals in bread is the consequence of pollution of flour and other materials as well as additives, and the pollution of machines and installations. Norms are often violated the content of cadmium and lead and are strictly dependent on the origin country of grain.

The third category of threats in bakery business is biological in nature. It is composed of a large and varied group of threats. One is warehouse pests, insects, rodents, and birds, and another – microorganisms that directly threaten the health of consumers or product quality.

The danger from insects – flies, cockroaches – is caused by spreading harmful microorganisms and mould spores.

The grain and flour pests are not only cause for major storage losses but can harm the health as well. The worst are mites, e.g. flour mite. They can be found in grain, flour, seeds of oil plants, powdered milk, etc. Their spreading is accelerated by:

- waste, sweepings, and rubbish that provide food to mites when not removed,
- flour sacks that are not shaken off and disinfected,
- production machines and transport equipment not cleaned properly.

Flour mites can be carried by people (on clothing and shoes), and rodents. The latter – mice and rats – cause sizeable industry damages, stock losses, pollution of materials with their feces, and most noticeably transmit pathogens, such as salmonella bacteria.

Birds which live freely around production facilities and waste dumps – pigeons, sparrows, seagulls – not only pollute the production halls but are also sources of pathogens, again especially of salmonella.

The most efficient method of pest control is prevention, with its main goal being prevention of the pests permeating into the bakeries, which is part of the abovementioned GHP. Implementation and maintenance of GHP prevents the occurrence of threats coming from pests.

From among the three categories, biological threats cause the most severe effects. Microorganisms cannot be observed with a naked eye and are found throughout the human-inhabited environment. There is no object or a living being that would be free of the presence of a multitude of microorganisms. Not all of them are harmful – there is a range of microorganisms that are beneficial and actually used by humans, such as yeast, lactic bacteria or some moulds. However, in production of bread some harmful microorganisms may be found which:

- cause negative effects to products by inducing spoiling,
- pose actual health risk if found in bread.

Microbiological threats in bread production are:

- microorganisms that cause spoiling of products,
- pathogenic microorganisms.

The former group of microorganisms causes visible changes to products, such as changed consistency, smell, fermentation or visible spread of mould. Such products may not be consumed and their buyer takes a material loss. Typical form of changes caused by bacteria is viscosity of bread. This is caused by the resting organisms of oxygen bacteria, decomposing starch and proteins. Resting form of these bacteria is resistant to heat and cannot be eliminated when baking.

Moulds are also a widespread problem. They cause the loss in expected life of bread.

From the perspective of food safety, the largest source of problems is pathogenic microorganisms. Impurity of raw materials or finished goods from pathogens is especially dangerous. The impurity cannot be observed and does not cause organoleptic changes, and as a result cannot be detected by the consumer. Diseases caused by pathogens are:

1. food poisoning, i.e. acute poisoning caused by live cells or toxins coming from ingestion of polluted food or water,
2. infections resulting from the ingestion and internal development of a live biological pathogen. Infections with disease-carrying bacteria can proceed with no symptoms. The infection occurs when microorganisms that carry a potential to infect others inhabit and multiply inside a person's body.

The source of pathogenic microorganisms are animal-derived materials, human carriers, and animal pests. Microorganisms of this type rarely appear in bakeries.

Not every bacterial count results in a disease. Danger comes from a sufficiently high number of pathogenic organisms.

Pollution of a finished product with disease-carrying bacteria can be the result of:

- primary presence of bacteria in materials,
- multiplying of pathogens in e.g. improper storage conditions,
- bacteria surviving following inefficient heat treatment, e.g. after the bread has been baked,
- secondary infection, e.g. through staff.

The role of a production technician is to prevent the multiplication of the primary number of pathogens or those that cause damage to products. Here, specific knowledge in technology and the habitation conditions of microorganisms is required.

The above results in a conclusion that the role of staff in bakeries is immensely important. Proper qualifications for individual posts are required as well as trainings in health and safety but also the involvement of the staff members.

The abovementioned health threats that may occur to some degree of probability within the bread production chain and are derived from materials, environment, equipment, the process, staff behaviour. Threat sources in bakeries are presented in Table 2.

Table 2.*Sources of health hazards in bakeries*

Sources of health hazards in bakeries				
Materials	Environment	Equipment	Process	Staff
a) flour	a) surroundings of the bakery	a) machines	a) material preparation	a) state of health
b) grain products	b) production halls	b) equipment	b) technological process	b) personal hygiene
c) additives	c) social rooms	c) tools	c) cutting	c) pro-hygienic behaviours
d) packaging	d) pests	d) transport	d) packaging	d) trainings
	e) waste			

Source: own work.

Applying GHP in bakeries allows to minimise or eliminate health threats in production. However, hygienic behaviour of production staff is of key importance. According to German sources, around 60% of quality faults in food products results from staff actions, while the remaining 40% comes from materials, production conditions, and other areas (Staszewska, 2002).

5. Summary

In Poland, bread has long been, is, and most likely will long be the fundamental food product. We reach for bread every day and we are at a daily risk of consuming products that might pose threats to our health.

Issues of food safety are of key importance in EU legislation and form part of the so-called Hygienic package. It covers areas such as:

1. minimum hygiene standards. These have been described in obligatory systems, called Good Hygienic Practice and Good Manufacturing Practice. Components of these practices are reflected in Polish legislation;
2. state inspections in agriculture and food businesses. Bakeries can be controlled by the Farming and Food Articles Goods Trade Quality Inspectorate, and State Sanitary Inspectorate. State Inspectorate for Protection of Plants and Seeds which controls the residues of pesticides works towards the high quality of materials delivered to bakeries;
3. programmes, systems, and procedures on food safety. Within the EU, the HACCP (Hazard analysis and critical control points) preventive system is commonly used. It is specifically aimed at assuring health safety of food and is based on defining potential and actual risks to consumer health and afterwards developing actions of preventing them. If required, Critical Control Points need to be established.

The starting point for the functioning of the HACCP system is threat analysis. In this paper, the authors defined types and potential sources of health threats that may arise with high probability in bakeries. These have been put in three categories: physical, chemical,

and biological. The sources of threats are: materials, environment, equipment, production processes, staff behaviours.

HACCP is not an obligatory system for small bakeries to be certified with. Such small bakeries, however, are obliged to introduce and enforce HACCP-specific rules. Voluntary (from the legal perspective) HACCP certification in small bakeries can prove necessary if such businesses want to cooperate with major retail chains which expect that food suppliers will guarantee steady quality of their products, apart from food being free of hazards.

In 2021, the authors conducted a study of 67 small bakeries in the Pomerania region of Poland. Despite HACCP certification being voluntary, three of the bakeries under study had HACCP certification.

The authors also received positive feedback from the bakeries they questioned on the treating of health safety of bread as one of the features that decide bread quality.

In recent years, a shift within quality systems can be observed, towards preventive mode. The systems mentioned in the paper are of that nature.

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LEADERSHIP AND MANAGING STRESS IN THE ORGANIZATION

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Purpose: The main purpose of the paper is to systematize and analyze relation between the role of leadership and stress management in the organizations, indicate sources of stress as well as to determine possible responses to such situations with regard to their impact on the organization.

Design/methodology/approach: The approach applied in the paper is of descriptive-empirical nature. The research methods involved in this paper are: induction, deduction, literature studies, as well survey and data analysis. The method of critical and comparative analysis was used in relation to the views presented in the literature.

Findings: The paper ends with a brief presentation of research findings which correspond to the formulated research questions on most common causes of stress in organizations and its impact on the organization and people as well as their behaviors and reactions.

Research implications: Future research directions should focus on further, expanded research exploration in the area, taking into account various industries. Additional work is needed to disseminate research findings among managers and employees and to implement them in appropriate stress management trainings.

Practical implications: The results of the research discussed in the paper have a number of practical implications mainly for the managers in terms of use of stress management tools and improvement of stress management strategies.

Social implications: Building awareness of stress management issues.

Originality/value The paper has a cognitive value for managers as well as employees working in organizations. Results have theoretical as well as practical implications in search of solutions to stress management.

Keywords: stress management, leadership, employees, organization.

Category of the paper: research paper.

Introduction

The paper constitutes theoretical and empirical study relating to selected aspects of stress management in organizations and the role of leadership in this regard on the example of chosen companies. The paper was divided into two major parts: theoretical and empirical.

The theoretical part completed the theoretical goal which was the extensive review of the literature on management of stress and leadership both in managerial and psychological aspect of the concept. The second part of the paper is of empirical nature. In this part, the author performed the cognitive goal which was the identification and analysis of stress factors in organizations, sources of stress as well as appropriate responses to such situation and possible resolutions from the perspective of leaders. For this goal the survey method was involved. It was carried out among respondents, both employers and employees in two selected companies. The first company was the social insurance institution and the other was the electronic engineering company.

The following research questions were formulated in the paper:

- How do leaders perceive stress at work?
- Do leaders pay attention to the stress occurrence among their subordinates?
- What is more important for leaders: company results or employees' well-being?
- How significant are the levels of stress among leaders?
- How does stress influence leaders' work performance?
- Do employees count on leaders when it comes to solving stress issues?
- How does stress influence employees' work performance?
- What are the similarities and differences between these two perspectives?

Introductory remarks on leadership

Companies would not be able to exist without humans who actually make it work. From the psychological point of view there are three main psychological traits which effective leaders should understand and be able to manage, namely: motivation, fear and anxiety, uncertainty (Kelloway, Turner, Barling & Loughlin, 2012).

There is nothing surprising in a statement that a leader should lead the team towards reaching a common goal. In order to do so every single team member has to do his job as best as possible (Bass & Bass, 2018). Nevertheless at times the amount of work may seem so overwhelming that many would be tempted to give up. That is a place where a leader's job is indispensable (Kotter, 1995). He has to constantly motivate the team to keep pushing forward. The same applies to stress and pressure. Leader has to know how to manage stress and fear, how to work under pressure and overcome anxiety. What is more leaders have to know how to deal with such states and emotions not only in themselves but also among the members of the team (Boyer-Davis, 2018). Noticing it at first glance may seem pointless, as some researchers believe that leaders should simply focus on getting a task done, however a responsible and effective leader knows that the best results can only be achieved when the employees' well-

being is taken care of (Barcik, Małysiak, Dziwiński & Jakubiec, 2021). That is the reason why both strategic and transformational approaches to leadership, discussed in more detail above are centered around the assumption that such workers are much more effective and efficient than those whose needs are ignored (Kirkeby, 2008). The last trait – uncertainty applies mostly to the leader figure. Business is indeed an uncertain area, many unexpected factors can influence it and leaders have to be ready for such challenges and know how to act even in the most unpredictable conditions (Holten, 2015).

Both strategic as well as transformational styles of leadership are built up around the psychological aspects of the concept. In the beginning of the twenty first century the idea of emotional intelligence started to gain popularity (Podgórska, 2014). The emotional intelligence can be perceived as an ability to recognize own as well as others' feelings, ability to be guided by emotions – again, own and employees' – in accordance with being able to motivate teams. The emotional intelligence is completely different from intelligence, knowledge or intellect (Barcik, Małysiak, Dziwiński & Jakubiec, 2021). It is also suggested that a high level of emotional intelligence is closely connected with organizational successes as a leader, characterized by emotional intelligence, possessed the ability to recognize and regulate employees' emotions which directly leads to building successful interpersonal relationships at work (Kouzes, Posner, 2002). That theory strongly emphasizes the role of intuition in making organizational decisions, trusting one's instincts instead of constantly relying on pure facts and knowledge. The major emotional competences of this type of leaders are as follows (Podgórska, 2014): self-consciousness, self-control, motivation, empathy, interpersonal skills.

It should also to be emphasized that a strong relationship between leaders' personality as well as situational experiences and the projects' success, claiming therefore that it is leaders' emotional intelligence, plays a significant role in a project's success or failure (Barcik, Małysiak, Dziwiński & Jakubiec, 2021).

The same point of view was also presented in literature which referred to transformational leadership and determined four areas that affect its success which are as follows (Bass, Avolio, 1990):

- idealized behavior – it makes a leader to be trusted and respected,
- inspirational motivation – the ability to stimulate employees to outperform themselves,
- intellectual stimulation – leaders stimulate the employees to ask questions and to solve old problems in new ways,
- individual consideration – refers to the habit of listening to the needs and wishes of subordinates.

Psychological aspects play an equally important role in the concept of strategic leadership (Hiller, Hambrick, 2005). There are three main ideas that strongly connect psychology of management with abovementioned type of leadership, namely (Sajdak, 2014):

- intuition – hardly measurable but highly effective tool,
- passion – leaders positive attitude spreads among the employees,
- core self-evaluations (CSE).

Researchers of strategic leadership have long been investigating the influence of leaders' self-esteem on their actual actions (Mansaray, 2019). It was observed that high self-esteem determines the most commonly valued leaders' characteristics, such as self-confidence, knowing own strengths or willingness to face challenges as well as influences the process of organizational decision making (Lussier, Achua, 2004).

Psychology and management should be examined together in order to grasp the underlying meaning of all the dimensions of leadership. The major attributes of leaders are presented in Table 1.

Table 1.
Attributes of a strategic leader

Characteristic	Description
Ability to anticipate	Identification of opportunities and threats achieved through, for instance, conversations with strategic partners of the company, conducting market research.
Willingness to take on challenges	Challenging oneself requires patience, courage, open-mindedness and innovative thinking.
Ability to interpret	Solving complex problems and dilemmas, verifying various hypothesizes, searching for missing information, etc.
Ability to make decisions	Requires taking responsibility for the team's actions, setting short- and long-term goals as well as choosing best options in a rapidly changing work environment.
Ability to find common areas of cooperation	A dialogue between parties with opposite visions and purposes in order to achieve common understanding.
Ability to learn	Leaders should learn from both successes and failures as they are figures whom the employees observe and look up to.

Adapted from: Own study based on Schoemaker P., Kupp S., Howland S. (2013). Strategic Leadership: The Essential Skills. *Harvard Business Review*. January – February Issue; pp.131-134.

Leadership undeniably cannot be considered, nor characterized, apart from both management and psychology. As it was briefly presented above, psychological aspects are visible in the most popular types of contemporary leadership as many personal traits still remain the basis of determination whether a certain leader can be perceived successful or not (Prentice, 2008).

Defining stress management

Stress is a phenomenon hard to avoid in a workplace. Perhaps most of the leaders, as well as the majority of employees, at least once in their career faced the necessity of working under pressure (Satpathy, Mitra, 2015). Such experiences can strongly influence the workers' effectiveness, organization's goals and the way leaders manage their teams. Therefore, there

are several reasons behind the importance of knowing at least the basics of stress management by the leaders (Maxfield, Hale, 2018).

Both workers and leaders can experience stress in their careers, for instance, when they are at times supposed to work under pressure and do not possess knowledge nor ability to effectively cope with it. As it was pointed out in the previous section, employees' well-being in many styles and types of leadership plays a crucial role as it directly impacts the company's effectiveness (Houghton, Wu, Godwin, Neck & Manz, 2012).

Coming back to the concept of core self-evaluations to the business environments, it was further developed in order to show that it can be considered in relation to organizational spheres, such as: job satisfaction, motivation and job performance. What is more, as it was discussed above, the CSE scale not only determines that people with higher results, with more self-esteem, make better leaders, but also affects the intensity of perceived stress (Panigrahi, 2016). Therefore, individuals with higher CSE results are proved to recognize less situations as stressful, are able to deal much better with pressure and in effect their well-being is reflected in the outstanding job performance (Barcik, Małysiak, Dziwiński & Jakubiec, 2021). Analogically, less self-confident human beings, with lower numbers on core self-evaluations scale, tend to consider more situations as threatening or stressful and thus their levels of perceived stress are significantly higher. Stress undoubtedly affects the employees psychologically, physiologically and behaviorally and all of these factors have been associated with lower job performance which is invariably a negative outcome for the organization" (Nelson, Burke, 2000).

The reasons behind stress at work can be both personal or result from poor leadership and company management. Stressors can be grouped into following categories (Burke, Cooper, 2000):

- individual work stress sources – resulting from own role at company,
- group – caused by the group's dynamics and managers' behavior,
- organizational – resulting from company's policy.

One can observe that either causes or results can be both considered from individual as well as organizational point of view. Focusing hereinafter on the organizational ones, one may distinguish, for instance, high absenteeism and employee turnover, poor productivity and effectiveness of work which in result leads to higher recruitment costs and various money losses. A company consists of people and it is individuals' well-being that plays a significant role in the company's success or failure (Romas, Sharma, 2022). Therefore it is the leaders' role to manage and reduce stress in their teams.

What can be done to manage stress? The four steps are presented below (Sahoo, 2015):

- Identifying potential work-related stress hazards – gathering information among employees, reporting it to higher instances, etc.,
- Assessing the work-related stress risks – identifying when, how often stress occurs and what results it brings,

- Controlling the work-related stress hazards and risks – presenting ideas of how to prevent stress occurrence and consulting it with employees,
- Implementing continuous improvement – reporting the effectiveness of implemented ideas to higher instances and regularly searching for stress risks.

Sometimes leaders identify factors which are difficult to deal with and in such case the author suggests taking it slowly and starting from reducing high-stress situations to lower stress. In extreme cases it is also suggested to use available counseling assistance programs. Most importantly however leaders should listen and stay in touch with their employees, make sure that the workload and working hours are compatible with each other as well as take care of the work environment and respectful atmosphere in the team (Van den Bergh, 2021). At times, reducing stress to zero may be impossible to achieve nonetheless it is perceived as leaders' responsibility to ensure employees' well-being and manage stress as successfully as it is in their power (Gardner, 2012).

Pressure nowadays can be considered on various grounds. One can distinguish time pressure, performance pressure but also innovation pressure. Both stress and pressure can be experienced by either leaders or employees however the leaders are believed to find themselves under pressure much often because of the fact that they are responsible not only for their own work but also for the results and well-being of their subordinates (Xu, Jin, 2022).

It should be pointed out that the biggest source of stress at work comes from time pressure. People in general do not find working under pressure to be a positive experience and search for ways which allow them to avoid such situations (Van den Bergh, 2021). Long-term planning as well as good organizational skills of leaders undoubtedly can be of help here. Working under pressure of time may also have a negative influence on the company in general as either employees or leaders, who need to meet short deadlines will certainly not have enough time for conducting additional analysis and therefore may be tempted to make unreasonable or even reckless, decisions (Romas, Sharma, 2022).

The twenty first century also introduced a new type of pressure which can be observed in the business environment namely innovation pressure. The world is changing so fast that many organizations must constantly implement new solutions to stay on the market and not to be replaced by the competition. Continuous learning, creation and use of knowledge, treating it as one of the business functions is now indispensable. The main advantage of the contemporary enterprise aspiring to be perceived as innovative are competences of its employees, especially their developmental, learning and creativity capacities as well as the ability to forecast, react and produce (Tran et al., 2020). Searching for innovative solutions and implementing them may decide about the organization's survival on the market. Leaders should therefore face such innovation pressure, remembering that employees should have the opportunities to constantly develop their skills and competences provided (Seaward, 2017).

Surprisingly, not all the types of pressure are considered as negative. Some leaders who rely more on task-oriented than human-oriented leadership perceive performance pressure as a useful tool of motivating their teams to use their full potential (Gardner, 2012).

Selected survey results

The survey was conducted among the group of the leaders and employees of two companies. In order to have a broader range of answers it was decided that not only employers and their deputies will be included in this group but also managers of different departments. The survey was conducted on a research sample of 30 participants who were the leaders and 90 participants who were the employees.

The first company to be surveyed was the social insurance institution. It is a strictly Polish state organization which has been operating since 1934. It is responsible for social insurance matters. It is the public sector company.

The other company was established in 1991. It is a Polish private sector company operating in the electronic engineering industry, mostly focused on digital scanning technologies.

The survey took place between September and October 2021. The questionnaire used in the study was designed solely for the purpose of the study.

According to the first question of the survey, respondents were asked if they have ever experienced any stressful situation at the workplace. It should not surprise that 0% respondents have never experienced stress at work which strongly supports the statement that it is simply impossible to avoid some stressful situations at the workplace. The questions shows that 13.3% of respondents have experienced stress at work either rarely or every day. Twice as many of them tend to experience it from time to time – 26.7%, and majority of 50% admits to experiencing stress relatively often. Table 1. includes the answers.

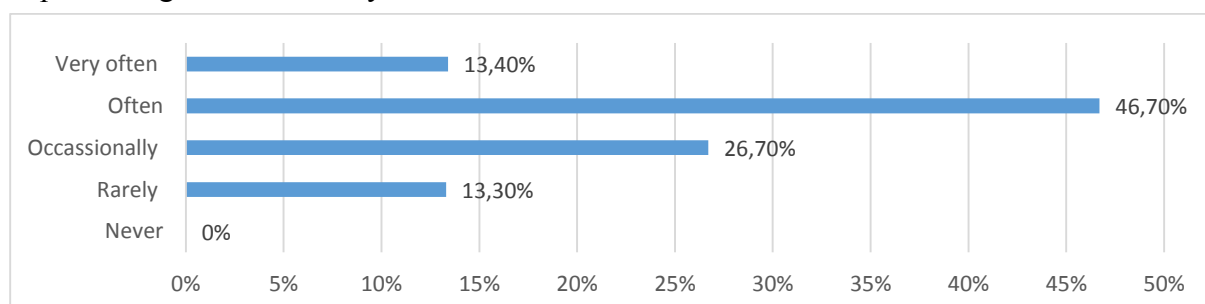


Figure 1. Have you ever experienced stressful situation at workplace? Source: own study.

According to Figure 2, half of respondents claim that they often have to work under stress for a longer period of time. 23.3% admit that it happens from time to time, 13.3% experience it rarely and only 3.3% never at all. Unfortunately about 10% claim that it occurs very often.

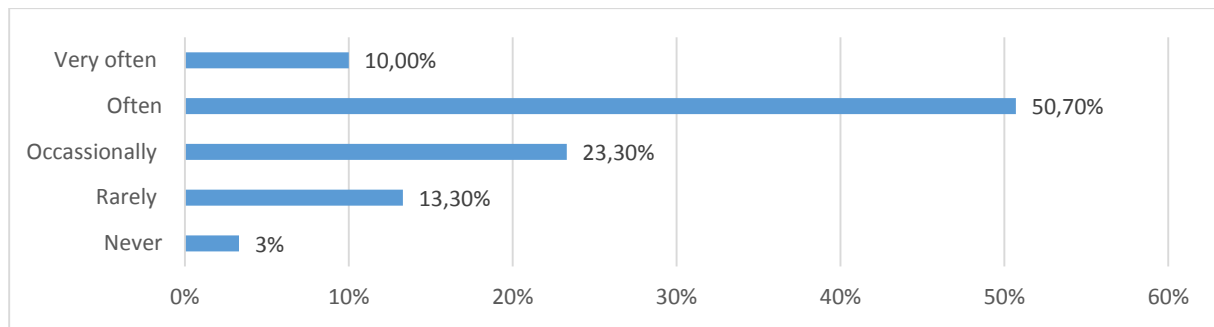


Figure 2. Have you ever been under stress at work for a longer period of time? Source: own study.

Working under pressure also appears to be difficult for most of the leaders. Half of them work under pressure often, 20% from time to time, 16.7% every day and only 13.3% rarely. One can observe that the option “never” was not chosen by any of the respondents. The results are presented in Figure 3.

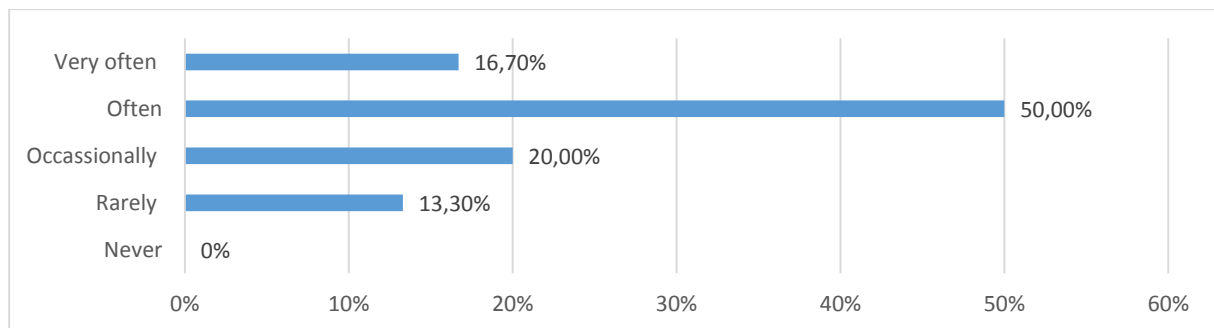


Figure 3. Have you ever worked under pressure? Source: own study.

When asked about limitations in performance caused by pressure, 13.3% of respondents claim that it has never stopped them from doing the best they can, twice as much – 26.7%, that it happens rarely, 33.3% admit that such effect occurs from time to time, 16.7% experience it often and exactly 10% deal with it daily. Fortunately, 43.3% of surveyed leaders claim that pressure never stopped them from going to work, 33.3% that it happens rarely and 23.3% voted for sometimes. Higher results remain at 0%. The results are presented in Figures 4 and 5 below.

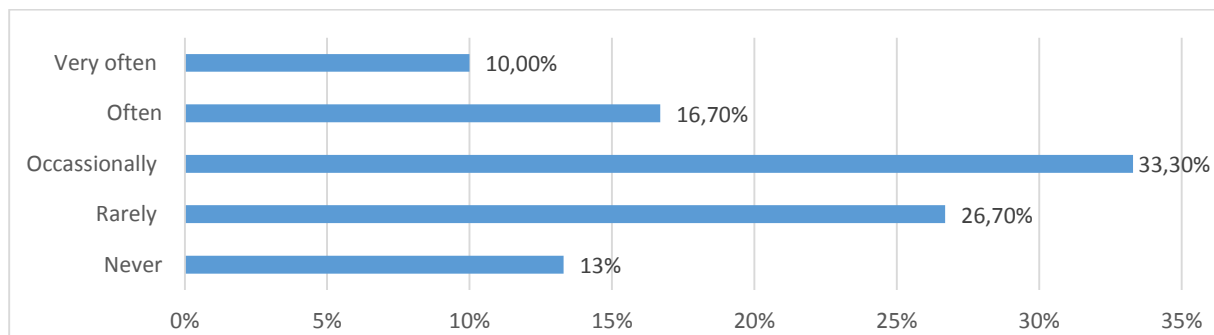


Figure 4. Have you ever been in a situation when pressure was so overwhelming that it stopped you from doing your job? Source: own study.

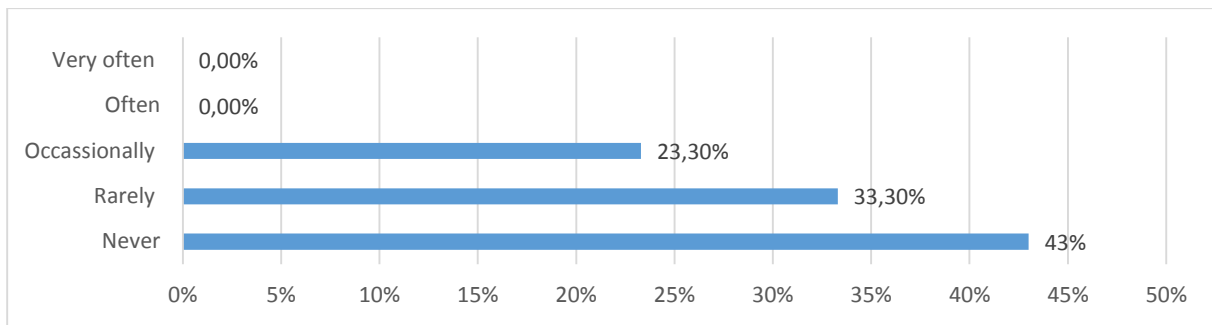


Figure 5. Has stress/pressure ever stopped you from going to work? Source: own study.

It has always been emphasized that for some leaders it may be difficult to treat work and personal life separately. Therefore only 3.3% of them say that stress never or rarely influences their personal life, 43.3% claim that sometimes it happens, 33.3% that it is often a problem and 16.7% admit that it is a daily struggle.

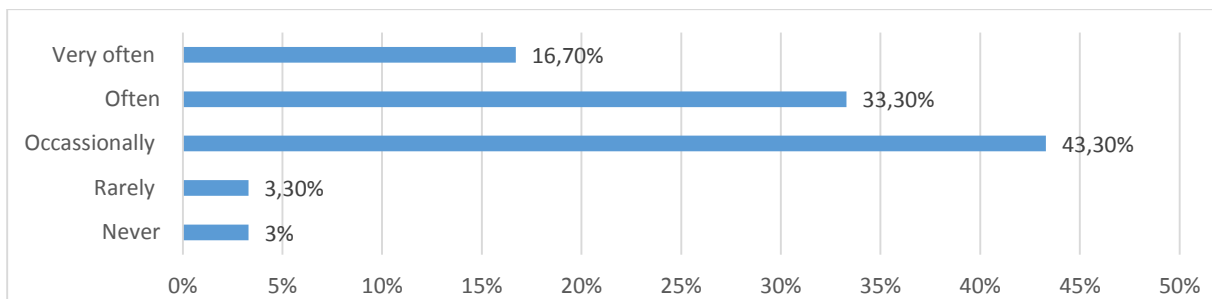


Figure 6. Has stress/pressure ever influenced your personal life? Source: own study.

It was also asked what is the leaders' personal attitude towards stress and pressure occurrence at work. 23.3% decided it cannot be motivating, 33.3% that it can motivate, but the majority of 43.3% said that it depends on circumstances. On the other hand, when asked if it can be discouraging, the huge amount of 83.3% voted that it may. It appears worth noticing that even though some leaders may consider pressure to be motivating, most of them are perfectly aware of its potential negative influence.

The half of respondents perceive stress and pressure as a limitation in reaching personal goals. 43.3% believe that it does not have such a powerful influence on their lives and only 6.7% of them are not sure of the answer. What is more, as much as 80% of respondents admit that sometimes they are anxious of starting another working day, when only 20% of them are completely free of such fear.

Stress can often be a reason for many issues connected with health. As we can observe in figures 17 and 18, 56.7% of respondents admit that at least once in their life they experienced health issues caused by stress and 50% state that such difficulties were on the basis of their mental health.

Leaders, motivated by the role they are supposed to play in the company, also tend to observe their subordinates and co-workers. That may be a reason why 70% of them did notice the influence of stress and pressure on their colleagues.

Remembering Covid-19 threat as well as difficulties connected with constant change, among others, it appears to be of no surprise to see that as much as 90% of respondents admitted to the belief that stress levels have significantly risen in recent years. Asked about the reasons behind stress and pressure occurrence at work, surveyed entities voted for several options. The 3 most voted were:

- work-life balance issues – 93.3%,
- competitiveness among colleagues – 53.3%,
- excessive demands of the job and feeling overworked – 46.7%.

The next question in the survey was concerned with the levels of stress at work in the recent year which due to unexpected circumstances of the pandemic was difficult for many businesses. Therefore, answering the question whether or not a given person experienced too much stress that year it does not surprise that 20% respondents found themselves under too much stress daily, 40% leaders often, 26.7% at some part of that year, and only 10% rarely. There was only one individual who claimed that he/she managed to avoid stress at work in the recent year completely.

The very last question in this part of the survey is concerned with making a mistake due to overwhelming pressure or stress at work. Surprisingly honest responses indicated that 60% of respondents have indeed at least once in their career had trouble overcoming stress and made a mistake because of that reason. Only 33.3% of leaders claim that this problem does not apply to them.

The first question in this part of research is concerned about whether or not a leader talked to his/her subordinates about stress occurrence at work. According to Figure 7, 87% of leaders believe that they did. Only 10% admit that it did not cross their minds and only 3% indicate a group of those who are not sure of the answer.

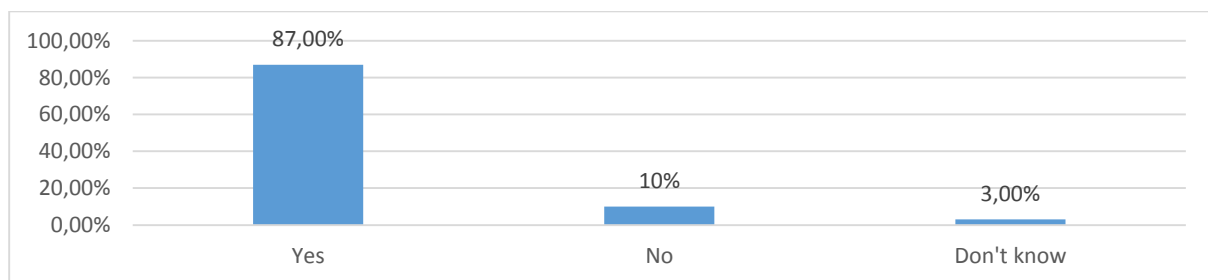


Figure 7. Have you ever spoken to your employees about stress at work? Source: own study.

The situation looks almost entirely similar in the question whether or not the leaders talked with their subordinates about potential consequences of stress occurring at the workplace. Figure 8 shows that 83% claim to have had such a conversation, while only 17 % of responses vary from complete denial to not being so sure about the answer.

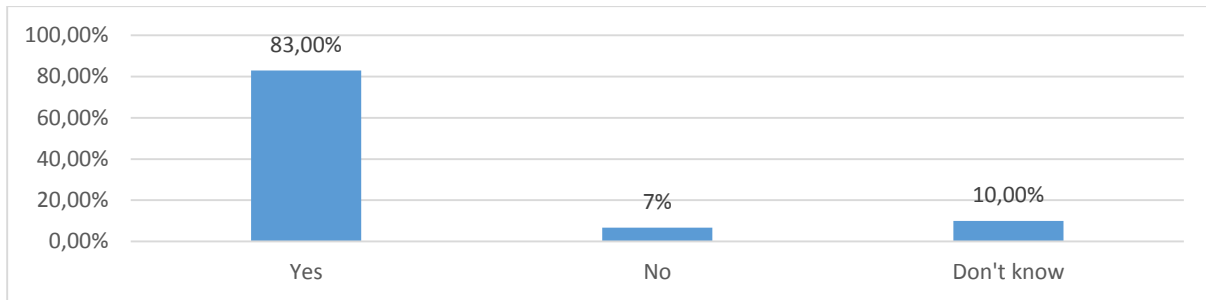


Figure 8. Have you ever surveyed your employees on consequences of stress at workplace? Source: own study.

According to Figure 9, 87% of leaders believe that employees can seek their help in stress and pressure related problems, 7% emphasizes that it depends on a problem and only certain individuals claimed that they would not be interested in hearing about such issues.

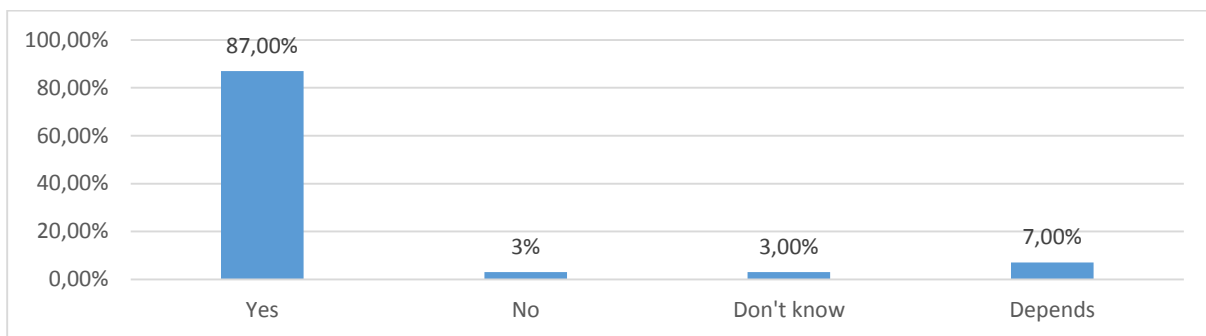


Figure 9. Do you think your employees could talk to you about stress/pressure related problems? Source: own study.

The following question (Figure 10) regards whether or not certain leaders did anything to combat the issues causing stress at work among their employees. 73% confirmed, 7% of respondents denied and 20% remained unsure. What is more, to those leaders who answered “yes”, the questionnaire included one more question, namely: what exactly do they do? Respondents gave many various answers, but the ones which were mentioned more than just one time included:

- encouraging subordinates to honest conversations,
- observing and staying willing to listen about employees’ problems,.
- team conferences where issues such as mobbing or stress are openly discussed

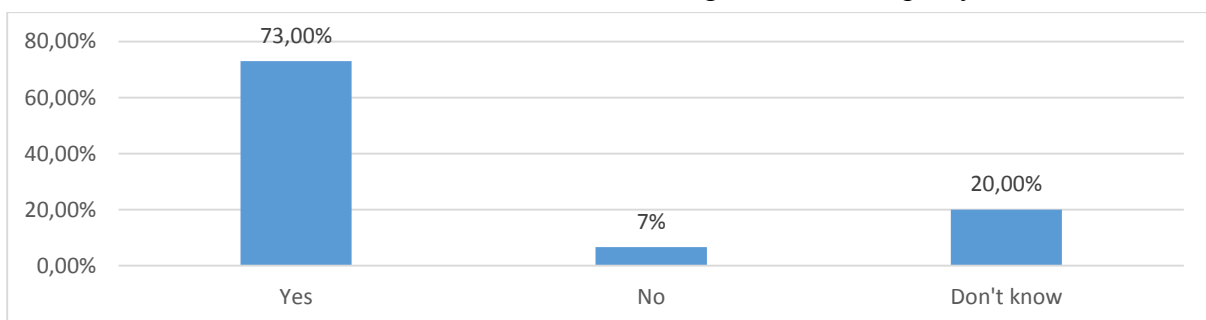


Figure 10. Have you ever done anything to combat the issues causing stress at workplace among your employees? Source: own study.

Yet another question poses a challenge whether or not a certain leader believes that she/he could do more to eliminate stress in the team of his/her employees. 66% of respondents admit that they could think some more about potential solutions, 17% claim that they could not do anything more than what they are already doing and exactly the same percentage remain undecided.

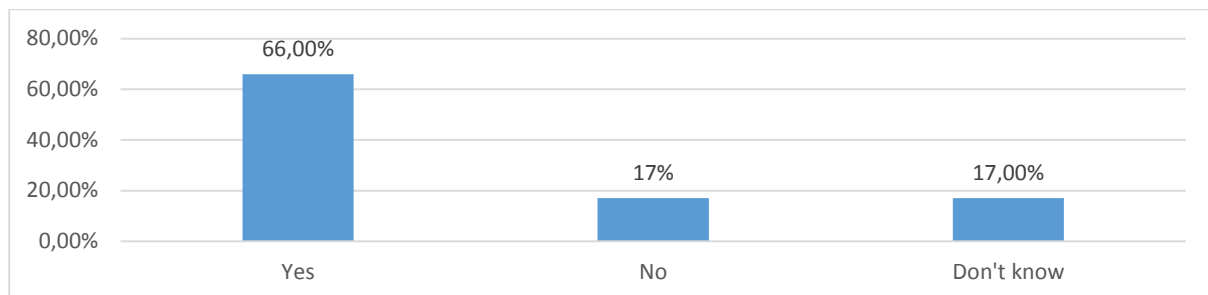


Figure 11. Do you think you could do more to manage stress at work? Source: own study.

The next question requires a distinction whether or not a certain leader could be a potential source of stress among his/her subordinates. The results show that 60% of leaders believe they were not the reason why employees felt pressure, 10% claim that they could be and 13.3% of them are not sure. Moreover, several leaders added additional answers to that question, most of them emphasizing that they hoped they were not such a stress-causing type of boss or that they did never intend to be such a leader.

The following question of the survey asks leaders to answer if they perceive themselves as supportive when it comes to stress and pressure at work. 90% of them openly believe they indeed are, 6.7% left the question diplomatically unanswered while 3.3% admitted that they may in fact not be.

Similarly, about 80% of surveyed entities claim they considered creating any form of support to help their subordinates deal with stress and pressure at work while 13.3% admit it has never crossed their minds and 2.6% remain unsure.

When considering a phenomenon of responsible leadership, as much as the majority of 90% of respondents believe that stress and pressure occurrence at work should not be overlooked or underestimated (Figure 12).

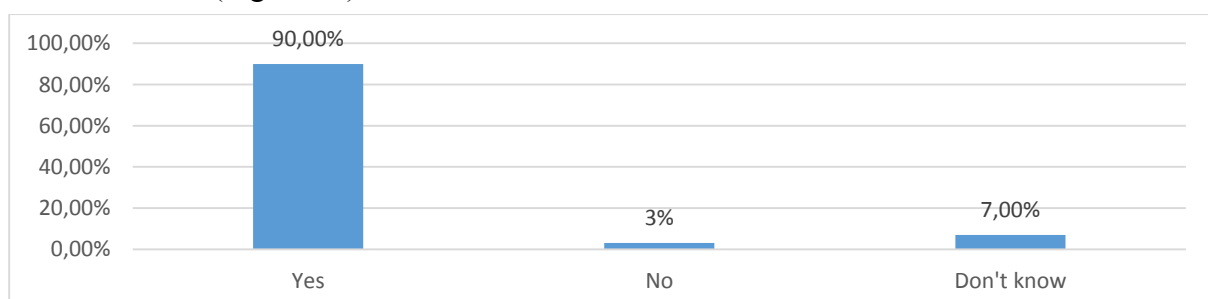


Figure 12. Do you think that responsible leader should not underestimate stress and pressure among workers? Source: own study.

The very last short-answer question asks whether levels of stress and pressure at work increased due to Covid-19 pandemic. 76.7% of respondents gave a positive answer, 13.3% denied and 10% remained undecided. The following question states that “if yes, in what way exactly?” Again, 23 respondents gave here their answers, but the ones that appeared at least more than once are as follows:

- increased workload and appearance of new tasks,
- more absences at work, a need to delegate workers to different departments,
- uncertainty about what will happen on the market,
- constant changes in daily tasks,
- moving to partly-online work.

Eventually the last question in that survey asks the leaders of their own forms of managing stress and dealing with pressure that they could share with their employees based on their own experiences. Among 30 responses those which appear the most often are:

- trying to keep healthy life-work balance,
- yoga; exercising; sport; or at least taking long walks,
- setting goals which can truly be achieved like relaxing at home after work for at least, 1h a day by reading books or news online,
- spending at least few hours a week doing what one loves most; giving oneself time to develop passions and focusing on self-development,
- supporting each other instead of competing,
- if stress and pressure get too overwhelming several leaders also mention beneficial support of a therapy.

Some overall conclusions resulting from the analysis of the gathered data may be useful to construct at least a simple characteristic of how leaders perceive the phenomenon of stress and pressure occurring at the workplace, how they deal with it and try to help their subordinates to overcome potential difficulties.

Leaders who have agreed to take part in this research generally admit to being under a lot of stress at work relatively often and at times even for a longer period. What is more, about 50% of them admit to be working under pressure. Leaders also claim that both stress and pressure can be considered as limitations in performance, as many of them pointed out that it is easier to make a mistake or not to reach a desirable goal due to its negative influence. Several of them acknowledge stress as a factor which can strongly impact both physical and mental health and general well-being of individuals. Despite the fact that approaching another working day and facing the challenges which it poses make 80% of leaders slightly anxious, hardly anyone of them is willing to skip such a day at work, which subsequently shows the responsible approach to handling their own duties. Even though some leaders acknowledge motivating influence of pressure at employees, most of them are more concerned about the possible negative consequences it may cause and therefore, are not at all willing to be leaders of whom employees tend to be afraid.

Among the most common causes of stress at work one may distinguish that leaders point out to the difficulties in keeping a healthy balance between work and personal life. They also mention the problem of competitiveness among colleagues as well as feeling overworked which may result from the abovementioned issue of taking work home. Respondents also emphasize that in recent years the levels of stress increased significantly, especially during the last year, as Covid-19 pandemic forced them to face many completely new daily challenges, introduced additional tasks as well as invented necessity of keeping employees well-informed even if they need to work from home.

The surveyed group of leaders generally tends to acknowledge if their colleagues or subordinates are under stress and around 80% of respondents claim to be supportive in such circumstances as well as value the opportunities to openly talk about it with employees, either individually or during some kind of a conference. If necessary, they are willing to listen and solve such problems. Nevertheless, around 60% of surveyed entities admit that, in fact, they could do much more when it comes to creating means of supporting employees in this sphere and acting against pressure occurrence. Moreover, 90% of the leaders acknowledge that responsible leadership requires paying attention to dealing with stress and pressure at work and not overlooking such dilemmas as it may in result significantly limit the work performance in teams of their subordinates. Obviously, there is no one universal solution to fully and irreversibly eliminate stress and pressure at work, but the group of surveyed leaders comes up with several ideas, among others emphasizing the importance of keeping balance between work and personal space.

Therefore, looking at the gathered data from the leaders' perspective, one may draw the conclusion that employees' well-being is taken into account at least as much as the company's results and that stress and pressure are considered only as a limitation in work performance and productivity. The following part however will take into account the same matters from a different perspective and will present the role of leadership in managing stress and pressure at work from the employees' point of view.

The second part of the questionnaire was prepared specifically for employees and focused on the role of leadership in managing stress and dealing with pressure from the perspective of the group of subordinates.

When it comes to a question whether or not employers talked to their subordinates about stress, 53% of respondents give the confirmation, however, 32% of them deny it and 15% cannot precisely recall such a situation (Figure 13). In comparison, 87% of the leaders claimed that they did conduct such conversation with their subordinates which makes both results not entirely compatible. Similar situation occurs when the question is formulated in a little bit more specific way and regards whether or not employees were spoken to about stress consequences. A half of them admit that they did, but the other half is either not sure or claims that their boss never talked about it – in this case 34% of respondents (Figure 14). It is worth noting here that 83% of leaders believe their emphasized consequences of stress when talking with employees.

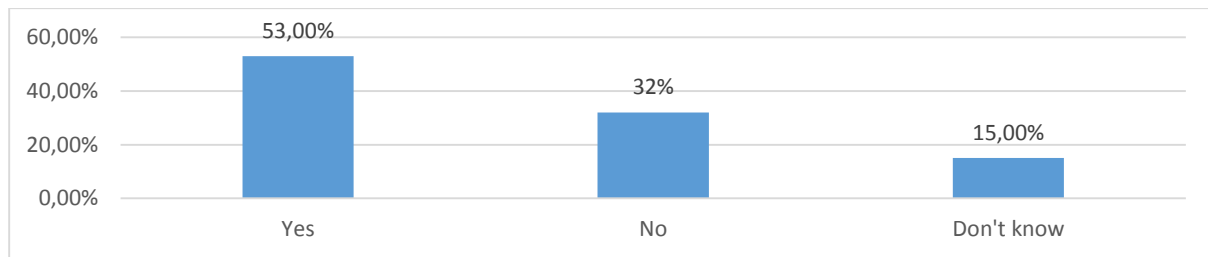


Figure 13. Has your employer ever spoken to you about stress at work? Source: own study.

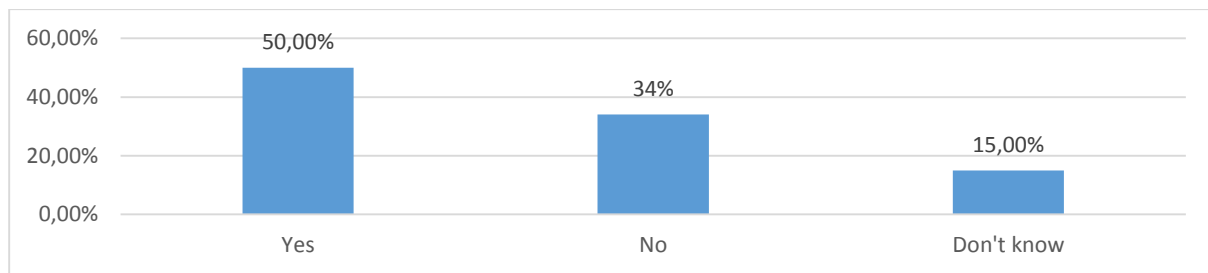


Figure 14. Has your employer surveyed you about the consequences of stress at your workplace? Source: own study.

The following question directed to this group of respondents focuses on the dilemma of whether or not in their careers have they ever feared losing job due to any mistakes made under pressure. The majority of 61 % decided that indeed, such an idea did at some point cross their minds, 28% have never experienced it and 11% did not recall either of the possibilities.

Another question explains the employees' perspective on whether or not they could directly talk to their bosses when considering a problem stress- or pressure-related. The vast amount of 42% of respondents were surprisingly more eager to claim that it depends on a given matter than simply decide that they would seek their employers' help – 30% or would definitely avoid such a solution – 16%. 12% of employees would consider it but not necessarily choose it as a first option and one individual adds his/her own idea that they would do it if the problem was important enough. In comparison, 87% of leaders claimed that their employees could definitely talk to them about stress and pressure-related issues which therefore shows that what seems obvious for one group, can not necessarily be perceived in the same way but the other one.

According to the survey results, over a half of all the respondents in this group decided that their employers have undertaken any action aimed at limiting stress occurrence at the workplace, the rest either denied it or remained hesitant (Figure 15). On the other hand, 66% admitted to the belief that their employers/managers could do more in this area, 17% claim there was nothing more that could be done, and again 17% of respondents did not pick any side (Figure 16). Moreover, the results of research conducted in the group of leaders revealed that both employees and the leaders' responses in this case correspond with each other pretty accurately.

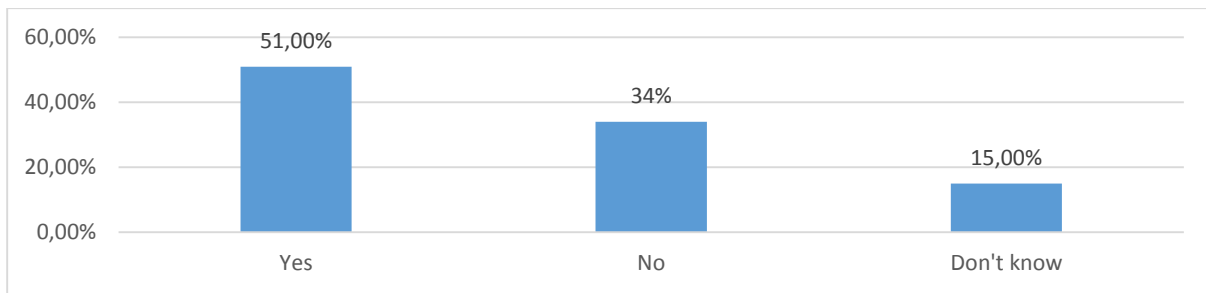


Figure 15. Has your employer done anything to combat issues causing stress at work? Source: own study.

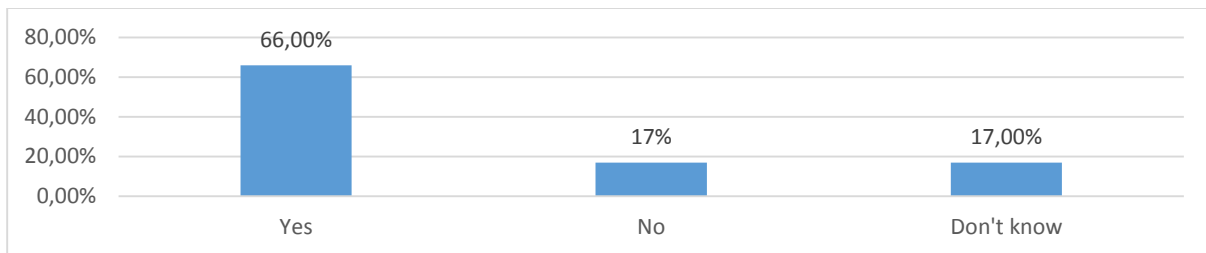


Figure 16. Do you think your employer could do more to manage stress at work? Source: own study.

Surprisingly enough the biggest dissonance can be observed in the question if the employer/manager had ever been a source of pressure for employees. While only 10% of leaders admitted that it could have happened, the remaining 90% hoped, and expressed in various ways that they would never intend to be. Meanwhile, 52.2% of employees admitted that, intentionally or not, their bosses caused them to feel pressure at work (Figure 17). On the other hand, while 90% of leaders expressed their support when it comes to stress and pressure occurrence at the workplace, over a half of surveyed employees indeed admitted to receive such assurance from the leadership layers of the company (Figure 18).

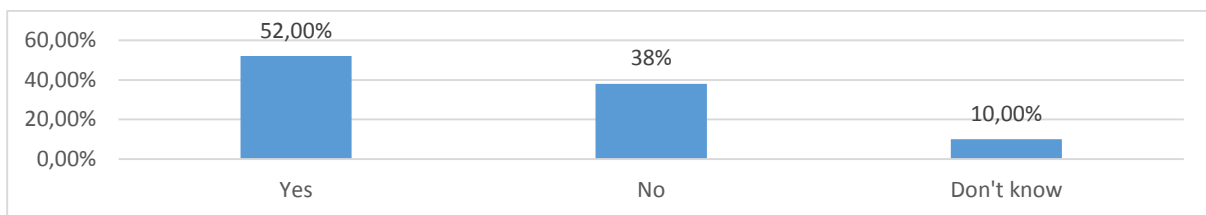


Figure 17. Was the employer ever the main reason why you felt pressure at work? Source: own study.

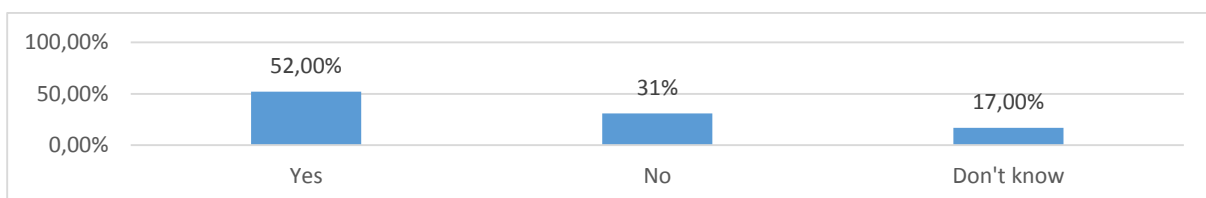


Figure 18. Do you think your employer supports you when it comes to stress and pressure at work? Source: own study.

While only 40% of respondents claim that they are aware of some means of support provided by their employers/managers, 80% of the leaders' group claim to be willing to put such solutions into practice (Figure 19). Although the difference here may seem twice as big, it is worth remembering that the research sample in both surveyed groups varies significantly, between 30 leaders and 90 employees, therefore differences in percentages are inevitable. What is worth noticing here is that no matter how many participants are taken into account when it comes to that question in both questionnaires, 90% of leaders and 81% of employees unchangeably believe that responsible leadership requires dealing with stress and pressure on a daily basis and supporting employees in overcoming any potential difficulties caused by stress and pressure at workplace (Figure 20).

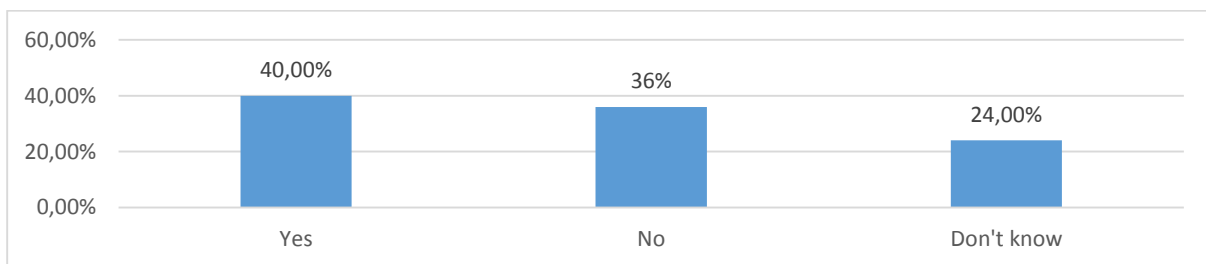


Figure 19. Are you aware of any support your employer provides to help employees to cope with stress and pressure? Source: own study.

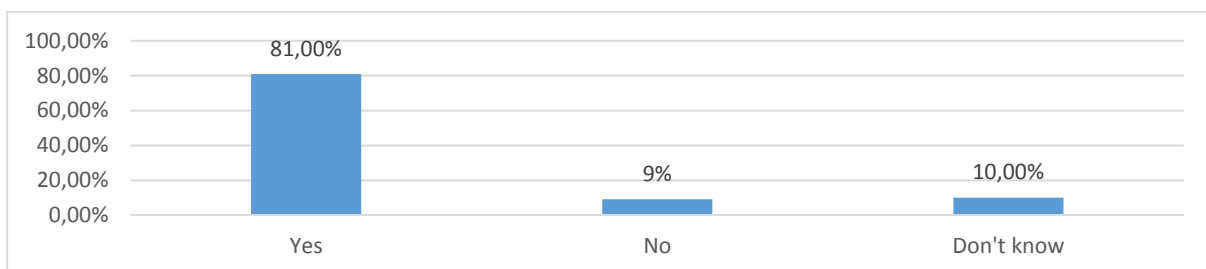


Figure 20. Do you think that responsible leader should not underestimate stress and pressure among workers? Source: own study.

Employees as well as leaders acknowledge Covid-19 pandemic's negative influence on levels of pressure and stress in the companies. Both companies have experienced it and have to deal with consequences it introduced to their daily routine. More than a half of the group of employee respondents claimed that the levels of stress and pressure significantly increased under the pandemic regime. Asked in the following question about the exact examples of what has changed, many answers did repeat several times, including:

- dismissals and worry for potential dismissals are any moment,
- having to additionally do the work of absentees alongside with their own,
- new tiring tasks and duties (for instance, lists of people under quarantine in Human Resources departments),
- being overworked,
- receiving less money monthly,
- working from home with limited access to resources.

As one can observe, there are some areas in which both leaders and employees have similar opinions, and there are other group-specific ones. At times employees may not be entirely sure of the leaders' intention as well as sometimes employees' worry and fear of leaders is completely unfounded, as was presented in numerous examples above, and therefore one most important conclusion which sums up the conducted research would be that both sides should communicate with one another in as clear and plain way as possible, in order to avoid stress and pressure causing misunderstandings.

Conclusions

Summarizing the above deliberations the following observations based on the survey were made attempting to offer the answer to the research question: The research results showed that:

- both leaders and employees admitted to experiencing stress and pressure at work often or even daily,
- both leaders and employees acknowledged that stress and pressure occurring at the workplace have disruptive influence on their work performance (such as making mistakes under pressure or not reaching desirable goals due to stress occurrence),
- both leaders and employees agreed that stress can be either motivating or discouraging, indicating also that negative influence is of greater possibility,
- both leaders and employees claimed that responsible leadership should pay close attention to problems stress- and pressure- related,
- considerably more leaders than employees admitted that the stress at work has a disruptive influence on their personal life,
- considerably more employees were willing to avoid stressful days or situations at work, while leaders emphasized being ready to face and overcome such difficulties,
- considerably more employees fear losing job due to mistakes made under pressure,
- competitiveness among colleagues inside the company appears to be growing problem among both employees and leaders,
- majority of the leaders claim to support their teams when it comes to dealing with stress-related issues while only minority of the employees admit to seek help of leaders while overcoming such issues,
- both leaders and employees stated that stress and pressure levels increased in the last year due to Covid-19 pandemic,
- approximately half of the members of both surveyed groups admit to having health-related problems due to stress at work,

- both leaders and employees emphasized the negative influence of stress on mental health and importance of its successful management,
- the majority of leaders acknowledge the importance of noticing the stress and pressure effects on co-workers and subordinates,
- most leaders claim to be actively acting against stress occurrence at work but also believe there is yet still much more to be done,
- leaders generally tend not to be willing to become a source of stress or pressure of their subordinates, while the majority of employees' voices claim to have experience such situation which subsequently leads to another conclusion that there is yet much to be done when it comes to clear communication between the leaders and employees.

The research results implicated that stress and pressure are still perceived as a huge problem among both groups of respondents and many of them tend to experience it often. Both leaders and employees classify stress as limiting their performance or even as a factor which can stop them from reaching goals while pressure is considered to be most likely the source of mistakes. Nonetheless the leaders appear to truly pay attention to the stress occurrence among their subordinates. They claim to be supportive and willing to offer all the help that is required to eliminate the occurrence of stress among their teams as much as it is possible. Therefore what is worth noticing is that most of the leaders had already acquired the belief that caring about the employees' well-being is equal to caring about the company itself as only motivated teams are most likely to achieve maximum effectiveness and efficiency and motivation is hardly ever achieved through causing fear among the workers. On the other hand the research results have shown that when it comes to stress and pressure at work, employees do not count on leaders to help them solve such issues and are more likely do deal with them on their own, claiming that they would only seek their employers' help if the problem was extremely important or causing a lot of damage among the whole team.

The change in the role of leadership in managing stress and pressure in the modern, competitive world of business appears to have already begun. The research has shown that the majority of leaders truly regard the employees' well-being and are ready to support the individuals in solving the problems they often face, instead of perceiving them just as a workforce, as a mean used to achieving bigger goals. The problem is that the employees' do not necessarily notice it or perhaps do not fully believe their leaders' intentions. Therefore the key to achieving the best cooperation between the leaders and employees is to clearly communicate their intentions by the employers and to more openly express their worries and expectations by the employees.

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HUMAN FACTOR IN INDUSTRY 4.0: ABOUT SKILLS OF OPERATORS IN STEELWORKS 4.0

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Purpose: The article presents the issues of metallurgist skills in the conditions of implementing the key technologies of Industry 4.0. The purpose of the paper was to propose a skills framework for a metallurgist in the context of Industry 4.0.

Design/methodology/approach: The paper consists of an introduction and two substantive parts. The first part deals with the role of the human factor in Industry 4.0. The second part is about the skills of a metallurgist (the general framework of skills 4.0) in the transformation of metallurgical enterprises to Industry 4.0. The paper is part of the current research on skills of operators in Industry 4.0. The study uses a qualitative descriptive method referring to a critical analysis of literature about skills of the future. The article briefly reviews selected theoretical approaches to the operator-technology skills in the reality of Industry 4.0.

Findings: The main result of the analysis was to bring closer the current, yet poorly scientifically recognised research about the place of human factor in the Industry 4.0 together with the structure of skills for the restructured employment in the steel industry.

Research limitations/implications: In the conditions of the fourth industrial revolution and strong popularisation of the concept of Industry 4.0, enterprises must be able to reorganize human resources (HR). A new package of knowledge, new skills of employees are needed to perform tasks efficiently and to cooperate with new technological solutions of production and control and monitoring systems of manufacturing and service processes. The topic about human factor (HF) in Industry 4.0 is very actual and it will be developed according to wider and wider implementation of new (smarter) technologies in enterprises.

Practical implications: Presented framework of human skills can be used to improve the skills profile of a metallurgist 4.0 (a worker in smarter steel mill).

Social implications: In developing of new skills of employees in smart steelworks, besides steel mills, is needed an educational ecosystem, that joins different educational and science organizations.

Originality/value: Reorganization of employment in Industry 4.0 is a new research field but very actual in the realized transformation process of enterprises. The paper is a form of introduction to discussion about new skills of operators in smart production.

Keywords: Industry 4.0, Operator 4.0, Metallurgist 4.0.

Category of the paper: Conceptual paper.

Introduction

In the conditions of the fourth industrial revolution and strong popularisation of the concept of Industry 4.0, companies must be able to quickly change capabilities, technologies, resources to be more innovative. The pillars of Industry 4.0 are intelligent machines equipped with artificial intelligence and augmented reality algorithms, autonomous robots, integrated information-computing systems and Big Data. Industry 4.0 does not exist without the Industrial Internet of Things (IIoT), which facilitates the transfer of information from device (machine) sensors to a decision-making centre, as well as improving machine-to-machine (M2M) and machine-to-product (M2P) communication. Data transfer is also supported by cloud services, visualisation of industrial processes and autonomous computer-based control systems and real-time process control. Autonomous robots and collaborative machines are bridging the gap between traditional worker-operated technologies and creating new areas for full automation and robotization of production (Kumar, and Kumar, 2020). Robots perform work in a similar way to humans with the ability to monitor and transmit data during operations (Wiesmüller, 2014; Wang et al., 2016).

Industry 4.0 is not only about new technologies, but also about the human factor, which has to cooperate with new technologies. In Industry 4.0, a new package of knowledge, new skills and new abilities of the company's employees are needed to perform tasks efficiently and to cooperate with new technological solutions of production and control and monitoring systems of manufacturing and service processes. The human factor in smart factories can be considered in the level of managers and in the level of other employees. As technologies advance, the boundaries between managers and operational employees, disappear (Neumann et al., 2021). Operations at many workstations are autonomously performed by technologies. In Industry 4.0, the number of automated jobs is even greater than it used to be. Technological operators get strong support from information and computer systems and artificial intelligence algorithms of machines in augmented reality. Human work is strongly intellectual. Employees in Industry 4.0 learn to cooperate with new technologies, co-creating the new value of smart production. The human being in cyber-physical production systems (H-CPS) is a dynamic operator, strongly connected to the processes and management methods of new technologies.

In the revolution taking place, scientists are looking for the place of workers in cyber-physical production systems. Participating in the discussion, the author presented the requirements for the profession of a metallurgist in the concept of Industry 4.0. In accordance with the accepted numerology, the skills of a metallurgist in the fourth industrial revolution was called: Metallurgist 4.0 or Operator 4.0. The paper focuses on the framework of skills of operators in the metallurgical processes.

The human factor in the concept of Industry 4.0

Industry 4.0 is a new idea of improving production in the fourth industrial revolution through high technologies and new tasks of its operators. In the fourth industrial revolution, the technological changes have radically accelerated and innovation has created common cyber space. In factories, Industry 4.0 is a change of production systems into Cyber-Physical Systems (CPSs), in which not only machines and IT systems or full real-time data analysis are important, but also the preparation of appropriate human resources. Each machine must be designed, programmed, serviced, and for this an operator is needed, who, according to the nomenclature of the idea of Industry 4.0, should be an "Engineer 4.0" or "Operator 4.0" (Romero et al., 2016a). The technological development forces changes in human labour. The digital transformation of businesses and organisations will increase the demand for all data analytics and digital occupations. Any change that involves the human factor often results in resistance and strong fears among employees about losing their jobs. Technological modifications in Industry 4.0 may entail the replacement of people employed in companies to build a new team of fourth-generation technology operators. Reports from global organisations including: World Economic Forum (2018) estimate that 75 million jobs could disappear when human labour is replaced by automated systems based on intelligent algorithms and smart machines, but at the same time nearly twice as many – 133 million – jobs will be created.

In Industry 4.0, the demand for workers will increase, especially where new directions for the production need to be set, where decisions are made by machines with learning algorithms. At the current stage of manufacturing automation, machines perform repetitive tasks and still require tools towards performance prediction and process simulation.

In Industry 4.0, humans must learn to adapt to new situations and function in dynamic manufacturing systems. Increasingly, operators' tasks will be hybrid in nature – a combination of human and machine skills. On the one hand, workers interact strongly with Industry 4.0 technologies, and Industry 4.0 operators support machines at the stage of training them (teaching them to work intelligently) and participate in explaining and interpreting the effects of their work and their maintenance. On the other hand, machines in Industry 4.0 amplify people's potential and enhance their cognitive, communication and physical skills (Daugherty et al., 2018).

Industry 4.0 needs more human responsibility for technologies and development of human skills in continuing education (Kopp, 2014 based on the platform: Industrie 4.0). Preparing employees for Industry 4.0 is a key challenge for companies implementing new technologies of the fourth industrial revolution. The concept of a systems approach to learning organisations created by Peter M. Senge is also current in Industry 4.0 (1990). This concept assumes that education is a core value and that companies are organisations that can continuously train and develop themselves. It is important that all employees do this. Learning organisations need to create good conditions for knowledge enhancement and motivate employees appropriately for professional development (Report: Manual 4.0, online:www.inspire-consulting.pl).

Figure 1 provides an illustrative diagram of the key challenges for the human factor in Industry 4.0. The scheme was inspired by G. Hamel's model – challenges for companies of the 21st century, which the author adapted to the requirements of the Industry 4.0 concept. The choice of three determinants of building Industry 4.0 was dictated by the adopted topic of the paper, in which the author focused on the development of the human factor in Industry 4.0.

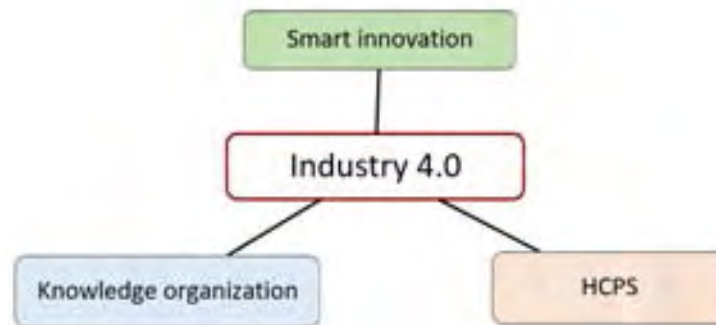


Figure 1. Complex Diagram of the dependence of human factor changes in the era of Industry 4.0. Source: own elaboration.

Human Cyber-Physical Systems (H-CPS) are collaborative relationships between humans and technologies of the fourth industrial revolution in a system of strong links between physical processes and digitalisation (Romero, et al., 2016a).

Innovation in Industry 4.0 can be described by: smart, efficiency, effectiveness, optimisation, dynamism, personalisation and customisation at reasonable (acceptable) cost (Kumar, and Kumar 2020). Innovations in Industry 4.0 arise in Cyber-Physical Production Systems (CPPS). Quoting from Flores et al. (2020, based on: Monostori et al., 2016) cyber-physical systems are engineered systems used to monitor, control and integrate operations in systems (structures) of physical and computer (digital) requirements. Considering different technological forms, cyber-physical systems can be more or less complex. Cyber-physical systems evolve at different stages of technological change and successive levels of implementation of Industry 4.0 technologies in enterprises. Companies start the changes with simple and single projects, and over time the number of projects increases (Gajdzik, 2020b). J. Lee et al. (2015) identified five levels of CPS architecture within the collaboration of physical processes and digital space. The different levels of CPS correspond to the functions of technology in smart factories. The first, lowest level includes data collection and interpretation – the level: Connection. The second level is the application of modern technology for analysing process performance – analytics capability – the level: Conversion. The next level includes monitoring of work (processes) in real time – real-time acquisition, and comparing monitoring – the level: Cyber. The fourth level is called cognition, annoyance or presentation – the Cognition level. At this level, technologies strongly support humans in optimising processes. The fifth (highest) level is services, processes, and network configurations – the level: Configuration. At this level, machines have cooperative learning and adaptive and executing algorithms. The different levels of cyber-physical systems are discussed in publications such as: Flores et al. (2020), Wiesner et al. (2017), Liu et al. (2017), Oztemel,

and Gurse, 2020). To the key CPS architecture proposed by the team led by J. Lee, another team of researchers led by E. Flores (2020) adds human factors requirements. At level one of cyber-physical systems, operator primarily involves the cognitive senses. At levels two and three, thinking skills (memory, intellect) are needed. At level four, operator acquires experience in cooperating with technology and becomes its machine teacher (engages his consciousness and emotional intelligence). At level five of cyber-physical systems, the operator takes concrete action through his technical and digital skills (bodily action). The links between Operator 4.0 and CPS levels are in line with the proposal of the scientific team led by Romero (2016a), who introduced the term: Human Cyber-Physical Systems (H-CPS or HCPS) – Figure 2.

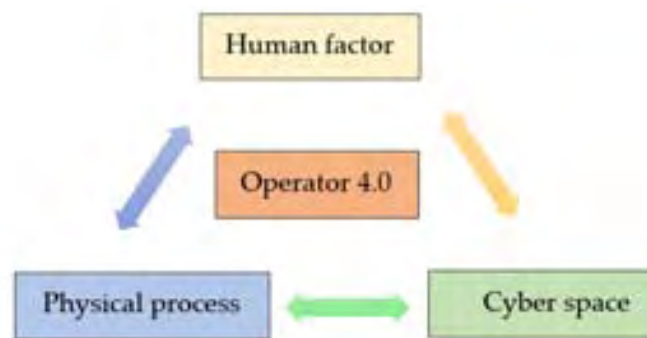


Figure 2. Key components of H-CPS. Source: own elaboration based on Flores et al. 2020.

Employees in Industry 4.0 are operators of increasingly intelligent technologies. The name "Operator 4.0" has been applied to describe the role of humans in cyber-physical systems. The established new arrangement of cyber-physical systems with human factors, abbreviated H-CPS, is a new concept of human-machine collaboration in increasingly intelligent production (Sun et al., 2020: based on Ruppert et al., 2018; Lorenz et al., 2015). The team: Ruppert et al. (2018) classified operators according to the extent of their collaboration with machines and the type of activities performed, starting from the lowest level or Operator 1.0, where manual activities dominate, to the highest level of Operator 4.0, which represents a new philosophy of collaboration between the operator and increasingly intelligent machines, at the level of their adaptation to each new situation in a dynamic production process. As part of cooperation with new solutions (machines) in cyber-physical production systems, the operator can take on various roles, such as: VR/AR (virtual operator), (Sun et al., 2020; Romero et al., 2016b; Ruppert et al., 2018), smarter operator, being a personal assistant of this technology, operator cooperating with robots (collaborative operator), analytical operator and many others. In addition to these functions, operators can also perform the functions of social operator and even personal data operator in the context of the impact of technology on humans and the efficiency of using technology (healthy operator).

In the conditions of digital transformation, knowledge becomes a key resource in transforming enterprises, and the key directions– the ways and speed of knowledge building in an enterprise. The wide use of new technologies in Industry 4.0 increase the demand for new skills, which are defined as human-skill perspectives. The skills of the future are "a set of many skills enabling taking on and carrying out tasks in a new work environment that is increasingly

flexible, geographically dispersed, susceptible to frequent and rapid changes, and in which it assumes the need to operate digital technologies and cooperate with automated systems and machines using artificial intelligence" (Report: Manual 4.0, p. 17).

The summary of this part of the publication and the presented conceptual issues of the location of man in Industry 4.0 is the comparison of the levels of cyber-physical systems with the human factor and the functions of operators (Table 1).

Table 1.

Humans in the cyber-physical systems of Industry 4.0

Levels of CPSs according to J. Lee (original nomenclature)		Functions of the technology	Human skills	Operator types according to Rupper et al.
1.	Connection level	Collection of data from the devices and their transfer to the system.	Using the human senses and human skills, such as: perceptiveness, concentration, field of vision, agility, etc.	Activity operator
2.	Conversion level	Process analysis using modern technologies (data transferred to decision-making centres in real time).	Human cognitive skills, such as: memorization, intellectuality.	Data Analyst Operator
3.	Cyber level	Process monitoring using modern technologies, including computer simulation, forecasting, intelligent algorithms, machine learning models, etc. – increasing human-robot collaboration.	Cognitive human skills: creativity, logical reasoning, complex problem solving, etc.	Cooperating operator, VR and AR operator
4.	Cognition level	Computer programs, graphics, interfaces, data penetration, etc., process optimization prioritization, autonomous process optimization, IC systems modularity, IC systems integration.	Operators' experience in working with machines and technological intelligence, emotional intelligence.	Operator of integrated systems, smarter operator
5.	Configuration level	Adaptation of machines to new situations, machine learning, smart technology, networking of devices.	Hard skills in the field of IT.	Co-operator of smart technologies.

Source: own elaboration based on: Flores et al., 2020; Lee et al., 2015; Romero et al., 2016b; Rupper et al., 2018.

When using measurement abbreviations, there should be space between the number and unit of measurement.

The framework for the skills of a metallurgical technology operator – Metallurgist 4.0

With the popularisation of the Industry 4.0 concept, work in the steel industry is changing. Manual activities and typical physical labour are being reduced to a minimum and replaced by the work of technological installations with an increasingly high degree of automation in steel production. Steel companies are strongly committed to digital transformation in the industrial revolution that is happening (Gajdzik, and Wolniak, 2021). The level of digitisation of the steel industry varies from company to company, but throughout the steel sector, the change towards Industry 4.0 is well underway. The sector is moving from level 3.0 to level 4.0. Companies are implementing solutions typical of Industry 4.0 to develop smarter steel production (Gajdzik, 2021a; 2022). And although the changes taking place are start-ups, they are developmental for the metallurgy of Industry 4.0 (Gajdzik, 2022). The main reason for steel mills to engage in digital transformation is the strong need to secure the future development of the industry.

At the current level of maturity for Industry 4.0, steel mills use information and computer systems for operational production management and control (MES), apply electronic document flow (EDI) systems and customer management databases (CRM), as well as mobile technologies and social media. Digital technologies typical of Industry 4.0, such as big data solutions, cloud computing, sensors and sensors that monitor machine operations, 3D printing and other incremental manufacturing technologies are also being used. The automation and computerisation of the steel sector is laying the foundation for investments in increasingly smart technologies.

Technological changes result in personnel changes. The importance of personnel reorganisation in the steel industry in Poland is important because the steel sector is part of five industries that together provide more than 50% of the gross value added in Poland. These sectors are: production of food products, metal products, motor vehicles, rubber and plastic products and furniture) (Owerczuk, 2016). These five industries in Poland, employ 51% of the industrial production workforce (Gönt, and Gracel, 2017).

The steel sector in Poland employs over 24.5 thousand people (Gajdzik, 2020a). The situation of human resources in the domestic steel sector in Poland is unfavourable to the extent that there has been a generation gap in steel mills for many years, which is a century of radical downsizing in the 1990s (Gajdzik, and Szymshal, 2015). The opportunity for the sector's development are young, well-educated and creative people but they need to be attracted and encouraged to work in metallurgical enterprises. Steel mills need to build a new image of a metallurgist working with digital technologies and overseeing steel smelting and the production of steel products.

The work of a metallurgist in Poland has changed a lot over the last two decades. The metallurgist is surrounded by IT systems, process visualisation systems, equipment monitored by computers, autonomous robots and artificial intelligence algorithms. In these new

technological areas used in the steel production system, workers must reorganise their existing skills, adapting them to the requirements of Industry 4.0.

The framework of the new metallurgist's skills profile is determined by hard and technical competences connected with operating steel production technology supported by metallurgical knowledge and many soft skills, including social skills, which are necessary in the work environment and in contacts with other people and in teamwork of equipment operators. Basic metallurgical and metallurgical knowledge, which employees acquire at the stage of education (vocational and secondary schools with technical profile, studies at technical universities) and during their professional work (work experience), under the conditions of Industry 4.0 must be supported by digital knowledge and digital skills.

Education and science centres in cooperation with industry must take care of the development of employees' competences and skills. The solution is cooperation of universities with industry and other organisations supporting employees in their professional development. The cooperating entities should create an educational ecosystem and join in the process of creating content and didactic forms for the development of personnel needed in Industry 4.0. In the popularised fourth industrial revolution, employees expect fast and effective acquisition of new competences and skills.

Reviewing the courses of education at several technical universities in the country, the author has determined the scope of education, useful for the profession of metallurgist, details in Table 2. In the prepared list, three categories of competencies and skills were combined, that is, metallurgical, engineering and digital.

Table 2.

Key fields of study to build up hard skills of metallurgist 4.0

Areas of education (study)	Examples of engineering typologies
Industrial engineering	production engineering, manufacturing engineering, materials engineering, process engineering: metallurgy engineering, welding engineering, foundry engineering, rolling engineering, etc.
Process support engineering	production quality engineering (quality control and quality assurance), environmental and recycling engineering, mechanics - machine operation, mechatronics, industrial chemical analysis, electrical engineering of industrial machines, electronics micro- and nanoelectronics, nanotechnologies, industrial biotechnology, photonics, sensorics, industrial mechatronic machines and systems, machine design, mechanical engineering and machine construction technology, maintenance engineering (PM), electrical engineering, robotics engineering.
Industrial informatics	computer programming and design, including: 3D design, computer simulation, computer modelling, data analysis, programming, process visualisation, industrial data platformisation, neural networks, industrial network administration, machine learning, AI support, AI environments, autonomous decision-making systems, sensorics, robotics engineering, cybersecurity.

Source: own elaboration.

Digital competences and skills are not limited to handling information and computer technology (process support systems) or computer programming and data analysis, but cover a wide range of skills from digital problem solving to knowledge of data privacy or cyber security. In addition to technical and digital skills, a steelworker must have soft skills, including: cognitive (thinking skills, creativity, logical reasoning, inquiry, recognition, compilation of knowledge, solving complex problems) and social skills (communication, teamwork, leadership and management of employees, effective group collaboration, emotional intelligence, entrepreneurship and others) (Gajdzik, 2021b).

In the category of soft skills, World Economic Forum experts (2018, p. 29) point to the usefulness, first of all, of skills such as: human resource management, negotiation skills, emotional intelligence regarding social and customer needs (product personalisation), alignment of one's actions with those of other team members (team of operators within a given process), cognitive flexibility (ability to flexibly switch thinking between different problems or sets of rules) complex problem solving (developed ability to solve non-obvious problems in complex real-world contexts, in the case of a metallurgist in controlled processes and operated technological ranges), critical thinking based on logic, reasoning, inference, and creativity as the ability to come up with unusual or non-obvious ideas on a given topic or in response to a given situation, or to develop creative ways to solve a problem).

Particular emphasis in operating next-generation technologies is on problem discovery, especially at the lower levels of the cyber-physical manufacturing systems architecture. The metallurgical operator must be a good researcher and observer of the technologies used in metallurgy. The metallurgical operator learns about the technology being operated and discovers its problems. Innovation and design thinking in operators is all about finding problems, not just solving them. It is important for the metallurgical technology operator to acquire the skills to deal with complex process problems. Metallurgists with many years of experience have learnt to look at process plants from different perspectives – practice makes perfect – and over time, this knowledge must be passed on to new employees so that it becomes a source of new possibilities for controlling processes and optimising operations.

These three categories of qualifications and skills are represented by the letter 'T' (Figure 3). In the European Commission's blueprint entitled: European vision on steel-related skills (...), May 2020, technical skills, digital skills and soft skills are the components of the letter "T", to which the author added basic cognitive, technical and social skills.

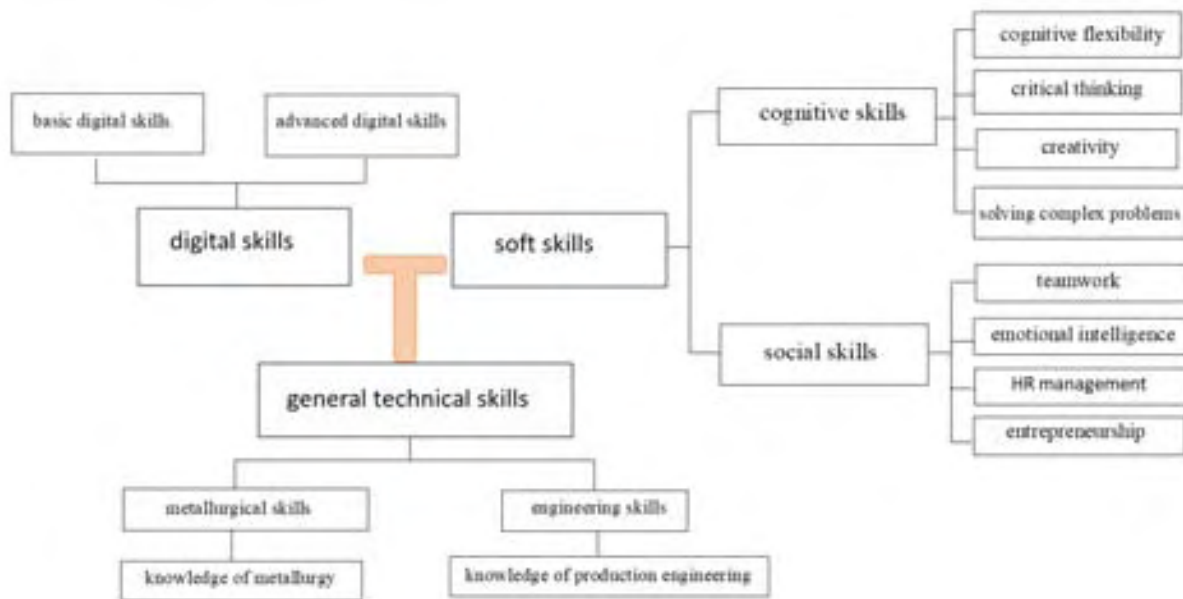


Figure 3. T-shaped diagram of a metallurgist's basic skills. Source: own elaboration based on report of EC, Blueprint, European vision on steel-related skills (...), May 2020.

In the OECD report *The Future of Education and Skills: Education 2030*, three additional categories of future skills were identified, called "transformative" skills. Transformative skills are: knowledge of creating new values (useful qualities of an employee: adaptability, creativity, curiosity, open-mindedness), skills of reconciling tensions and solving problems (useful qualities: empathy, emotional intelligence, cooperation in a team) and responsibility of an employee (key qualities: intellectual and moral, professional and technological maturity).

The metallurgical operator must be able to work both independently and in a team. Specific process technologies are operated by several teams of operators. Working in teams, often dispersed at work, requires the ability to efficiently manage the work of people and technologies, coordination and decision-making. It is in the employer's interest that team skills are transferable skills (Yate, 2019). Teams in steel mills should be multi-tasked and metallurgists in technology teams should be strongly supported by IT staff, especially at the stage of learning the technology to be supported. Over time, the ability to do basic computer programming of technology gradually becomes as basic as the ability to operate computer office programs. From basic digital skills, the metallurgist moves over time to advanced digital skills. The key skills of the metallurgical operator are continuously adapted to the technological maturity of the enterprise to Industry 4.0.

Each enterprise is at a different stage of transformation to Industry 4.0. There is no universal path for enterprises on their journey to Industry 4.0 (Gajdzik et al., 2021). The set of key competences of a metallurgical operator may differ from one enterprise to another. In general, it can be assumed that the key skills of a metallurgical operator refer to what is not yet written in the algorithms of the machines and are necessary to perform process operations in the transformation of a steel mill to Industry 4.0

Summing up the considerations, the author would like to point out that the profession of a metallurgist evolves with technological progress, in successive industrial revolutions, the workers of steel mills acquire new process skills and physical labour is replaced by machine work. In the fourth industrial revolution, in addition to the process typology of the metallurgical profession (blast furnace worker, steel worker, rolling mill worker, etc.), the typology of industrial digital technologies is used, e.g. metallurgical analyst, metallurgical programmer, metallurgical technology transformation specialist, metallurgical process optimisation specialist. The operator metallurgist as part of the teamwork collaborates with specialists in AI (artificial intelligence), ML (machine learning), process automation and robotics and multiple data analysts (data analyst, software analyst, data security analyst, etc.). Figure 4 shows a new overview layout of the operator metallurgist skill map – Metallurgist 4.0.

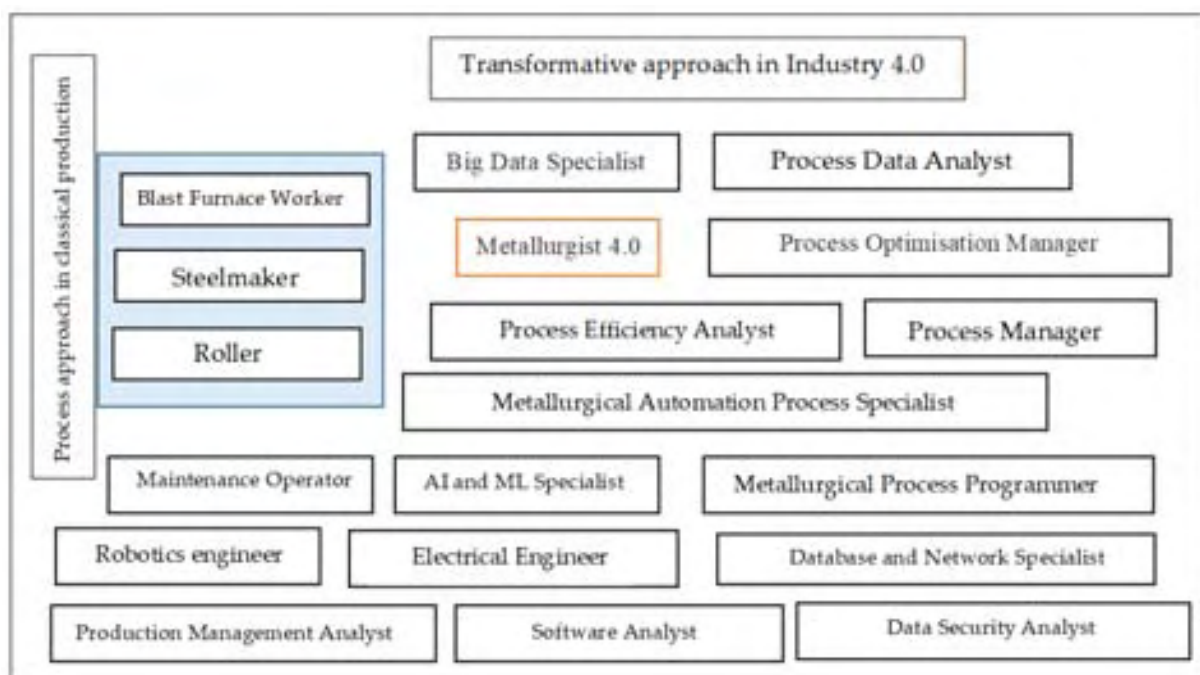


Figure 4. Map of operator skills in steelworks 4.0 – Metallurgist 4.0. Source: own elaboration.

Conclusion

In the conditions of digital transformation, knowledge becomes the key resource, and the key competence of people and organizations - the way and speed of acquiring and using it. In the labour market shaped by automation processes based on artificial intelligence and platformisation, there is a need for employees who, relying on advanced cognitive, social and technical (including digital) competences, can cooperate with fourth generation technologies and participate in the creation of cyber-physical manufacturing systems. The use of new technologies affects the form and nature of work in many industries, including the steel industry under analysis. With the transformation of metallurgical enterprises to Industry 4.0, many tasks

performed by people will be increasingly replaced by the work of machines (the replacement concerns repetitive and routine activities, both physical and mental). At the current stage of metallurgical transformation, the metallurgical profession is subject to the enrichment of digital (initially basic, with time advanced) and cognitive and social skills.

The arrangement of the triad of skills (hard, soft and digital) of metallurgy facilitates employees to work with technology and understand complex operational (process) tasks. A contemporary metallurgist is a member of a team of operators and IT specialists, with whose participation he gradually acquires knowledge and learns the possibilities of high technology. The acquired experience should be enriched by education in the organisations offering training, courses and other forms of education.

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GENERAL ASSUMPTIONS FOR PROJECT MANAGEMENT IN INDUSTRY 4.0

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Purpose: Authors of the paper develop the main assumptions for project management in the Industry 4.0, and present them in the short form as basic knowledge, useful for managing smart manufacturing (SM) projects in companies.

Design/methodology/approach: the process of preparing SM (smart manufacturing) projects and their implementation, in the Fourth Industrial Revolution, have been changed, due to the importance of the issue of linking more and more intelligent machines, IT-computer programs and monitored processes into integrated technological systems of key importance for the construction of cyber-physical production systems (CPS). The paper applies a conceptual analysis of possible areas of change in project management (PM) when enterprises build the smart manufacturing (SM).

Findings/conclusions: companies building the smart environment must adapt their organization of project management to the new requirements and opportunities of Industry 4.0 (I 4.0) technologies.

Research limitations: the narrow scope of knowledge about the ongoing changes in SM project management is due to the short period of experience (the Industry 4.0 concept has been implemented since 2011), therefore the authors have only presented the framework of changes in organization of project management.

Practical implications: the authors' intention was to initiate a practical discussion about the changes in project management in the ongoing industrial revolution.

Originality/value: Since 2011, when the government of the Federal Republic of Germany recognized the concept of "Industrie 4.0" as the key strategy of innovative development, Industry 4.0 has become an important discussed topic among practitioners and researchers. The fourth industrial revolution is expected to result in a leap in the efficiency of companies operating in the intelligent technological environment. Key technologies or pillars of Industry 4.0 are implemented in manufacturing enterprises to build the smart manufacturing processes. Enterprises develop new projects and make investments in order to create Cyber-Physical Production Systems (CPPS).

Keywords: Industry 4.0 (I 4.0), project management (PM), integrated technologies and IT systems, digitalization, smart manufacturing (SM).

Category of the paper: Conceptual paper.

1. Introduction

The environment of business is becoming more and more revolutionary, the periods of use of industrial technologies are shorter, and enterprises are increasingly forced to develop and implement successive projects for new technological solutions. Companies prepare more and more projects and realize new investments for the modification of production means. These projects are: technological projects, reorganisation projects, software projects with computer support of processes, projects for new products and even the new structure of supply chains. Under the conditions of the ongoing the Fourth Industrial Revolution and the proposed disruptive technologies (pillars) of Industry 4.0, the investment needs of enterprises are ever greater and more revolutionary. The term "Industry 4.0" is strongly popularised in highly developed countries. In Industry 4.0, the aim is to fully automate processes and digitise industry, towards the transformation of existing production facilities into self-controlling and self-adapting Cyber Physical Systems (CPS), forming, over time, smart factories with smart values (Lasi et al., 2014). The Fourth Industrial Revolution, despite being only a general vision of industrial development, brings with it key changes in the area of production. This applies in particular to further investments or projects transforming the existing manufacturing system into a smarter one, which in turn requires the development of new assumptions for Project Management (PM). The purpose of this article is the conceptual analysis of the main changes in PM during the implementation of the Industry 4.0 concept in manufacturing companies.

The paper is based on a literature review with short synthesis. In the first part of the paper, the idea of the Industry 4.0 concept in the context of project management was presented. The main framework of changes in the project management in Industry 4.0 was in the second part of the paper. The paper concluded the summary.

2. About the background for project management in Industry 4.0

Industry 4.0 refers to the changes of the Fourth Industrial Revolution. The term 'Industry 4.0' was first used in 2011 by the German initiative group 'Industrie 4.0', made up of representatives from business, politics and academia, as the name of a concept for the development of smart and high industrial technologies (Kagermann et al., 2011). Industry 4.0 is the trend of the next industrial revolution. This trend is spreading across more and more companies in different industries, moving towards smart manufacturing with cyber-physical systems that are a combination of real and virtual worlds, Internet of Things (IoT) and Internet of Services (IoS), up to smart factories (Greengard, 2015; Gajdzik et al., 2019). In the Fourth Industrial Revolution, the aim is for intelligent manufacturing systems to be dynamic and flexible (adapting to change), clever and intelligent (self-organising and optimising).

Manufacturing systems in Industry 4.0 are formed by intelligent machines and devices and the IT and network systems that support them. The set of technological solutions constitutes a dynamic structure that constantly reconfigures itself depending on the changing needs of the customer and business conditions (Erro-Garces, 2021).

The implementation of Industry 4.0 projects in manufacturing enterprises brings about changes in all areas of the functioning of business. From the point of view of management sciences, the changes in organisation and project management are particularly momentous. In opinion of Spalek, the importance of project management in the Industry 4.0 is greater than before (Spalek, 2017). This situation is the acceleration of technological progress and the growing number of projects and their increasing scope for technological change. According to the idea of the Fourth Industrial Revolution, the technologies implemented should ensure the standardisation and modularisation of process solutions through interconnection and flexible modular combinations, as well as the integration of information and computer devices and systems, enabling the creation of identities of machine components and communication systems and creating conditions for the development of interconnection networks with computer optimisation and system virtualisation solutions, as well as ensuring the continuous development of technologies. Companies planning new investments or developing projects or modifying existing process solutions, must make a reliable diagnosis of the company's needs and select optimal variants of technological development from the vast set of possibilities brought by the fourth industrial revolution. In modern technological projects, companies must remember about the principle of integrating manufacturing technologies with IT systems by using IoT. According to the idea of Industry 4.0, integrated devices and IT systems are able to improve the management of business processes or factories and ensure nearly full control of the situation in a dynamically changing environment. Technological projects in the fourth industrial revolution are different from the previous industrial projects of companies, although they use some of their characteristics, which they process in their own way, that is, towards smarter solutions of manufacturing. In the current conditions, enterprises are oriented towards combining the digital and physical perspective. The former includes modern manufacturing systems, analytical systems, smart sensors, mobile interfaces, among others. The latter includes, among others, new materials, advanced robotisation, automated vehicles, intelligent products. The importance of IT and digital solutions is growing in new technological projects. Synchronization of biggest and biggest databases and compatibility of IT systems is the beginning of building projects of intelligent technologies of Industry 4.0. There are more and more projects in companies and the implemented installations are almost a common organism that can react to the business environment. The new project management plays an important role in the development of Industry 4.0. The PM is an appropriate tool for achieving the goals and activities of evolving smart technologies and operations (López-Robles et al., 2019). All project resources influencing project success must be integrated, with the aim of achieving smarter solutions than previously used, and must be equipped with self-organising and self-optimising process functions (Monostori et al., 2016).

3. Main challenges for project management in Industry 4.0

The term 'project' is defined as a construct involving budget, time and quality (Bryde, 2008; Fortune, 2011; Turner, 2009). According to the classical definition of a project, the project purpose is to find a solution to business problems, after an initial and precise definition of the them (Kerzner, 1989).

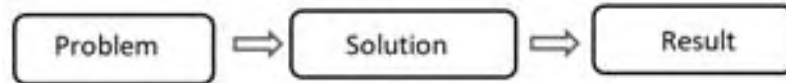


Figure 1. The concept of project based on classic definition of project management. Adapted from: "Zarządzanie projektami" by H. Brandenburg. 1999 by Publisher: Politechnika Śląska, Gliwice, p. 46.

In Industry 4.0, the projects aim to adapt the enterprise to the requirements posed to it in the Fourth Industrial Revolution, i.e. to create a cyber-physical production system (CPPSs) that enables the achievement of quality defined as the adaptation of production to personalized needs (individual orders), while at the same time the projects must ensure the optimization of the process and reduce energy consumption. The classic project management diagram shown in Figure 1 can be presented in a slightly different way according to the idea of Industry 4.0 (Figure 2).



Figure 2. The concept of project management in Industry 4.0. Source: own elaboration.

Industry 4.0 refers to the key technologies or pillars of the fourth industrial revolution, which include: autonomous robots, simulation, system integration, Internet of Things (IoT), incremental manufacturing (3D printing), data processing, cloud computing, databases, augmented reality and cyber security (Kagermann et. al., 2011). The solutions that a company can implement are not as obvious in the Industry 4.0 as one would think, as the path leading a company to create the cyber-physical production systems is long and complex and consists of many projects (Gajdzik et. al., 2021). The new development projects in industrial enterprises are not simple projects due to the diversity and range of applications of Industry 4.0 pillars. The multiplicity and diversity of technological solutions in relation to other projects creates new relationships between individual machines and information systems in the field of flexibility based on cooperation between technologies. Each project involves further projects that must be completed to create an intelligent solution. S. Spalek (2012, pp. 172-188) notes, that the complexity and number of projects carried out by companies has increased in the modern century. The new projects (in Industry 4.0) are associated with greater risks than

projects of fragmentary technology modification. There is a greater technical risk resulting from the complex environment of implementing new technological solutions (intelligent machines with learning function, installations responding to emerging problems and able to adapt to changes) and completely new production engineering assumptions (intelligent optimisation). Lack of communication and cooperation between used technologies can be the main obstacle (barrier) to the success of projects. The basis of new projects is the integration of information systems and technologies without unnecessary operations in processes and re-entering data.

New projects are so innovative that designers may feel they are doing something beyond their capabilities and competence. Artificial intelligence (AI) will control entire production lines, ensuring product quality and improving the efficiency of processes. Algorithms can be used to predict many problems, but they must first be developed based on the company's specific process conditions. In the implemented projects, it is assumed that the applied technologies of Industry 4.0 should ensure resources (energy, materials etc.) savings. The concept of development of Industry 4.0 is based on the assumptions of sustainability (Gajdzik et al., 2020; Aghemo et al., 2014). Based on research by Vrchot et al. (2021), it was found that there is a relationship between the benefits of Industry 4.0 and the sustainability of projects. The research found that in companies that use project management, project managers believe more in Industry 4.0 to achieve sustainability. The analysis also showed that large companies see the benefits of Industry 4.0, especially in projects aimed at introducing new energy sources in the manufacturing processes. In Polish industry, the problem is still low diversification of energy sources. The success of many projects of domestic industrial companies in the long term is related to the diversification of energy sources. The energy economy of Polish industry is still based on coal and energy supplies from external commercial sources. Therefore, it happens quite often that when starting a new technological project, an enterprise must first create a new energy source in order to later optimise its energy economy or diversify its energy supply sources. In the technological projects of the fourth industrial revolution, the cheapest energy is considered to be the energy that the machine has not consumed and therefore has saved and can transfer to other devices. Companies can either adopt the strategy of making the investment on their own by investing in the energy management system (their own capital) and diversifying energy sources or use external companies that will design the technologies together with an energy saving service in the form of so-called "as a service" (Gendys, 2021).

Projects in Industry 4.0 are implemented under conditions of high uncertainty and volatility of the environment, which in turn enforces the use of agile methodologies at the stage of project management (Spalek, 2017). For example, the Scrum method is used in IT projects, which offers a general framework for proceeding with a set of desired behaviours. The pillars of Scrum are (Arczewski, Salwin, 2021, pp. 369-377, Wybraniak-Kujawa, Salwin, 2021, pp.423-430):

- transparency: all stakeholders in the project should receive understandable information and interpret it in the same way using the same standards and codes,
- inspection based on verification (audit) of the current level of progress of the project,
- adaptation by continuous improvement of the project to the current situation.

Besides the pillars, the basic determinants of Scrum are (Schwaber, Sutherland, 2017):

- the list of tasks,
- the list of operations,
- the analysis of results and increments.

The key Scrum characteristics are: mutual respect, openness to any challenges in the project, commitment to the goal, focus and courage to overcome difficulties (Asproni, 2006). In turn, Scrum events are: sprint, sprint planning, daily sprint, sprint review and sprint retrospective. More on Scrum in the document "The Scrum Guide". For illustrative purposes, the authors present an example of project activities: Development of an equipment health check system.

Table 1.

Project scope: development of a condition monitoring system

Sprint No.	Scope of activities	Results
1.	Determination of the scope and type of sensors to monitor the operating status of the machine "A"	Installation of temperature, pressure and level sensors on machine "A" and other machine parameters
2.	Generation of data from the operation of machine "A"	Transmission of data on the status of machine "A" to the decision-making system of the prevention centre
3.	Transformation/processing of data from monitoring the operation of the "A" machine	Applied visual system of data (tables, graphs, etc.) on the operation of the machine "A"
4.	System for preventive maintenance of the "A" machine (adaptation of the system to the needs of end users)	Condition monitoring of the "A" machine by systems with extensive analysis options and software for evaluating machine efficiency
5.	Accessing the operations of machine "A" and testing the control system called: Successful predictive maintenance of machine "A"	Active prediction system of the machine "A" with dynamically changing data presentation and analysis modules

Source: own elaboration based on: Wybraniak-Kujawa, and Salwin, 2021, pp. 423- 430.

Many manufacturing changes start with pilot projects, where data analysis is prepared and trends are simulated in order to assess the final effect. From the project to the undertaking, the time extends significantly due to the complexity of the Industry 4.0 concept. Apart from the already mentioned necessity to integrate IT systems, Industry 4.0 projects require considerable automation of activities, or even full automation. Industry 4.0 technologies, together with integrated IT systems and full automation, give only an insight into cycle time and the entire process. Determining the number of devices and places where they will be installed also requires the creation of visualisation systems, in which various disturbances must be taken into account, e.g. disturbances of learning algorithms in the work of mobile robots carrying out the process. The implementation of Industry 4.0 projects takes place in small steps, from individual workstations to entire production lines, up to factories and supply chains.

In Industry 4.0, project management methods are changing, from classic (cascade) ones, there is an increasing shift to variable methods, using the latest ICT developments and digital networking of industry (Marouska, Novotnego, 2016, pp. 80-85; Spalek, 2017). In the initial period of adaptation of project management methodologies, hybrid solutions are emerging, characterised on the one hand by the rigid framework imposed by traditional project management methods, and on the other hand by the integration of agile methodologies into the overall project management process. This approach is currently used with great success by companies located in Germany (Spalek, 2017 based on Komus et al., 2015).

At the stage of project development, the method (matrix) Smart Manufacturing Kaizen Level (SMKL) in the corporation Mitsubishi Electric. To develop a project, the current place (state diagnosis) is marked, as well as the place to which the company is aiming. According to the four levels of maturity, the company checks whether it collects data, if not then it begins this stage, if so, the data collected from the machine must be visualised and the results from this particular machine must be provided to managers and/or designers for analysis, who make the decision. Once you have optimised one station, you can move on to the next, until you reach the entire production line (visit the Mitsubishi Electric website, and see the ARC 2020 document, p. 5, IAF document, 2020, 4/1, p. 6). Of course, in accordance with project management, at each stage of the project implementation it is necessary to provide adequate resources and analyse the return on investment. In this article, the authors do not undertake a discussion of financial issues, but only draw attention to the availability of the so-called financial navigator of investment projects, as a tool to facilitate the financial analysis of the digital transformation of the enterprise. Smart Manufacturing projects are created in accordance with Japanese concept of Kaizen applied in Lean Manufacturing. Kaizen consists of continuous operational improvement in small steps. In the conditions of the Fourth Industrial Revolution, the level of Kaizen refers to the level of influence or effectiveness on the enterprise of the modern technologies and projects of digitisation of the enterprise. The concept of Industry 4.0 is very useful for achieving significant process efficiency. Bottom-up projects with low costs help many companies to implement smart technologies. By developing projects, the company establishes a starting point and outlines the direction of the projects (enterprise) to achieve Smart Manufacturing. Getting to Smart Manufacturing requires the development and implementation of many projects. Companies start their journey to the smart manufacturing from simple projects with low costs to increasingly complex ventures and investments (Gajdzik et al., 2021). In enterprises with the Smart Manufacturing direction, many different projects are realized. The number of projects is increasing as the availability of Industry 4.0 technologies increase. Each activity within the individual pillars of Industry 4.0 can be a separate project built from multiple activities, e.g. installing sensors on machines, developing AI algorithms for operating objects, designing a visualisation system for a machine control station.

At the stage of project development and implementation, companies very often use the services of specialised external IT companies. In Industry 4.0 projects implemented in specific enterprises, the importance of internal IT and R&D departments, which participate in the development and implementation of projects, is also growing. In the new technological solutions of Industry 4.0, moreover, the cooperation of humans and robots in the Systems of Human Cyber-Physical Systems (H CPS) is realized (Romero et al., 2015).

The members of the project teams are strongly differentiated and selected in terms of having the necessary competences for each stages of project management. The teams are open, i.e. they are constantly being expanded with additional individuals or companies, contractors or stakeholders. The members of the project teams include numerous computer scientists and programmers, as well as technologists, mechanics, material scientists, power engineers, laboratory workers, electro-mechanics, electronics engineers, planners, economists, etc. Each project team must be characterised by a high degree of flexibility in the actions taken, due to the fact that the project developed and implemented should be fully system-integrated and the technological solutions used should identify, react and adapt to changes (Cerezo-Narváez et al., 2017; Gajdzik, 2021). The project team members and their managers need to use new digital technologies and physical systems to communicate (Cakmakci, 2019). The three knowledge domains, i.e. technical knowledge, engineering knowledge and IT knowledge, must strongly complement each other in Industry 4.0 projects (Figure 3).

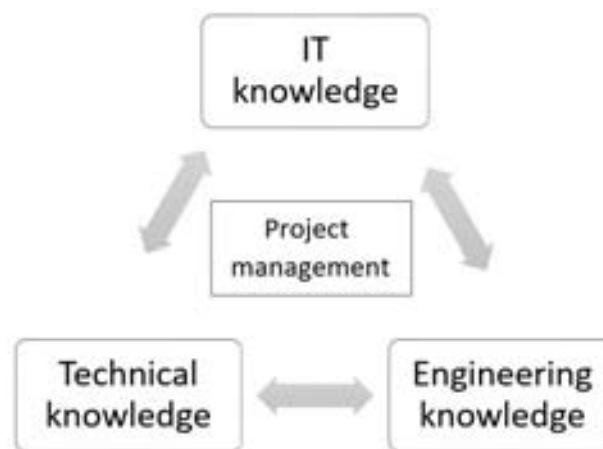


Figure 3. The knowledge triad in the project management. Source: own elaboration.

In Industry 4.0 there is not one but several project controllers due to the complexity of the implemented technological solutions according to tasks of projects. The decision-making centre is at the strategic level of enterprises. In large projects managers control and make decisions centrally. In many smaller projects decisions are decentralised (Hofmann, Rüsçh, 2017). The specifics of decentralised and centralised management are shown in Table 2. In addition, the authors introduced a hybrid approach consisted from decentralized and centralized management of projects. Organization of projects should be task or matrix. Such forms are used when new and complex technologies are implemented in enterprises (Brandenburg, p. 63).

These forms are characterised by high flexibility and extended scope of supervision (double supervision principle). In these forms both project managers and engineering and IT staff are heavily involved in project tasks. Both the project manager and the engineering or IT manager have supervisory and coordinating roles. However, one of the key differences between them is their responsibilities, which means that they differ in terms of the scope and span of project management. A project manager oversees the progress of a specific company project. A project can be very short or long term, lasting several months or even years. The scale of the project can be small or large, but once the project is completed the project manager moves on to the next project. An engineering manager is usually an engineer who supervises a group of other engineers, acting as the head of a team, department or programme. The engineering manager is responsible for employees (process works). The manager has the authority to coordinate directly with the projects' human resources department. An engineering manager may also oversee research and development or a specific project, but unlike a project manager, their position is permanent. While the project manager may come from a non-technical background the engineering manager must be an engineer and have technical knowledge and IT (industrial computing) expertise (White et al., 2019). Engineers and IT specialists are heavily involved in the development of projects at the operational level of the company, first on specific jobs and over time in the development of production lines and building smarter manufacturing with CPS.

Table 2.
Types of project management in Industry 4.0

Centralised	Decentralised	Hybrid
Projects are strongly embedded at the strategic level of the company	Projects are strongly embedded at the operational level of the company	Project framework developed at central level (top management) but problem solving carried out at functional groups (processes level)
Aims and topics of projects are fixed by the top management	Problems are identified by operational services and employees during process improvement	Aims and topics of projects are fixed by the top management based on the synthesis and final drafting of the operational services (engineering teams)
Projects are coordinated by a project centre team located at the top level of management	Projects are coordinated by process managers according to organization of management systems	Projects are coordinated by a team comprising a representative of the management and the bottom-up auditors and machine operators or process managers
Top management is strongly committed to the projects	Overseeing the implementation of projects by the top management as agreeing to projects and providing resources	Projects are embedded in strategic management in the strategic business units
Projects are strongly linked to the corporate strategy	Strategic business units organise their sub-projects according to the corporate strategy	Main assumptions of project result from the strategic objectives (corporate strategy) but the objectives and tasks are strongly connected with the specificity of the unit implementing the project (it fits into the framework of the strategic, main project)
Key (strategic) version of the realized project is proposed by top management	Strategic business units carry out internal projects	Strong project diversification, projects strongly adapted to the needs and capacities of each operational level

Adapted from: "Zarządzanie projektami" by H. Brandenburg. 1999 by Publisher: Politechnika Śląska, Gliwice p. 46.

4. Summary

The considerations undertaken on the basis of the literature review were the introduction to the broad topic of project management in Industry 4.0. In the Fourth Industrial Revolution, the development of project management in companies is more focused on the flexibility of activities and the continuous improvement of processes. Expected results of the project management are the cyber-physical production systems in companies. New conditions are changing the current methods and organization of project management. There are changes in the structures and ways of working of project teams, and consist in a constant adaptation of projects to changes occurring in the turbulent digital environment of Industry 4.0. Project management has a fundamental impact on the development of Industry 4.0. There is a research gap about the project management in Industry 4.0. Many success factors affect the success of projects. Research about the impact of Industry 4.0 technologies on project management is a new research area that will be developed in the near future.

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PSYCHOLOGICAL SAFETY OF EMPLOYEES (NECESSITY OR OPTION)

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Purpose: This article describes these kinds of working conditions which has become known as psychological safety.

Design/methodology/approach: The article describes the workforce development from farm forced-labor to the first Industrial Revolution factory workers and finally to the knowledge-based company personnel. As the work was becoming more complicated and technologically advanced, the methods of incentives to increase the productivity of the workforce needed to be revised. To solve the complex problems of the world, one person or either one discipline is not sufficient. It is required that people work together, communicate with each other and exchange knowledge.

Findings: This paper is focusing on building psychological safety as an organizational culture. Psychological safety is also being incorporated into education as a method conducive towards learning and the exchange of knowledge. Post-secondary graduates already trained in a psychologically safe environment are a great asset to their future employers. Most proactive knowledge-based companies, especially in Industry 4.0, already have psychologically safe environments or are in the process of creating them.

Research limitations/implications: As a direct consequence of the research topic, theoretical activities will be carried out in the next publication. The direct consequence of such activities will be theoretical activities aiming, in the next publication, at building a model and empirical research aiming at verifying the theoretical layer of the described problematic. The issues of security and its threats constitute a constant element present in the actions of individuals and social groups interpreted in a historical perspective. Nowadays, these issues have been treated as important and in need of ordering in accordance with the requirements of science. In accordance with the requirements of science.

Practical implications: This article is an introduction to further research in the field of safety psychology and may serve as an inspiration for other researchers or companies in improving work safety procedures, employee training, awareness of safe work, etc.

Social implications: The topic of the psychology of occupational safety is part of society's concerns about the health of people working in industry.

Originality/value: In the next industrial revolution- Industry 4.0, the topic of safety psychology is a new area of research because factories are building smart environments.

Keywords: safety, psychological safety, industrial revolution.

Category of the paper: Conceptual paper with case study.

1. Introduction

Development of society changes the requirements of the workforce. During the agricultural era, forced labor or slavery were the general adopted model. The productivity of the workforce working under those conditions was achieved by applying physical force. This productivity depends on innovativeness, creativity and psychologic approach to human resources (Grebski and Grebski, 2021; Wolniak and Grebski, 2018). Individuals working too slow were physically abused by the supervisor. Corporal punishment was an accepted norm for supervision. The Industrial Revolution and the need for labor in the manufacturing sector changed that model. Forced labor or slavery did not apply well in the manufacturing settings. The workforce had to be motivated differently to be effective and productive. In the United States this created a conflict between the industrial North and the agricultural South. The northern states wanted to abolish slavery to gain factory workers. Southern states wanted to maintain slavery as the least expensive alternative to produce cotton and other agricultural labor-intensive crops. This conflict led to the Civil War and the abolition of slavery. Forced labor and slavery was replaced by work in manufacturing factories. The workers were being paid for their work. The workers were being intimidated and threatened to be fired for not delivering the expected productivity and quantity. Since there were no or limited social programs, work was essential for their physical survival. People were theoretically free, but practically they had to work long hours at manufacturing companies. Extremely unacceptable practices were replaced by practices which were not much better. Some social programs were developed over time. However, the management techniques did not change. Assembly lines introduced by Henry Ford to produce automobiles was the beginning of the *golden age* of the manufacturing industry. Fear and intimidation were commonly used as proven management methods to increase the speed and accuracy of production workers. The fear and intimidation methods were effective in reducing assembly line production time of one automobile from twelve hours to three hours. The conditions within the manufacturing industry kept changing. Industry is more and more complex and driven by knowledge. The methodology, however, did not follow the changes in industry. Human factors are always the most difficult ones and the last ones to change. Until today the “command and control hierarchy” methodology is often being used. This approach combined with setting undeliverable goals leads to economic failure. Fearful employees to maintain their positions create false images and an illusion of success. The individuals in charge are being kept with the false illusion of success. Everybody except the captain knows that the boat is on a collision course with an iceberg. There are many examples the “command and control” method of management can have catastrophic consequences. Many employees see the problem, but the lack of psychological safety prevents them from voicing their opinion. The biggest fear of the great and effective leaders of modern corporations is compromising psychological safety within the corporation. Compromising psychological safety always leads to misinformation, illusion of success, false sense of security and eventual failure.

2. Psychological Safety in short literature review

The analysis of psychological determinants of an individual's actions is an important challenge in the broadly understood problem area of social sciences. Psychological safety in coronations is nowadays a rapidly developing stream in the group of social sciences which also includes psychology.

The scope of researchers' research in the topic of safety psychology and organisational culture is very extensive. Since Kahn's (1990) and Edmondson's (1999) initial work on psychological safety at the individual and team levels of analysis, empirical research on its antecedents, outcomes, and moderators has proliferated (Baer & Frese, 2003; Kark & Carmeli, 2009). Autors (Newman et al., 2017) performed a literature review of the scopes of study by individual and team. First, examining individuals' perceptions of psychological safety in dyadic relationships, studies by Tynan (2005) and Detert and Burris (2007). Reserachers constructed their own measures of supervisor or have used adapted versions of Edmondson's (1999). Researchers' examples: Carmeli (2007), Carmeli et al. (2009a-c, 2010), Hetzner et al. (2011). Later researchers were based on the publications and measurements of their predecessors, e.g. Singh et al. (2013) adopted a measure from Chrobot-Mason and Aramovich (2004), De Clercq and Rius (2007) used a measure from Brown and Leigh (1996). There were also hybrid, combined studies, based on individual measurements and ready-made ones. The same situation also occurred in the category: Team-level measures. Many authors of papers have cited Edmondson's publications (1999, 2001-2014). The scopes of research are very broad and include: leadership, mediator, organisational practices, relationship networks, communication, knowledge, etc. (Newman, 2017).

Researchers realise that model building is a complex task that requires multi-track efforts. They aim to take into account all possible conditions and factors affecting the performance of the individual and the team in difficult situations, which, depending on personality, behavioural and temperamental variables, may perceive and interpret these conditions differently.

Research in the field of occupational safety psychology, or rather its results, is a component of building (improving) the culture of an organisation. The concept of workplace culture is also understood broadly, and one of its components is the mental pillar (including psychological and ethical elements such as higher values, moral principles, awareness, subject identity, wisdom and knowledge, and social norms) (Cieślarczyk, 2010).

Every individual has his or her own value system. The analysis of values understood as a continuum making motivational sense in triggering the individual's actions under given conditions can also be a separate research topic (Czajkowski, 2014, 2017).

Each person may perceive the threat of the workplace and the environment differently (Holyst, 1991). It is possible to identify situations in which someone experiences an extremely strong sense of threat in a situation in which others do not. The indicated difficulties of interpretation and definition related to the notion of threat and sense of threat suggest the need to take into account many points of view when organizing the issue of psychological safety.

The concepts of security and threat are the ends of a continuum, between which a wide range of different situations can be identified. Each of these situations can be described from the perspective of fulfilment of criteria relating to the state of security and the state of threat. At the same time, in each of them many levels of functioning of an entity can be distinguished, on which it is possible to analyse and interpret the fulfilment of security and threat criteria. It is also clear that in a given moment of an entity's activity it can experience both a state of security and a state of threat. It is therefore possible to draw a conclusion about the complexity of the situation concerning the subject's sense of security and sense of threat, which have the character of subjective states intensively experienced by the subject (Czajkowski, 2017, p. 145).

Research confirms that knowledge of readiness of an individual to respond in a specific way to relevant objects, which can be both objects (things, people, etc.), as well as and ideas, is one of the most important factors making it possible to predict human behavior (Ajzen, 2001; Fishbein & Ajzen, 1997).

Therefore, it is worthwhile to study the psychology of safety in order to build up knowledge about people's attitudes.

3. Psychological Safety Within Corporations

Psychological safety is a culture within a company to comfortably discuss issues, directions and potential problem. Psychological safety allows to recognize a potential problem early and prevent a catastrophic failure. Company failures never occur overnight. The problems leading to failures are visible to many very early. Senior management, however, is not aware of them because there is discomfort and risk in communicating the problems. Often it is easier and safer for the employee to cover-up the problem and make up false evidence of success (Giolito et al., 2017; Lynch et al., 2016; Schuetz 2016).

The business plan cannot become a rigid policy enforced from the top down. Business plans need to be viewed as a hypothesis and need to be constantly verified. Very often the frontline workers of the company are in a better position to see the weaknesses of the business plan and they need to be able to communicate these weaknesses to the top management of the company. This is the only way to avoid very painful and costly mistakes. The lack of psychological safety creates a situation where people remain silent. Many tragedies could be avoided if people were not afraid to speak up and share their concerns. The fastest growing companies in the United

States have one common value. This is psychological safety. In many companies everybody is required to have an idea journal to write down their opinions, suggestions and/or perspectives which can be shared with colleagues and management. No criticism is to be taken personally. The ideas are being criticized and evaluated, but the employees are not (Chapman and Sisodia, 2015; Minor and Rivkin, 2016). The discussions and debates within companies are being done for the purpose of exploring lateral solutions to a problem. There are no winners and losers in the debate. (Losing the debate is a more valuable experience than winning the debate.) Management of the company, however, makes the final decision. Many companies are taking transparency to the extreme. Most of the meeting in those companies especially those at the higher managerial level are being videotaped and available to any employee to view at any time. To ensure full transparency employee evaluations related to work performance are always available to the employee who is being evaluated (Cable, 2018; Hirak et al., 2012).

Leaders who are demonstrating vulnerability and often say, "I don't know." are successful in engaging the hearts and minds of the employees. Understanding and supporting a company's purpose combined with caring leadership motivates employees to go the extra mile contributing to the company's success. In companies with psychological safety, the role of managers and employees are reframed as follows (Brown and Leigh, 1996; Edmondson, Amy, 1999):

Table 1.

Traditional and reframed roles of managers and employees

	Traditional Role	Reframed Role
Managers	Has answers. Gives orders. Assesses performance.	Sets the direction. Invites input to clarify and improve directions. Creates conditions for the employees to be successful.
Employees	Employees are doing what they are asked to do.	Provide feedback with first-hand knowledge.

1. Security: We need predictability, consistency, certainability. Lack of these signs of security is being viewed by the brain as a threat to our safety and releases unconscious defense mechanisms. Psychological threats are being treated on the same level as physical threats.
2. Autonomy: Having choices increases safety. Lack of control is viewed by the brain as a threat to our safety.
3. Fairness: Fairness is rewarding to the brain. Lack of fairness is viewed as a threat to our safety.
4. Esteem: Feeling that we are regarded highly is rewarding to the brain. Lack of regard by others is viewed as a threat to our safety.
5. Trust: Lack of trust is viewed as a threat to our safety.

4. Individual Psychological Safety

Even while working in a psychologically safe environment, *our old brain* is periodically being triggered on an unconscious level sending us signals of potentially dangerous situations. This part of the brain is wired for safety. Those signals are strong even though they may be false alarms most of the time. It is necessary to be aware of those false alarms and manage the triggers. The technique for managing triggers is called T.R.A.I.N. (trigger, reflect, appraise, include, neutralize). A trigger occurs when the *old brain* senses a threat to our safety. Most of those threats are false alarms on the unconscious level. We need to dampen those false alarms by getting our PFC part of the brain to override the unconscious reactions. It takes practice to do that quickly enough to avoid offensive responses. The next step is to *reflect* on unconscious safety concerns and *appraise* our negative perspectives and consider positive perspectives. This is being followed by *include* another perspective into our safety zone and broaden our exposure to diverse ideas. The last stage is to *neutralize* the negative signal from the *old brain* and continue the dialogue at the PFC brain level.

5. Team Psychological Safety

The principles of building psychologically safe teams include the following (Kahn, 1990):

- Value and nurture psychological safety of yourself as well as the members of your team.
- Promote and practice transparency and openness.
- Feel safe to offer your opinion and take a risk.

Communication in the workplace must respect and comply with the psychological safety needs by addressing and avoiding potential triggers. In any tasks the communication must include:

- Clearly explain the purpose of every assignment to avoid rumors and speculations (Radecki, Dan and Leonie Hull, 2021)
- Clearly explain the structure and expectations.
- Provide employees with choices within the framework of the assignment.
- Reassure all the employees that nobody will be put in a risky situation.
- Create an atmosphere of inclusion (We are all in this together and everyone is welcome).
- Reassure equality and fairness.
- Demonstrate how individual safety will be protected.

Psychological safety can be achieved by building a psychologically safe culture. The relationship between management and employees needs to be built on partnership, mutual respect and collaboration. Discussions must be always a two-way discussion during a timeframe

convenient to both sides. The goal is to create an environment where everyone in the organization feels (De Smet et. al., 2021):

- Appreciated, valued and respected.
- Safe to be open and transparent.
- Safe to admit failures and weaknesses.
- Safe to speak out and take a risk.
- Obligated to protect everyone's safety needs on an ongoing basis.

There are training programs available and offered by human resource professionals. The training normally includes the theoretical background as well as team coaching sessions. Experts model psychologically safety behavior. These experts can be assigned to the company for a period of a few months to observe and provide feedback related to building a psychologically safe culture (Herway, Jake, 2017). Psychological safety coaches create some structure during the brainstorming session and also help to optimize the communication style. Psychological safety is often defined as good feelings of safety, freedom and confidence without anxiety and fear. These feelings are described by Maslow's hierarchy of needs to be on the top of the pyramid. Psychological safety can be viewed as either an individual approach or group approach. Edmondson (1999) introduced psychological safety from the team perspective to be applicable to the organizational setting. All employees need to work together as a team within the organization. For this to happen there is a need for support from management to create an atmosphere of self-expression and clearly define everybody's role within the organization. Research indicates that the level of psychological safety directly affects the employees' motivation, attitudes and performance. At the present time there are at least four scales to assess psychological safety (Edmondson, 2019). Cronbach alpha coefficient for those scales varies from :73-.94.

6. Factors Influencing and Influenced by Psychological Safety

The factors influencing and influenced by psychological safety can be divided into the following (Edmondson, and Per Hugander, 2021):

- Individual factors (Based on individual characteristics).
- Interpersonal factors (The relationship between the employees affects psychological safety).
- Leadership factors (Leadership plays the most important role in promoting psychological safety).
- Organizational factors (Changes within the organization creates uncertainty and lowers psychological safety).

- Knowledge sharing factors (These factors have a very positive influence on psychological safety and vice versa).
- Innovation factors (These factors have a very positive influence on psychological safety and vice versa).
- Employee engagement factors (Those factors are affected by psychological safety).
- Job performance factors (Psychological safety improves job performance) (Li et al., 2017; Chen et al., 2015; Li and Yan, 2009).

Research has shown that psychological safety is positively affecting the desired outcomes of an individual, team and organizational levels.

7. Conclusions

Research has shown that psychological safety is beneficial to the company as well as their employees. Most proactive modern companies either have already implemented or are in the process of implementing psychological safety. Research also has shown that psychological safety is conducive to innovation, creativity and knowledge-sharing. Psychological safety in the workforce is beneficial and without question. The implementation, however, requires the development of a new culture within a company which is a time-consuming process. Presently psychological safety is also being implemented in higher education. Engineering and business graduates will soon understand what it means to be in a psychologically safe environment. These graduates will be able to lead their future place of employment toward psychological safety. Further research will be conducted among university students to find out their knowledge on building a safe work environment, at the level of the impact of the knowledge obtained at university on building safe work awareness. The pilot study will look at the components of safe work awareness.

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INSTRUMENTS USED TO IMPROVE THE BETTERMENT OF PRODUCTS QUALITY

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Purpose: The main goal of the research was to determine the spectrum of instruments supporting management processes that are used to improve the quality of products in terms of sustainable development. We analyzed the degree of their use in the practical functioning of the surveyed enterprises. In addition, the aim of the research was to determine the scope of application of the indicated instruments or the possibility of their use in the decision-making process relating to the improvement of the broadly understood quality of products.

Design/methodology/approach: The research method applied are: 1) standardized survey research making based on a survey conducted in contact and remote way conducted in 78 enterprises in south-eastern Poland; 2) analysis of the source documentation and in-depth interviews. It is a component of broader research.

Findings: The following methods were used in decision-making processes with varying frequency: the Delphi method by 58% of respondents, Tree of Failure Analysis (by 52%), Event Tree Analysis (by 44%), and the QFD method (by 41% respondents). The surveyed companies that have implemented a vapour management system based on ISO standards tend to use 5 methods out of 25 cited in this study (these are a survey, brainstorming, 5Why and/or 5W2H, benchmarking, and the Delphi method). As a result of using mainly the above-mentioned methods in decision-making processes, 74% (out of all) of the respondents indicated an increase in the quality level of products, and 39% of respondents indicated the enhancement of the pro-ecological impact of products on the natural environment.

Research limitations/implications: Most of the analysed enterprises from SMEs are tried integrating qualitative-environmental actions as part of improving the quality of products. This approach is crucial when improving the quality of products in SMEs.

Practical implications: It is necessary to develop a multidimensional model enabling the optimization of decision-making processes with the possibility of making full use of the available instruments for improving the quality of the product in such a way as to meet the rapidly changing requirements of stakeholders.

Originality/value: The article has cognitive value for development of knowledge, science, quality, and environmental in the area of management of products.

Keywords: quality management, sustainable decision support, production engineering, quality of products, mechanical engineering.

Category of the paper: Research paper.

1. Introduction

The beginning of the 20s of the 21st century is characterized by an extraordinary, fast and difficult to define pace of changes. (Migala-Warchoł, 2021). Additional challenges were reinforced by the consequences of the Covid-19 epidemic and the Russia-Ukraine war. The effects of these events are visible in the social, political, and economic life of all countries, in particular, Poland (Piecuch, Chudy-Laskowska, Szczygieł, 2019). Therefore, optimal (usually understood as rational) decision-making in the process of the so-called green management is gaining more and more importance. It should take into account the impact of sustainable development not only on the work of engineers in the design of products but also on their entire life cycle following the idea of "cradle to grave" (Wyrwa, Ziółkowski, 2015).

The topic is important at the micro, meso and macroeconomic level and is important not only at present, but also relates to the future of, for example, technical and engineering solutions. It is one of the global challenges (Deqiang Zhijun, Hajduk-Stelmachowicz, Larik, Rafique, 2021). There is a need for cooperation between theoreticians and practitioners representing a broad spectrum of scientific fields in order to develop implementable solutions that bring the widely understood synergy effect to production processes. Especially in view of the latest challenges adopted for implementation by the European Union under the so-called circular economy is an important and current topic (Ferreira Gregorio, Pié, Terceño, 2018). In this study, the authors attempted to indicate the instruments used to improve the quality of products in SMEs.

2. Decision-making process in enterprises

The primary condition for making a decision at each stage of business management should be a correct, detailed analysis of the problem with all its aspects (Gunther, 2008; Davenport, 2011). A significant role in the decision-making process is played by the proper boundary conditions defining. They should precisely define what procedures have to be followed and indicate the available and necessary means, resources, and implementation time of a given project (Drucker, 2005). In the conditions of the presence of many rapidly changing input data to the process (including numerous determinants of the external and internal environment), the decision-making process – especially un-programmed one – becomes a challenge for decision-makers.

The starting point of any decision-making process is the arises of a decision-making situation, which can be defined as a change in the state of affairs in the functioning of the enterprise as a whole or its subsystems. Regardless of the procedures that may be used when making decisions, one can indicate constant elements of the decision-making process (Brzeziński, 2007). Their diagram is shown in Figure 1.

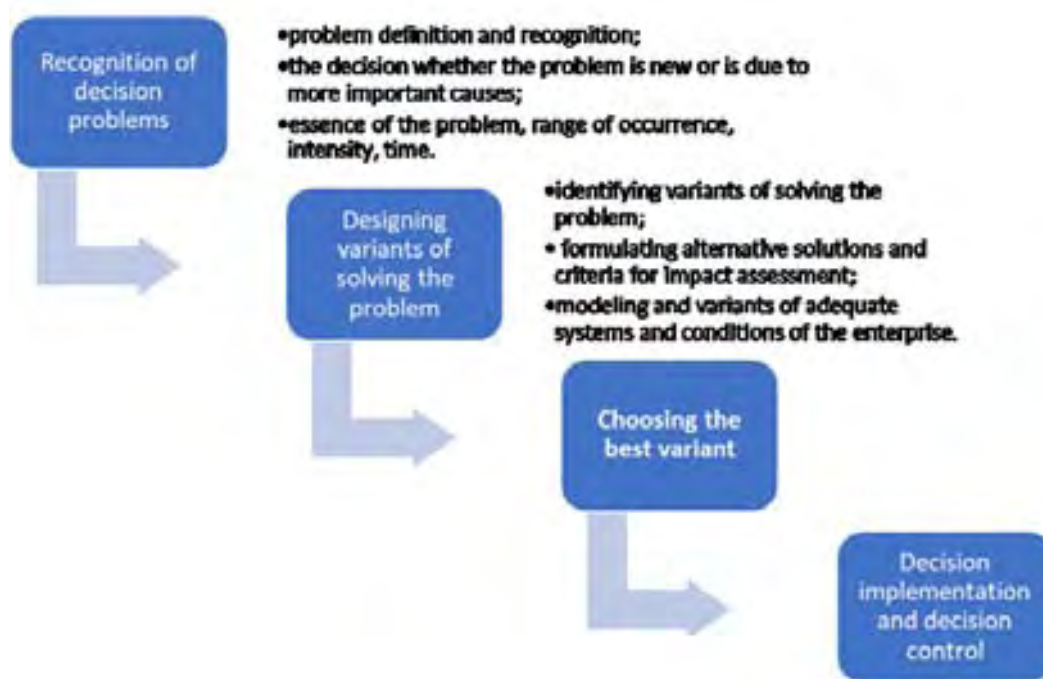


Figure 1. Elements of the decision-making process. Source: own study based on: Griffin, 1996; Stoner, Wankel, 1996; Brzeziński, 2007.

In scientific studies relating to the subject of management, the need to understand complex and multidimensional mechanisms related to the process of making right decisions is emphasized. The decision-making process is influenced by a large number of factors. They include, among others cognitive abilities, personality type, emotional state, views, attitudes, context (circumstances), presence of people (influence of other people) or lack thereof

(Okrah, Hajduk-Stelmachowicz, 2020). The literature on the subject emphasizes that the key in the 21st century is the increase in the ability of managers to make quick and accurate decisions, react to changes and create them. This pursuit of a better quality of its products leads to changes, referring to improving production processes, implementing innovation, and changes in organized character (Jonek-Kowalska, Wolniak, 2022).

Summing up, managers making the right decisions regarding the improvement of product quality should be based on several aspects, which include, among others, such (rational and irrational) components, such as e.g.:

1. Intuition – especially important when information, knowledge, experience, and methods used so far are not sufficient in the face of the need to solve problems in the conditions of cognitive difficulties, the so-called indeterminate/fuzzy decision situations (Jankowska-Mihułowicz, 2008; Adamkiewicz-Drwiłło, Jankowska-Mihułowicz, 2008).
2. Emotions – the importance of positive and negative emotions/emotional processes in the process of making managerial decisions (in conditions of uncertainty) is very significant in relation to the problematic content, e.g. posing a threat. In management sciences, emotions are treated as an irrational element, which means that they are considered potential risk factors (Jankowska-Mihułowicz, Chudy-Laskowska, 2019).
3. The use of appropriately selected instruments, including multi-criteria decision-making methods that are used in various areas of management (Czerwińska, Belch, Hajduk-Stelmachowicz, Siwiec, Pacana, 2021, Siwiec, Pacana, 2021).
4. Analysis of reports and information from, among others, from the accounting system, Business Intelligence systems, ERP class systems, own programs of enterprises, external and internal audits, integrated management systems).
5. Measurement of the company's achievements, including key success indicators.
6. Controlling analyses covering the area of production logistics (Belch, Belch, 2020; 2021).

The main components of multi-criteria decision-making tasks include (Mechitov, Moshkovich, Klimberg, 2022):

- alternatives (alternative decisions, options),
- criteria (attributes, characteristics),
- specific requirements for the final decision,
- a decision maker,
- experts,
- consultants (analysts),
- active social groups.

It is necessary to be aware that the so-called managerial decision-making is not only an intellectual attribute of managers of the strategic management level. It is also a manifestation of the charisma (knowledge and mindfulness) of lower-level leaders. In addition, it is an expression of readiness for continuous learning, high resistance to stress, high level of so-called ambiguity tolerance. It is a measure of proficiency in making correct multi-faceted decisions in various situations, and therefore also in specific conditions, in conditions leading to the need to manage change (this manifests itself in the form of, among others, information gaps, information obsolescence, or information chaos).

3. Research methodology

The survey questions were developed on the basis of the literature review on the subject, e.g. (Ejdys, Kobylańska, Lulewicz-Sas, 2012; Ostasz, Siwiec, Pacana, 2022; Pacana, Siwiec, 2021; Siwiec, Pacana, 2021; Pacana, 2015; Świrk, 2020).

The survey questionnaires were sent to production companies from the Podkarpackie voivodship. Moreover, where possible, direct interviews were conducted (the so-called in-depth interviews with persons responsible for decision-making processes related to the improvement of the quality of products). The data collection stage was carried out in the first quarter of 2022. Ultimately, correctly completed questionnaires were obtained from 78 companies. The group was selected in a non-random, intentional manner, which is both an advantage and a disadvantage of this study. The methodology used resulted from the adopted goal of the work.

The researched companies were characterized on the basis of the following criteria:

- the size of the enterprise measured by the number of employees,
- company headquarters location,
- the degree of internationalization of economic activity,
- the implemented quality management system according to the international standard ISO 9001:2015,
- the implemented environmental management system based on the guidelines of ISO 14001:2015.

Taking into account the criterion of the size of the studied entities, it should be noted that the majority (58% and 18%, respectively) of the participants of the conducted research are medium and small enterprises. This fact results from non-random, deliberate sample selection. The structure of the respondents taking into account their size is presented in Table 1.

Table 1.*The structure of the surveyed enterprises in terms of size*

The size of the enterprise	Number of enterprises	Percentage of enterprise
Large enterprises (over 250 employees)	12	15
Medium-sized enterprises (51-250 employees)	45	58
Small enterprises (10-50 employees)	14	18
Micro enterprises (1-9 employees)	7	9

Source: own study based on the results of research in enterprises. N = 78.

Another criterion for the selection of the research sample was the seat of the enterprise. In this case, the vast majority were entities located in urban areas. The distribution of research participants by the seat is presented in Table 2.

Table 2.*The structure of the surveyed enterprises according to the seat of the enterprise*

The size of the enterprise	Number of enterprises	Percentage of enterprise
Rural area	24	31
Urban area	54	69

Source: own study based on the results of research in enterprises.

As part of the research, participants were also divided according to the scope of their activities. Thus, four categories of entities were distinguished: national, international, local, and regional enterprises. The distribution of the surveyed enterprises according to the scope of their activity is presented in Table 3.

Table 3.*The structure of the surveyed enterprises in terms of the range of economic activity*

The size of the enterprise	Number of enterprises	Percentage of enterprise
Local	1	1
Regional	5	6
National	15	19
International	57	73

Source: own study based on the results of research in enterprises.

In addition, it was analysed whether the respondents had a quality management system compliant with the ISO 9001: 2015 standard and an environmental management system based on the requirements of the international standard 14001: 2015. The importance of these standards is emphasized in the context of a systemic and eco-innovative approach to management in the conditions of hyper-competition. The test results are presented in Table 4.

Table 4.*Quality management system implemented*

Management system implemented	ISO 9001:2015		ISO 14001:2015	
	Number of enterprises	% of enterprises	Number of enterprises	% of enterprises
yes	53	68	27	34
no	19	24	45	58
in the course of implementation	6	8	6	8

Source: own study based on the results of research in enterprises. N = 78.

Most of the research participants were SMEs operating in international (73%) and domestic (19%) markets. Enterprises regionally operating constituted 6% of the respondents, and entities operating only in local markets constituted 1%. This research aimed to answer the question about what instruments are used by the surveyed entities in the decision-making process regarding the improvement of the broadly understood quality of products. Obtaining an answer to such a research question made it possible to determine to what extent and to what extent the methods/tools that support and optimize decision-making processes described in the literature are used. It is an extremely important topic in the context of the functioning of entities in a condition of an unstable environment.

4. Results

In management and quality sciences and in economic practice, terms such as: methods, instruments, concepts, techniques, approaches or management tools are often treated as synonyms. Similarly, the lack of a universal approach to instruments supporting decision-making, can be indicated. In foreign literature, both terms are included in the category of management tools (DiLeo, 2019; Helmold, 2021; Velikikh, 2021; Bernardo, Rampasso, Quelhas, Leal, Filho, Anholon, 2022; Ostapenko, Kubetska, Olha, Antipova, 2020; Günter 2022; Dückers, Wagner, Groenewegen, 2008; Helmold, 2021). For the purposes of the article, according to the dictionary of the Polish language, the term "instrument" or "method" means a means to achieve something (PWN Dictionary of the Polish Language).

The degree of use/suitability of individual instruments recommended for improving the quality of products was determined, maintaining the 5-point Likert scale (Figure 2).

In the decision-making practice of production companies, the method of brainstorming was used very often. Only 5% (and rarely 3%) of the respondents have never used this method. The respondents declared that a survey and/or questionnaire form and/or an interview were often used. This method was never used by 12% (and rarely 9%) of the respondents. However, sometimes benchmarking and 5Why and/or 5W2H were used. The first of these instruments was never used by 27% of respondents (12% declared occasional use). Often, very often, or always, the benchmarking method was used by more than half (54%) of the respondents. The 5 Why method and/or the 5W2H method was/were never used or used occasionally by 36% and 6% of respondents, respectively. Often, very often, or always in the process of improving the quality of products, this instrument was used by 42% of the respondents.

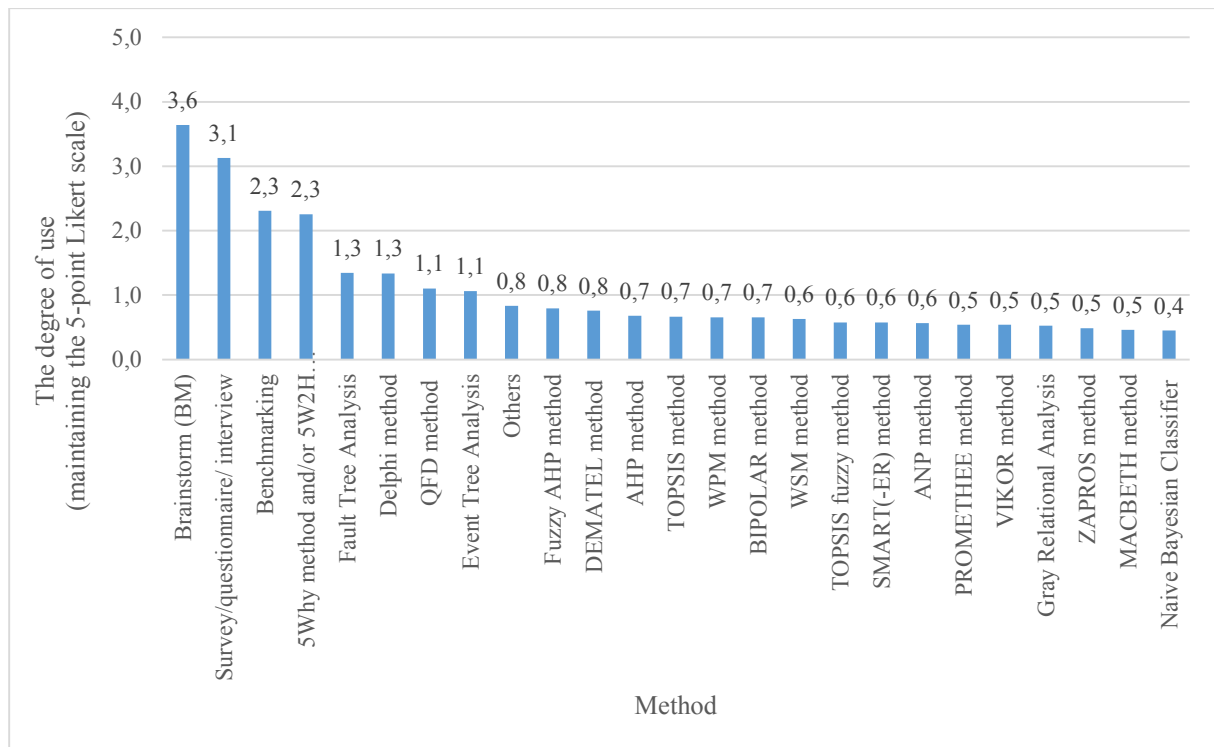
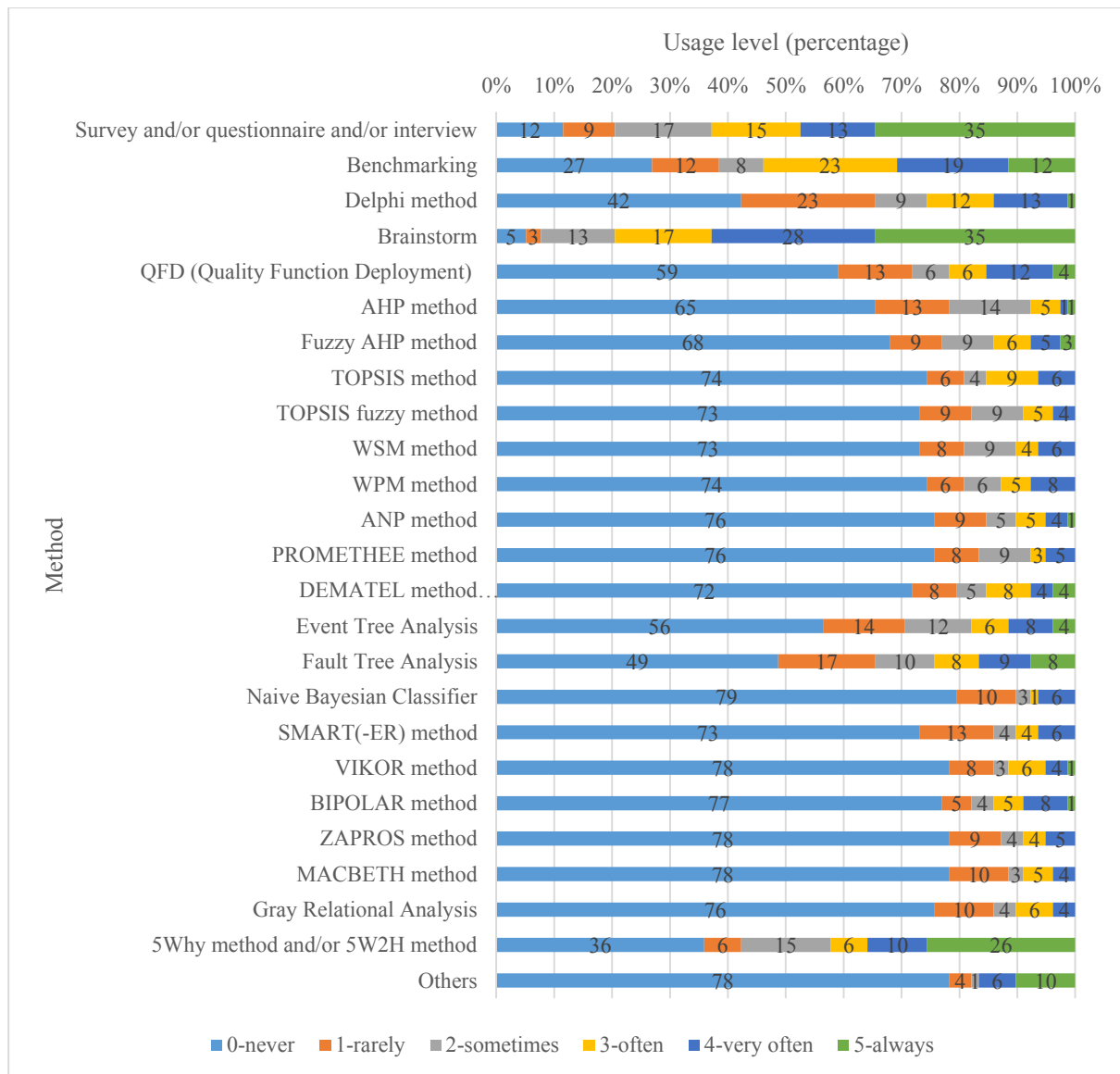


Figure 2. The degree of use of quality improvement methods recommended in the literature by the surveyed enterprises. Source: own study based on the results of research in enterprises. N = 78.

The remaining instruments indicated in the research were rarely used (values from 0.8 to 0.5 in the diagram). The least frequently used method was the Naive Bayes Classifier (NKB). Nearly 80% of respondents have never used instruments such as the ZAPROS method, the MACBETH method, the VIKOR method, the BIPOLAR method, the GRA method (Grey Relational Analysis), the PROMETHEE method, and the ANP method (Analytical Network Process) in decision-making processes related to the improvement of product quality. About 70% of the respondents have never used: the TOPSIS method (Preference ordering by similarity to ideal solution and fuzzy TOPIS method), SMART(ER) method, WSM method (weighted sum model), WPM method (weighted product model), DEMATEL method (Laboratory of trial and evaluation of decision making), fuzzy AHP method. The low degree of use of the methods proposed in the literature may result, among others, from the lack of knowledge about their existence and/or the deficit of various types of possibilities of their use in a given industry, in various decision-making areas, or the lack of knowledge/skills in the correct methodology of their application in practice. Further research in this area seems interesting.

The respondents were asked to indicate instruments used in decision-making processes in order to improve the quality of products and to determine the frequency of their use in decision-making processes (Figure 3).



Legend: More than one answer was possible.

Figure 3. Instruments used to improve the quality of products. Source: own study based on the results of research in enterprises. N = 78.

The following methods were used with varying frequency in decision-making processes: Delphi method by 58% of respondents, Tree of Failure Analysis (FTA) by 52% of respondents, Event Tree Analysis (ETA) by 44% of respondents, and the QFD method (House of Quality) by 41% respondents.

The surveyed companies that have implemented a management system based on ISO standards tend to use about 5 methods out of 25 cited in this study (these are the survey, brainstorming, 5Why and/or 5W2H method, benchmarking, and the Delphi method).

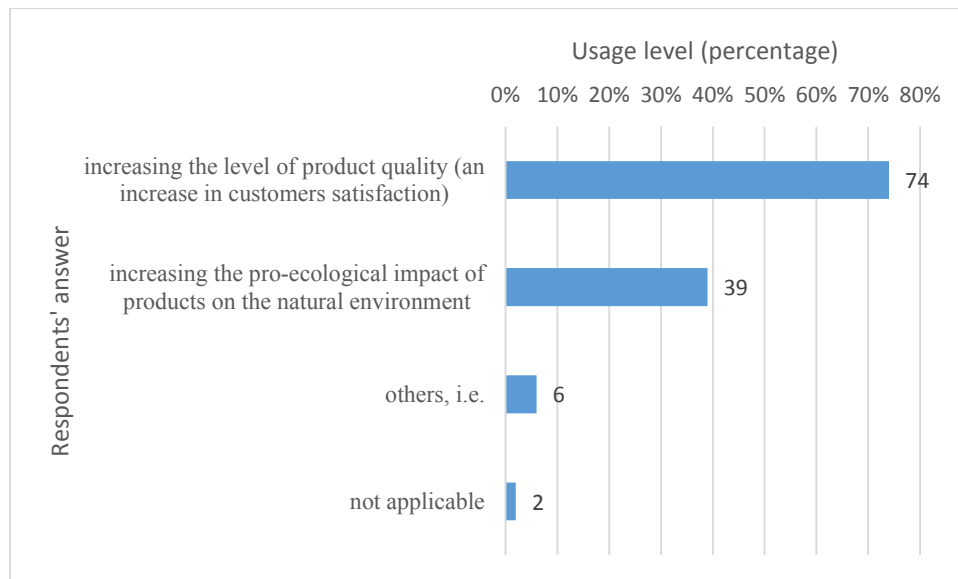
Both among companies that have implemented ISO 9001 and those that are at the stage of implementing a quality management system, there is a clear focus on the use of methods such as surveys, benchmarking, 5Why and/or the 5W2H method. The results of this research show that the implementation/functioning of an environmental management system, similarly to ISO 9001, may contribute to increasing the awareness of the existence of other quality improvement methods. As part of the continuous improvement of management systems, the best available practices are often disseminated, for example (within the supply chain).

Among the companies that do not have ISO 14001 implemented, 18% of the respondents never use the questionnaire to improve the quality of their products. 59% of companies that have implemented an environmental management system declare that they always use this type of tool. Looking at the indications of companies that declared that they have a functioning quality management system based on the ISO 9001 standard, it should be noted that 51% of the surveyed companies often or always use questionnaire forms.

The implementation of formalized management systems (both based on the requirements of ISO 14001 and 9001 standard) has a positive effect on the use of heuristic methods, e.g. 5Why or brainstorming. The functioning international management standards have a positive effect not only on increasing the awareness of the existence, but also on the practical use of such a tool as benchmarking (more on Szydoło, Kołodziejczuk, 2016).

The literature on the subject highlights the growing importance of creating and using various models of quality management instruments in the production processes of each modern enterprise (Fraś, Fraś, Fraś, 2017). It is necessary, in order to generate competitive, and at the same time innovative (also in the field of pro-ecological management) solutions, that meet the complex and multidimensional requirements of a wide range of stakeholders and, in particular, meet the expectations of each client. The literature on the subject emphasizes that the deliberate use of instruments used to improve the quality of products in terms of quality and environment, in the long period, may contribute to the improvement of the competitive position of the enterprise (Mentel, Hajduk-Stelmachowicz, 2021). It is possible thanks to the increase in the quality of products (as, inter alia, the effect of improving decision-making processes at the tactical, operational, and strategic levels). It allows for effective largo-type product quality management (not only in the entire technological chain of the production process but also in logistics (Bełch, Bełch, 2021). In addition, it allows you to reduce the number of internal shortages, and thus reduce complaints, also affecting the growth of customer orders.

The conducted questionnaire research makes it possible to indicate the application or the possibility of using decision support instruments in the product improvement process. The results are shown in Figure 4.



Legend: More than one answer was possible.

Figure 4. The use or possible use of decision support instruments in the process of improving the quality of products in the opinion of respondents. Source: own study based on the results of research in enterprises. N = 78.

74% of the respondents emphasized the increase in the level of product quality as a result of using the methods indicated by the respondents. On the other hand, increasing the pro-ecological impact of products on the natural environment, far fewer respondents, i.e. 39%. Analysing the literature on the subject, it can be concluded that there is a broader spectrum of possibilities of using the instruments proposed in the studies (both theoretical and practical). It is a key finding in the context of the implementation of the assumptions of sustainable development, circular economy, corporate social responsibility, systemic management (quality and pro-ecological), ethics in business, and finally the increase in satisfaction of various groups of internal and external stakeholders (constantly modifying their needs in a turbulent environment). The conclusions from the in-depth interviews clearly show that, especially in the SME sector, there is a need to increase the knowledge about the essence and actual possibilities of using the recommended instruments in a modern, multi-faceted and multi-dimensional decision-making model, in order to generate a triad of economic, environmental and social benefits not only in the short term but also in the long-term perspective. All methods and instruments should be used with the entire product life cycle in mind, and this is crucial in improving the entire decision-making process at each decision-making level.

5. Summary

The elaboration has a cognitive value for the development of science in the face of the challenges of the circular economy. The article allows indicating the level of knowledge and use of management instruments that can support managers in the optimized decision-making desired from the sustainable development perspective. It contributes to the understanding of the essence of a systemic, integrated, and multi-faceted approach to decision-making processes related to quality and environmental management in the area of products management.

Sustainable development is part of the new management concept, which also includes an approach to product quality management in a broader sense than before (Hajduk-Stelmachowicz, 2014; Pacana, Siwiec, Bednárová, 2020; Siwiec, Pacana, 2021). In light of the challenges of the next industrial revolution (Industry 4.0), SMEs face many challenges. Among them are those concerning making optimal decisions, both qualitative and environmental. As part of the identification of the determinants of decision-making regarding product improvement, a questionnaire survey was carried out among 78 companies. Where possible, in-depth interviews were also used. It was found that the use of various decision support instruments is aimed at increasing the level of product quality in the surveyed entities, as well as increasing the pro-ecological impact of products on the natural environment. The level of use of the available instruments is low. It may result from the lack of knowledge about them, and a deficit of knowledge about the possibilities and scope of their comprehensive use in the practice of the functioning of economic entities.

The awareness of the existence, the ability to use, and the use in production companies (selected depending on the changing needs of customers) of various instruments supporting comprehensive decision-making allow to increase the level of product quality and strengthen the pro-ecological impact of products on the natural environment.

Increasing the knowledge of the subject of consideration by managers will affect the development of their competencies, reducing the level of risk associated with making a wrong decision as a result of, for example, an information gap. It will contribute to the optimization of processes related to making multi-faceted decisions (including both quality and pro-ecological criteria) taking into account the growing and changing customer requirements. Further research is necessary to enable the application of a comprehensive and systemic qualitative and environmental approach to improving the quality of products in SMEs.

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INNOVATION AND SUSTAINABILITY AS A CRUCIAL TREND IN ENERGY SECTOR PROJECT MANAGEMENT – LITERATURE REVIEW

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Purpose: Project management is a universally recognized methodology for business and project activities. Organisations are increasingly using project activities to achieve strategic benefits. It is purposed to optimize the time, human and financial resources, without deviating from the planned quality of the final product of the project and while maintaining the principles of sustainability. The energy sector is no exception. The purpose of this paper is to determine trends in energy sector project management.

Design/methodology/approach: To present the research concerning project management in energy sector innovations the literature review process was carried out. The analysis of keywords, abstract, and on this basis further deeper analysis of scientific texts allowed to identify trends in project management in the energy sector. There is a research gap in research summarizing trends in the description of the issue of project management in the energy sector.

Findings: The literature analysis presented indicates that the interest of scientists is largely directed towards sustainable projects in the energy sector. This has to do with global trends not only in the energy sector but in every sector of the economy. Energy project management should continue to focus on becoming more sustainable, especially when more and more organizations are aware that their strategy should include ecological sustainability, such as eco-innovation and environmental innovation.

Originality/value: It is one of the few scientific texts that touches on the problem of project management in the energy sector. In terms of implications, studies have shown that particular emphasis should be placed on the aspects of project teams creating sustainable innovations for the sector, as well as neutralizing the carbon footprint of the project teams themselves.

Keywords: project management, energy sector, sustainability, review.

Category of the paper: Literature review.

1. Introduction

Nowadays we, as humanity, have to face crises in climate, food, biodiversity, and energy which are critical to deal with not only on a local but also on a global scale (Leach et al., 2012). Therefore, one of the key challenges of the modern global economy is to reduce environmental pollution and save limited natural resources (Wolniak et al., 2020). The use of renewable energy is seen as a major strategy to reduce greenhouse gas emissions, fossil fuel imports, and create a sustainable energy system, which is bound to have a profound socioeconomic impact on society (Xue & Yue, 2020).

Today's companies and organizations, regardless of their size or their location, are under obligation to look for and implement sustainable innovations at, preferably, every step of providing their products or services (Kern et al., 2019). It strongly applies to their carbon footprint and use of green energy. More and more organizations are aware that their strategy should include ecological sustainability, such as eco-innovation and environmental innovation (Carrillo-Hermosilla et al., 2010) or sustainable innovations defined as the process of developing new ideas, behaviour, products, and processes that contribute to a reduction in environmental burdens or to ecologically specified sustainability targets (Rennings, 2000). Noppers et al. (2014) convince that a key strategy is a transition to innovative products and services that use less energy or rely on renewable energy sources since reducing fossil energy use and the emission of greenhouse gases is one of the major (environmental) challenges.

It must be stressed, that today we can observe the increasing importance of project-based undertakings which stem from the fact that business activities are more complex and flexible (Jarosz et al., 2020; Jarosz & Zakrzewska, 2020). Kerzner (2017) define project as series of multifunctional activities with specific goals, defined start and end dates, limited budget, defined resources. According to the same author (Kerzner, 2017) "project management is the application of knowledge, skills, and tools necessary to achieve the project's requirements". This truth also applies when it comes to broadly understood energy area. Energy as economy sector can be defined as "a complex and inter-related network of companies, directly and indirectly, involved in the production and distribution of energy needed to power the economy and facilitate the means of production and transportation" (Chen, 2021). By using the phrase "energy project management" in the article, the authors mean project management in the energy sector.

Moreover, the changes which stand behind the fourth industrial revolution have increased the need for innovative, sustainable, and ecological solutions in energies area. Due to this fact project management in the energy area has attracted the interest of academia and practices all around the world but we still find the topic of its impact on project management in the energy sector is unexplored enough. Wu et al. (2012) propose the identification of energy projects in two ways:

1. According to the project-level in the organization:
 - a. dependent projects and emergency projects,
 - b. operational projects,
 - c. strategic projects.
2. According to the type of energy:
 - a. traditional energy projects,
 - b. new energy projects,
 - c. intermittent energy projects,
 - d. non-intermittent energy projects.

Especially since renewable energy projects have to face many challenges (Xue & Yue, 2020) and the problems associated with investments in alternative energy projects are not sufficiently developed (Rostova et al., 2019), this is the area that requires urgent attention from researchers and practitioners. Renewable energy projects are described by three characteristics (Chang, 2013):

- the cost disadvantage of renewable energy makes it highly dependent on government subsidies to compete with traditional energy,
- one of the greatest appeals of renewable energy is its ability to tap into free natural resources as fuel, such as solar and wind power,
- the technological know-how needed to produce renewable energy is often controlled by a small group of vendors.

Project management has a fundamental influence on the implementation of projects in enterprises (Vrchota et al., 2021), including for instance sustainability principles, Industry 4.0, or energy projects. When it comes to energy projects, they are often using large land areas and may change landscape and fauna along with it (Rolstadås & Johansen, 2021). Because of its impact, energy project management should focus on becoming more sustainable, since projects are about value. The value is defined as not only successfully delivering a complex project in terms of time, cost, and quality, but also as a value that connects projects with a long-term effect on society and organizations (Rolstadås & Johansen, 2021). Sustainability requires ecological or environmental sustainability matters to be addressed, but also requires economic (e.g., competition, costs, and construction time), social (e.g., health and safety, local community needs), and technical sustainability (Kiani Mavi et al., 2021). Taking all this into consideration it is claimed that distinguishing three traditional dimensions of project efficiency—time, budget, and scope - is very important aspect especially in energy sector (Shenhar et al., 1997). The project scope has the largest role, because it also has an impact on customer satisfaction, which more and more often rely on project sustainability.

The main goal of this article is to present the results of literature review according to the recent phenomena and scientific trends of project management in energy sector. In the light of the literature review, there is a research gap in research summarizing trends in the description of the issue of project management in the energy sector. Accordingly, this article is compiled

to fill this gap. The novelty of this study is manifested in the fact that the article can provide guidance to the project management in energy sector. The paper is organized as follows. In the next section, we present the steps of the methodology of the literature review. Then, it presents a descriptive analysis that covers identified trends in papers that have been studied. After that, the conclusions are presented that stemmed from the study and discussion, which contains recommendations for further studies in this field.

2. Methodology

Concerning the current research on project management in the energy sector, a systematic review of the literature, especially bibliometrics, was carried out. Literature review was used because it allows to analyse the current effects of scientific work related to the discussed problem and indicate the main areas of interest of researchers around the world. This method has been used for a long time in business and management studies (Smith, 1977) and it can help evaluate research characteristics, status, trends, and hotspots (Xie et al., 2018).

The first step was to launch a query in chosen database. When it comes to search strategy, the selection of databases is critical. There are claims that for the biomedical field (Bramer et al., 2017) and also for management studies (Kosch & Szarucki, 2020) it is well known that one database is not enough to perform a comprehensive study. Due to this fact, a search was conducted within two databases: Scopus and Web of Science.

The following queries were run on 12 April 2021 and rerun on 24 April 2021:

- WoS: TOPIC: ("project management") Refined by: WEB OF SCIENCE CATEGORIES: (ENERGY FUELS) Timespan: 2010-2021. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.
- Scopus: TITLE-ABS-KEY ("project management") AND (LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010) AND LIMIT-TO (SUBJAREA, "ENER")).

The search in the WoS database yielded 160 results, in Scopus resulted in 2,085 results. Figure 1 shows the publication of articles each year for Scopus and WoS databases.

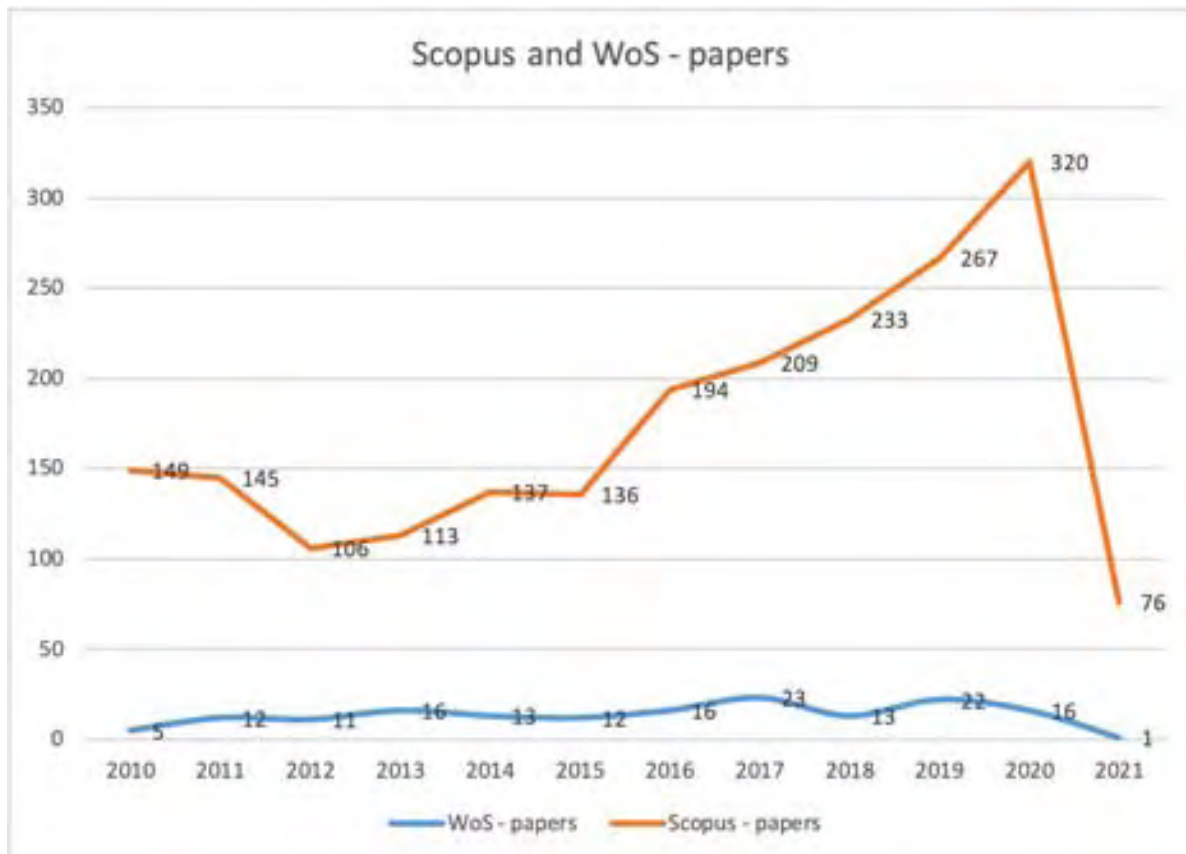


Figure 1. Publication of articles in each year for Scopus and WoS databases. Source: own study.

3. Results

This resulted in creating a database of scientific articles, among others, amounting to 2139 publications. A quantitative analysis of the keywords was then carried out, a summary for all years 2021-2010. Quantitative keyword analysis consisted in counting all keywords that were used in the researched scientific research. For obvious reasons, keywords were excluded from the analysis such as project management, management, energy. Figure 2 shows the most common keywords occurring in texts more than 10 times.



Figure 2. The most common keywords in years 2021-2010. Source: own study.

As we can see, the most common topic keyword concerns Sustainability and it occurred 97 times. Next in terms of occurrence were, among others: sustainable development 49 times, Construction 44, Risk management 40, Renewable energy 23, Energy efficiency 19, BIM 19, Construction industry 17, Risk assessment 15 times.

The final step was to search and select articles from created database to further qualitative, literature analysis. These articles were very thoroughly verified based on abstracts. Issues related to the most common topic emerging from the analysis of keywords and abstracts such as *Sustainability*, *sustainable development*, *Construction*, *Risk management*, *Renewable energy*, *Energy efficiency*, *BIM*, *Knowledge management*, *Innovation*, *Critical success factors*, the text was selected for further, profound analysis.

Sustainability. Integrating sustainability aspects into project management can help an organisation choose the best plan and meet the requirements of its business strategy and stakeholders (Sanchez, 2015). Furthermore, it may allow an organisation to fulfil its goal while making a massive contribution to the environmental and social dimensions (Chen et al., 2019). Sustainable project is seen as a “total design”, able to find moments of compatibility with other structural dimensions of the environment (Consuelo, 2020).

Thus, organisations transition towards more sustainable products, services, assets, business practices, and methods (Van Tulder et al., 2013), the project management process is also involved (Armenia et al., 2019). Sustainable project management is emerging as a new paradigm in project management (Armenia et al., 2019; Silvius, 2017). Project managers may be seen as organisational change agents. They are also increasingly recognised as playing

a critical position when it comes to the change towards further sustainable business methods (Marcelino-Sádaba et al., 2015). The crucial role of the project manager in this process (Maltzman et al., 2014) is recognised in recent industry standards for project management, which equal sustainability to a view to be considered when managing and controlling projects (Silvius, 2017). Nevertheless, there are claims that project management and sustainability are not natural friends (Silvius et al., 2012), so it should be still examined the difference between theory about sustainability in project management and what is done in the practical project management life (Marnewick et al., 2012; Økland, 2015).

Sustainable development. Sustainable development takes many forms, referred to as the Brundtland Report (WCED, 1987), it is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

For sustainable development, scholars often assume that economic development should lead to higher social coherence (which includes decreasing social stratification, equal opportunities, and combating marginalisation and discrimination) and enhance the overall quality of the environment by limiting the adverse effects of production and consumption on the state of the environment and the protection of natural resources (Kuraszko, 2017).

It should be also noted that sustainable development relates to the social and economic development of a company that enables it to implement its strategy and operational activities and achieve its objectives while not compromising future implementation (Witek-Crabb, 2005). Therefore, a company's development must be conducted in a way that does not compromise its future development potential, including based on creating a competitive advantage.

Construction. It is estimated that the construction ecosystem contributes 13% of the global gross domestic product (Ribeirinho et al., 2020; Bamgbade et al., 2017). Simultaneously, the construction sector is responsible for 36% of global energy consumption and 39% of energy-related carbon dioxide (CO₂) emissions (UNEP and IEA, 2017). Not surprisingly, sustainability in the construction industry is at the top of the plans of government, experts, and the scientific community (Mavi et al., 2021). The emergence of this trend in the description of project management in the energy sector is further evidence that project management today's reality revolves around sustainability and reducing environmental impact.

Consideration of sustainable construction often focuses only on environmental or ecological sustainability issues. Nevertheless, it should be broadened also on economic (e.g., competition, cost, construction time) and social (e.g., health and safety, local community needs) (Hill, Bowen, 1997). It is believed that trust, open communication, and a common vision are vital for successful contractor-owner relationships (Suprpto et al., 2015).

Yang et al. (2019) indicate that construction and infrastructure can be described as especially high-risk industries. In reply to the increased project risk and complexity, as well as timetable and budget limitations, there are many calling for a shift in the way contracts are managed in construction (Chan et al., 2011). Worldwide, there has been a growing interest in cooperative business arrangements and cooperative forms of contracting in infrastructure and

construction projects. These patterns are frequently referred to as alliances or partnerships (Larsson and Larsson, 2020). This tendency is particularly effective during the age of new public management (Klakegg et al., 2021), where governments and private actors are anticipated to be working together in ever more sophisticated, or complicated contractual arrangements (Hodge and Greve, 2010; Baxter, Casady, 2020).

Risk management. Energy retrofitting of residential properties has been recognised as an essential measure to save energy, reduce emissions, and improve people's quality of life. To ensure efficient risk management, it is essential to understand the major risks throughout the entire process of upgrading projects and their stakeholders (Jia et al., 2021). Risk management is regarded as an important area of project management (PM). Rodriguez-Rivero et al. (2019) highlighted the integration of risk management as the most highly regarded improvement of the log frame approach. Hekala (2020) likewise noted that the risks associated with IDPs have their influence and pointed out that even though these risks are unavoidable, they might be better controlled through improved project planning and the development of project managers' abilities. A successful project can be interpreted in two respects: project management success and project impact success. Following two versions of success may also be independent of each other. (Klakegg et al., 2021) Usually, project management literature associates successful project management with effectiveness particularly in terms of the recognised golden triangle (scope, cost, and time) and efficacy is based upon customer satisfaction (Berssaneti, 2015).

Renewable energy. Global energy demand has doubled over the past 50 years and is anticipated to increase by a further 45% by 2030 (US DOE, 2009). The major energy supply to satisfy this demand is fossil fuels (Edenhofe et al., 2011). Given the significance of diverting the world's energy supply farther from fossil fuels, various renewable energy sources are being used to fulfil people's energy needs and it is safe to say that the effort will be made to get rid of fossil fuel.

Fossil fuel subsidies persist and have been identified as public enemy number one during the transition to renewables and have proven themselves difficult to eliminate (Casey, 2013). When a subsidy has been put in place, financial investments and commercial interests are more likely to sustain its continuation (Victor, 2009). This interaction is extremely efficient and runs counter to the 2009 commitment by G20 leaders to reduce subsidies (REN21, 2013). Victor (2009) analysed fossil fuel subsidies in developed and developing countries and found deep-seated interdependencies between social and political dimensions that hinder the removal of subsidies.

The environmental impact of lock-in on the diffusion of renewable electricity is well known. Still, there is a lack of knowledge about the strategies required to prevail over the complex economic, political, regulatory, and social factors responsible for its persistence. Systems analysis and social science studies are important elements to fill this knowledge gap (Gottschamer, Zhang, 2016).

Energy efficiency. The energy efficiency market concept as a foundation for energy efficiency policy design provides a clearer awareness of the general environment in which the policy will be applied. Established upon the market assessment, decision-makers are facing the challenge of developing a policy instrument that addresses the identified barriers to energy efficiency. Under the market assessment, it is necessary to define the framework for the shape of policy instruments and policies.

Energy efficiency is acknowledged as a major strategy to address three energy-related challenges: energy security, economic development, and climate change at the lowest possible cost to society (Bukarica, Tomsic, 2017). Nevertheless, notwithstanding this official acknowledgment, it is still the very least understood and the most overlooked feature of global energy policy.

BIM. Building information modelling (BIM) enables simulation and analysing performance, mathematical optimisation, and automation processes as well as in the initial design phase and throughout the project. In a virtual environment, all stakeholders will be able to participate to test real-world conditions before implementation and enhance the total success of the project (Sanhudo, Martins, 2018). This allows for greater transparency in the management of all stakeholders' interests (Paiva et al., 2017). Using automation, procedures are simplified, and data errors, conflicts, and loss are minimised. (Höft et al., 2021) A standardised design method allows objective quality control and offers architects or engineers additional time for creative advances (Khairulzaman, Usman, 2018). BIM may be used to improve decisions on materials, components, and design and compare them towards each other in terms of potential energy savings or cost impact before construction begins (Starynina, Ustinovichius, 2020).

Knowledge management. The practical context for the implementation of knowledge management is provided by making sure that the post-project phases are carried out properly and effectively, including the system for analysis and the collection of a bunch of suggestions for improvement for the next project management.

Nevertheless, practitioners are under obligation to bear in mind that knowledge management is not just about ensuring its evaluation, accumulation, and subsequent use, but also organising and requiring continuous training for those proposing sustainability projects and managing their implementation. Simply put, the assessment of the causes of problems with sharing the experience should be advised and the identified causes should be targeted (Doskočil & Lacko, 2018). One of the main reasons for success in project management, mainly in the energy sector, is to make use of the experience of project management practitioners.

Innovation. The existing research on sustainability transitions argues that further technological and social innovations are required to address growing challenges including resource shortages and climate change (e.g., Hoogma et al., 2002; Geels et al., 2008). Although incremental innovations are typically backed by settled socio-technical systems, mostly disruptive innovations are developing in niches (Schot and Geels, 2008).

Even though systems innovations (Martiskainen & Kivimaa, 2018) potentially face more general barriers to innovation due to their disruptive nature, systems innovations can require extra support compared to modular innovations from intermediary actors to join diverse innovations and actors, especially in the diffusion phase (Van Hal, 2000).

Innovation intermediaries are key actors in innovation processes (Howells, 2006). The term intermediary is defined differently in various research methodologies (Kivimaa et al., 2018), but we see intermediaries as actors who create spaces and opportunities for others (Stewart and Hyysalo, 2008) and mediate, working in the middle, making connections, enabling a connection between different people or things (Hodson et al., 2013). Intermediaries, whether individuals, organisations, or platforms, are greater than knowledge brokers (Geels and Deuten, 2006) or networks (Hamann and April, 2013). They may enable innovation processes by training, pooling, and allocating both financial and manpower resources, assessing new technologies/practices, forming alliances, and influencing rules and regulations (Stewart and Hyysalo, 2008; Kivimaa, 2014). Alternatively, they might shape (e.g., configure) how innovation appears as it comes at the user, and establish linkages and negotiate (e.g., mediate) for the benefit of other actors (Stewart and Hyysalo, 2008).

It must be stressed that the energy sector, given its key role in the fight against climate change, global warming, and emission reductions, is forced to constantly seek innovation – especially when it comes to innovation related to low- or non-carbon energy sources.

Critical success factors. Business activities are more complex and flexible due to technological progress which is base for Industry 4.0 (Jarosz et al., 2020; Jarosz & Zakrzewska, 2020). The single most significant factor for the sustainability of Industry 4.0 projects is funding, which determines whether projects can be implemented. The sustainability gains of Industry 4.0 were found in projects that implement new energy sources. The research found out that enterprises see the gains of Industry 4.0 particularly in projects that implement new energy sources (Vrchota et al., 2021).

Back in the 1980s, Peters and Waterman (Peters, Waterman, 1982) examined management using the Critical Success Factors model. Alias, Zawawi, Yusof, and Aris (Alias et al., 2014) classified these factors into project management activities, project processes, people factors, project factors, and outer environmental variables. Several studies have focused on identifying critical success factors in project management in scientific writings (Walker, Vines, 2000). The phrase "project success" is specified as a concept that includes budget, time, and quality (Bryde, 2011; Fortune et al., 2011; Turner, 2009). Standards for assessing the project success differ according to the size, uniqueness, and complexity of the project (El-Saboni et al., 2009; Mueller, Jugdev, 2012; Mueller, Turner, 2007; San Cristobal et al., 2018) Nevertheless, the long-term success of projects is associated with sustainability.

Silvius and Schipper (2014) conclude that sustainable project management is the transition of critical success factors from time, quality, and budget to long-term social, environmental, and economic priorities. Van der Brink (2009) refers to sustainable project management in a wider context as a shift in the timing of project stages to support future generations, and a shift in the scope of project components to the well-being of the overall society.

There is a shortage of research on how the critical success factors of Industry 4.0 influence project sustainability. Research on the integration of Industry 4.0 technologies in project management has mainly concentrated on the skills and competences of human resources (Cerezo-Narváez et al., 2017; Bauer et al., 2019). Human resources play a key role in project management and therefore influence the success of projects.

Identifying the success and risk factors that an organization will face during the execution of projects have a significant impact on enhancing readiness to deal with risk factors and minimize the likelihood of project failure (Alavi & Mirmohammadsadeghi, 2021). Chan et al. (Chan et al., 2004) split the critical project success factors into five parts: human factors, project factors, project work processes, project implementation, and factors of the organisation's external environment. Following factors have become applicable in many scientific kinds of research over the past few years (White, Fortune, 2002). A further breakdown of these factors looks like the following: environmental factors affecting the project (Hyvaeri, 2006; Jha, Iyer, 2006), human resource factors (Tishler et al., 1996), procedures, methods, tools (Khang, Moe, 2008; Shenhar et al., 2002) and project contextual issues (Sausser et al., 2009).

4. Discussion

Project management in the energy sector must keep up with the trends that dominate the global energy sector. It must be emphasized that markets for new and renewable energy and electric vehicles grow rapidly, and the limitations of fossil fuels and energy problems continue to emerge, the importance of high-capacity energy storage technologies for efficient energy use and response to climate change is greatly emerging (Lee et al., 2020). The recognition of the human impact on the environment and particularly, the huge increase in CO₂ emissions and ozone layer depletion caused by the use of fossil-derived energy has made nation governments decide that something must be done to change behaviour and the current evolution trends (Caetano et al., 2017). Efforts are being made to develop new technologies, which, in turn, can reduce the impact on climate change, replace natural gas with renewable energy sources, enhance resource efficiency, bring a competitive advantage in the market, and improve living standards (Dobrovolskienė et al., 2021).

Schaeffer (2015) indicates that the global energy sector currently is in turmoil because of different and often conflicting drivers and reasons:

- growing energy demand from emerging economy countries,
- the global economic crises,
- climate change policies,
- peak oil phenomena,
- the sudden increase of shale oil and shale gas production in the United States,
- geopolitical tensions,
- the demise of nuclear energy,
- the plummeting costs of renewable energy technologies.

The “green” economy includes those activities that, in addition to modernizing and improving production efficiency, contribute to improving the quality of life and the living environment (Rostova et al., 2019). The result of these factors is a strong trend in the sector to become more sustainable. Sustainability should, as Danish and Senjyu (2020) claim, go beyond basic statistics and has to cover multi-dimensional aspects. These dimensions include energy production, distribution, delivery, and consumption and consider technological efficiencies; the pillars of sustainability are economic, social, institutional, technological, and environmental. The energy sector, in its crucial role in the effort to reduce the impact of climate change, global warming, and emission reductions, is under obligations to constantly look for innovations – especially when it comes to innovation related to low- and non-carbon energy sources.

Renewable and low-carbon energy technologies are considered as a major alternative route towards sustainability and—consequently—there are major political and industrial efforts to increase their share in the global energy consumption (Raven et al., 2009). A goal of many governments worldwide is to invest substantially in renewable energy to reach the reducing fossil-fuel energy goals committed in the Paris Agreement. While power generation has always been an asset-heavy industry, capital intensity is even higher for most renewable energy sources as compared to fossil fuel-based plants (Schmidt, 2014; Steffen, 2017). Due to this fact, the authors anticipate intensification of the use of the project approach for investments and innovations related to the use of renewable energy sources. Moreover, current renewable energy projects, especially those dealing with the use or the storage of wind, solar, or water energy, are increasingly afflicted with the challenge of an alternating acceptance by the parties concerned (Hitzeroth, Megerle, 2013), which is also vital issue to deal with when it comes to stakeholders in renewable energy projects.

5. Conclusions

Project management as an internationally recognized methodology for business and project activities is purposed to optimize the time, human and financial resources, without deviating from the planned quality of the final product of the project (Oskolkova, 2020). Organisations are increasingly using project activities to achieve strategic benefits (Cabała et al., 2020). Project management can be viewed as a proper answer to challenges of today for instance by using project management in order to obtain innovative solutions in organization. There are claims that project management, in the understanding of processes taking place in energy enterprises, can tackle many key issues for the company (Kinelski, 2020). Moreover, managing innovation projects requires the implementation of certain standards of competence, which will guide project teams and enhance the effectiveness of achieving the objectives that, when creating innovation, have a very high intellectual and market value (Zakrzewska et al., 2020).

The studies presented in this article may be a guide to the direction in which projects in the energy sector are going. The literature analysis presented indicates that the interest of scientists is largely directed towards sustainable projects in the energy sector. This has to do with global trends not only in the energy sector but in every sector of the economy. Organizations have shown a great interest in incorporating sustainability into managerial concepts, both at the strategic and operational levels (Toljaga-Nikolić et al., 2020).

Taking into consideration that in this day and age consumers are more and more aware and demanding, and it is thanks to modern technologies such as blockchain, etc. can make use of these tools to control the sustainability of the products or services they purchase and to influence producers. People more often pay attention to their environmental impact and the consequences of their decisions, while paying attention to the origin and sustainability of the goods and services they acquire. Furthermore, when one of the key challenges of the modern global economy is to reduce environmental pollution and save limited natural resources (Wolniak et al., 2020), project management is forced to be greener and more sustainable by itself and also to seek sustainable innovations which contribute to increased use of renewable energy to reduce greenhouse gas emissions, fossil fuel imports and create a sustainable energy system. Unfortunately, the authors' own observations show that attempts to maintain the principles of sustainable development are very cost-intensive, especially for the lower social classes.

It is one of the few scientific texts regarding the problem of project management in the energy sector. This work has both practical, theoretical, and research implications. When it comes to the practical implication, project management practitioners in the energy sector have the opportunity to learn about trends in the use of project management methodology in the energy sector. Projects in this sector focus on innovation, in particular as regards innovations that can contribute to greater sustainability and reduction of harmful greenhouse gas emissions. However, a critical aspect is too much focus on the ecological pillar of

sustainable development and the neglect of social factors in energy projects. When it comes to the theoretical aspect, the article can be an example of bibliometric analysis, using both quantitative analysis of keywords and qualitative analysis of texts, to study trends in the description of project management issues.

The article also has research implications. It provides a possible path for further research into project management in the energy sector. The authors of this publication believe that further research into project management in the energy sector should move towards a uniform principle of sustainable project management specific to the energy sector. The future scope of work includes, inter alia, analysis of case studies and empirical research on the challenges and problems of managing energy projects. Particular emphasis should be placed on the aspects of project teams creating sustainable innovations for the sector, as well as decreasing the carbon footprint of the project teams themselves

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PROJECT MANAGER TYPE AND PROJECT SUCCESS

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Purpose: In the literature relatively little attention is paid to the project manager's background, i.e., to the importance of whether the project manager is a line manager, a line employee of the organisation in question who is no one's supervisor or whether the project manager is involved solely in project management. The purpose of this paper is to answer the question of how the type of project manager is related to project success.

Design/methodology/approach: The research hypothesis was formulated and the results of the empirical studies were presented. The empirical verification of the research hypothesis was accomplished through survey research in Europe and USA.

Findings: Based on the empirical data obtained, it was concluded that in terms of all three project parameters (scope, time and cost), the project manager, who is also a line manager, was the most successful. The empirical research indicated a possible relationship between project manager type and project success.

Research limitations/implications: In the analysis, it should be borne in mind that there are other several internal and external factors responsible for potential problems in meeting the project scope, schedule and budget.

Practical implications: Project management by line managers can be a sound basis for the interaction of processes and projects, manifesting itself, for example, in the transfer of knowledge between processes and projects during the activity of solving problems, especially those lying at the interface of one type of activity and another.

Originality/value: The results obtained should draw attention to the need to complement previous research characterising the ideal or effective project manager with a new variable, the type of project manager.

Keywords: project management, project team, organizational structure, power of project manager.

Category of the paper: research paper.

1. Introduction

In the literature, a great deal of attention has been paid to the person of the project manager. This is because the project manager is a key figure in the project management process as he/she is responsible for both the success and failure of the project. It is the project manager who, in order to be successful, must first and foremost select the appropriate members for the team and manage them effectively. As indicated in the literature (Spatek, 2004), significant success factors in project management include establishing a project manager and his/her high authority (93% and 85% impact on success, respectively). Thus, many studies focus on defining the requirements that characterise an ideal or effective project manager (e.g. Musioł-Urbańczyk, 2010; Marek-Kołodziej, Łapuńska, Jagoda-Sobalak, 2018; Wachowiak, Gregorczyk 2018). However, when there is a strong interest in the competences of project team leaders, relatively little attention is paid to the project manager's background, i.e., to the importance of whether the project manager is a line manager, a line employee of the organisation in question who is no one's supervisor or whether the project manager is involved solely in project management (i.e., he/she is not a line employee of the organisation or comes from outside the organisation). While in the first two cases, employees of a given organisation are project managers on an ad hoc basis (performing such a function only in the projects implemented in the organisation where they hold specific positions which differ in their names; a good case in point is a marketing specialist leading the design of a new advertising campaign), in the third case, the project manager is permanent. In other words, the project manager holds such a position in the organisation (e.g., IT project manager) or performs such a profession and works simultaneously even for several companies. Indeed, as Piwowar-Sulej (2013) notes, the criteria for selecting a project manager changed at different stages of project management. While, initially, it was his/her expertise that counted, later it was whether he/she belonged to the management team (e.g. he/she was a functional manager), today the project manager functions in the organisation as an integrator of resources, knowledge and processes on an equal footing with other line managers. As can be seen, in each of these cases, he/she will not only have different empowerment in the organisation and the associated authority but he/she will also be involved to a different degree in carrying out its recurring activities that are at odds with the unique nature of the projects. In this context, it is essential to ask whether the project manager's background is associated with project success. This question is vital because while, for example, a line manager's authority and experience should be conducive to, for instance, acquiring resources for a project, his/her activities as a project manager will require an entirely different mindset and behaviour from the one he/she is used to in his/her line position. Conversely, while a "permanent" (not *ad hoc*) project manager will focus exclusively on the work of the project team, he/she may often be forced, in the struggle for the necessary resources, to confront line managers concerned about the smooth functioning of their recurring organisational processes.

As can be seen, these different types of project managers may be an additional, hitherto under-researched, factor in project management success. Therefore, this research gap provides the rationale for undertaking the study that is the subject of this paper.

To sum up, in the context of the above discussion, the purpose of this paper is to answer the question of how the type of project manager is related to project success. The three above-mentioned cases are considered:

1. the project manager leads only the project team and is not a line employee of the organisation or comes from outside the organisation,
2. the project manager is also the line manager,
3. the project manager is a line employee without a management position.

Thus, in the first step, the research hypothesis will be formulated. Secondly, the results of the empirical studies will be presented and, finally, conclusions will be formulated.

2. Project manager type and project success – a research hypothesis

Project management is defined in Project Management Institute (2013) as a discipline concerned with the application of knowledge, skills, tools and techniques to meet project requirements, that is, the expectations and needs of project principals. It also lists the work that the project team does during the various phases of the project life cycle, i.e., during the phases of initiating, planning, executing, monitoring, controlling and closing the project. What is also pointed out is that the simultaneous management of the scope, time, cost, risk and quality of the project are interdependent factors, which means that a change in one of them conditions a change in the others. In addition, it is assumed that contact will be established with the stakeholders of the project, which will entail getting to know their expectations and needs connected with the project. This is combined with making an attempt to meet and satisfy each group as much as possible. Therefore, meeting and identifying project requirements are critical to the success of a project.

According to Trocki (2009), the nature of project management creates a new world of work. It implies several changes in organisations that are usually engaged in conducting recurring activities (Table 1). Since the circumstances of project management differ essentially from the circumstances of managing the day-to-day recurring operations of an institution, what changes is the tasks and requirements for employees, including, as might be assumed, the project manager, the relationships between superiors and subordinates, their roles, the ways they are evaluated and compensated as well as the mindsets that underlie all activities.

In the case of any type of project manager, his/her authority by law, and thus the ability to direct the work of the project team, will be determined both by the organisational by-laws and, in each case, by the sponsor of a particular project (cf., e.g. Nicholas, Steyn, 2012; Project

Management Institute, 2013; Prosci, 2018). The rights of the project manager may thus relate primarily to:

- having the project budget at his/her disposal, which means having the possibility to incur expenses during the project implementation within the budget and reserve (e.g. estimate reserve) allocated to the project,
- possessing a schedule reserve; it refers to the time of project implementation,
- having a budget reserve at his/her disposal, which means that the project manager does not have to request a budget change from the project sponsor when necessary,
- making budget updates and implementing corrective and/or remedial actions (once the sponsor determines the timeframe and financial threshold),
- having other resources at his/her disposal; apart from people, money and time available for the project, this includes tools, machines, facilities (after determining which resources are involved and agreeing on access to resources with their administrators),
- having the decision-making rights concerning scope management; the project manager can make scope changes to the extent explicitly determined by the sponsor,
- selecting the project team and genuinely having people at his/her disposal (e.g. in confrontation with line managers) within the established workload of the team members in the project.

Table 1.

Comparison of recurring activity management and project management

Management field	Recurring activity management	Project management
Tasks	recurring	non-recurring
Organisational structure	permanent	impermanent, time-limited
Execution time	short	long
Expenditures, costs	small, medium	large, very large
Funding	entity funding	subject funding
Risks	average	high
Expertise	average	high
Innovation	insignificant	significant
Changes	evolutionary	radical
Standardisation	high	low

Source: the author's study on the basis of (Trocki, 2009).

Thus, it can be assumed that any project manager who is entitled to make decisions regarding all of the above aspects will have much power and will be able to significantly influence the project team regardless of whether he/she is the first, second or third type of project manager.

Likewise, the authority of each type of project manager discussed above is also dependent on the support he/she obtains for the project. Involving key stakeholders in the project definition process and getting them to agree on all aspects of the project not only makes them feel co-responsible for the project but they also strengthen the project manager's position in the

organisation. Thus, he/she is not left alone – he/she can count on the support and real help, and his/her authority in the eyes of employees increases (Prosci, 2018).

However, the assumptions outlined above about how the project manager functions must be verified by the context created by the organisation where the project is implemented (e.g. Świętoniowska, 2015). Thus, in the case of the project manager who directs only the work of the project team and is not a line employee of the organisation or comes from outside the organisation, it should be noted that although he/she is responsible for the success of the project, he/she does not have direct authority over the resources (people, money, infrastructure) necessary for the proper performance of tasks. Thus, solving the slightest problem often requires the involvement of the sponsor. Whether the project manager has much or little authority is especially apparent when he/she shares responsibility for project team members with the line managers to whom they report on a daily basis. A line manager is usually closer to the employee than an “interim” project manager appointed to a single project. Good cooperation between the line and the project, and consequently the team’s involvement in the project, depends mainly on the project manager’s agreement with the line manager on the terms and conditions of his/her people’s participation in the project. If this understanding is lacking, problems will likely arise at every step due to people’s fears, frustrations and uncertainty about the future.

When indicating the project manager’s authority, we should also remember the frequent crossing and overlapping of hierarchical ties. As Lichtarski (2011) rightly writes, if, for example, the manager of a project team is an employee of a given department, and this team includes people occupying positions higher up in the hierarchy, perhaps of his/her direct supervisor, there is a situation of mutual linking of two units by hierarchical relations of the opposite direction (or turn). In this case, sustained hierarchical dependence will significantly weaken or nullify task dependence. Although the team leader is entitled to give instructions in the project area and enforce their implementation, he/she will not exercise this right because the team member reporting to him/her is also his/her superior in the home unit. Therefore, this points to the need to view the project manager’s authority in a broader context – beyond the project team. However, this does not change the original premise that the project manager with more authority also can effectively manage the project regardless of what type of manager he/she is. Conversely, the project manager who does not have this authority (e.g. even as a line manager) will not be able to influence the project team effectively and will struggle to achieve project goals. As might be assumed, privileged in this situation, however, will be the project manager who is also a line manager. This indicates that while the project manager who solely directs the work of the project team may be very well-equipped thematically to direct the project, these power issues within the organisation may make it very difficult for him/her to execute the project with the project team entrusted to him/her.

In the context of the above discussion, it is important to note the second type of project manager who is also a line manager. Combining recurring work with unique projects is not an isolated phenomenon. This may be due to the fact that, firstly, the growing importance of changes and projects in the organisation's activities – referred to as *projectification* – has also forced line managers to acquire project management skills (cf. e.g. Brzezińska (2016) or Christensen, Innstrand, Saksvik (2019)). Thus, project management is apparently no longer the domain of specialised project managers only. Secondly, projects can be characterised by different intensity of project features. If they are, for example, not very innovative, simple, their deadline is not tight and the level of technology is low, they can be managed using knowledge, skills and tools also used in the process-related part of the organisation performing recurring activities (Shenhar, Dvir, 2008). This will naturally privilege line managers. What can serve as an example here is the form of project organisation in a line structure appropriate for small projects with a scope that fits within a single organisational unit. The project team comprises the employees of only one organisational unit and the project manager is their existing supervisor (Trocki, 2009). Thirdly, a clear separation of the roles of project manager and line manager is more likely to be afforded by larger organisations. In small organisations, the roles of line manager and project manager often overlap. Fourthly, as Nowosielski (2018) rightly notes, the functioning of projects and processes side by side does not need to and may not be viewed in isolation. This means that project management by line managers can be a sound basis for the interaction of processes and projects, manifesting itself, for example, in the transfer of knowledge between processes and projects during the activity of solving problems, especially those lying at the interface of one type of activity and another. Finally, as the author of this paper's research has shown, the project team is also often characterised by a specific organisational subculture that is reinforcing in contrast to organisational culture (Kamiński, 2021). This means that the project team's norms and values differ from those adopted by the organisation; however, they do not challenge them. Thus, in a project team, the autonomy of employees is higher, the degree of formalisation of activities is lower, the superior's support of subordinates is stronger, people identify more strongly with the project team than with the organisation, the reward for achieved results is weaker than in the rest of the organisation, conflicts between employees or teams are more accepted and risk is more accepted. Functioning in such a subculture containing elements of organisational culture will, as might be suspected, be easier for someone who is familiar with both aspects of organisational functioning –the execution of both recurring processes and unique projects.

The arguments in favour of the special role of a line manager who also serves as a project manager are further strengthened by his/her stronger position in the organisation in relation to line managers, from whom he/she must obtain the resources necessary for project implementation. He/she also has a greater ability to influence project team members, which comes from a better knowledge of the participants in an organisation and how they respond to

different leadership styles. While, according to Frame (2001), an experienced project manager will apply a laissez-faire style to his/her closest colleagues in the creative planning phase and a democratic approach in the more routine implementation phase before deciding on the choice of the leadership style, he/she should take into account the other “dimensions” of the situation, i.e., the characteristics of the team members, the current phase of the team’s development, the time remaining to complete the task and the nature of the task itself, etc. Ultimately, the line manager is likely to take longer to build his/her personal authority among the organisation’s employees who may become members of the project team and is more familiar with the characteristics of the organisation’s operations than a project manager coming from outside the organisation. This strong embedding in the organisation in which the project takes place and the authority that the line manager wields lead to the belief that, in many ways, the line manager can lead the project team more effectively and efficiently than a project manager who only leads the project team and who is not a line employee of the organisation or who comes from outside the organisation.

Ultimately, in the case of the third type of project manager, the line manager, who already has experience in managing his/her subordinates and his/her organisational unit, can use this experience when managing the project team. This, of course, puts him/her in a position that is an advantage over the line employee, for whom project management may be just the first place where he/she will learn what management is all about and how to act as a project manager. Project execution under the guidance of a project manager who is also a line manager should therefore run more smoothly because of his/her ability to use at least basic management tools. In contrast, a project manager who is a line employee without a management position, lacks the authority that comes from a traditional hierarchy, has his/her own line supervisor and is often not delegated to the project for a full-time job, will have to reconcile many conflicting demands without having a strong position in the organisation. Therefore, it might be anticipated that this will hinder the effective and efficient leadership of the project team and reduce the chances of project success.

In summary, the requirements for a project manager are fundamentally different from those of a line manager. In addition to a number of other competences, to meet these requirements, the project manager must have sufficient authority, which depends largely on the type of project manager. Thus, firstly, the line manager has an established position in the organisation and already accumulated management experience, which should be conducive to the success of the project. Secondly, while a project manager who is solely in charge of the project team and is not associated with a line in the organisation is fully capable of focusing on project management tasks and specialises in this area, he/she has less authority in the organisation compared to a line manager. As might be suspected, it will be more difficult for him/her to achieve the goals of the project successfully. Ultimately, a project manager who is a line employee without a managerial position will be the least likely to succeed in a project. While a person delegated to manage a project may more or less (e.g. when working on a given project takes up 100% of

his/her working time) focus on completing project tasks, it will be difficult for him/her to successfully manage a project from the standpoint of the authority held in the organisation and due to a possible lack of management experience. As might be thought, the functioning of the three types of project managers discussed above will translate into the probability of project success, as shown in Figure 1.

	Type of project manager		
	The project manager is the line employee who does not occupy a managerial position on the line in the organisation	The project manager leads only the project team and is not a line employee of the organisation or comes from outside the organisation,	The project manager is also the line manager,
Project success	Less likelihood of project success	Greater likelihood of project success	

Figure 1. Type of project manager and project success. Source: the author's study.

Thus, on this basis, the following research hypothesis can be formulated:

Hypothesis: Projects managed by project managers who, as line employees, are not line managers are less likely to be successful than projects managed by line managers or project managers who only manage the project team and are not line employees of the organisation or come from outside the organisation. Conversely, projects managed by line managers are more likely to be successful than projects managed by managers who manage only the work of the project team and are not line employees of the organisation or come from outside the organisation or are line employees without managerial positions.

3. Research method

The empirical verification of the research hypothesis was accomplished through survey research. In the case of the research object, it was considered that the study could include any organisation whose core business is recurring in nature and which has project teams using classical project management methodologies (e.g. PRINCE2, PMI, IPMA). What was thought as the main reason for choosing the traditional approach to project management was the clearly defined project objectives, a well-defined organisational structure or the restrictiveness of management in terms of how key project processes are carried out (cf. e.g. Wyrozębki, 2007; Kopczyński, 2014). Therefore, the questionnaire was addressed to project managers of different organisations (by industry, size and form of ownership). However, only the data coming from the questionnaires meeting the above-mentioned limitations were used to verify the hypothesis. The objects of the research were organisations operating in Europe and the USA. The questionnaire addressed to project managers in Poland was written in Polish whereas the questionnaire directed to other project managers in Europe was in English. Thus, the study

conducted *via* LinkedIn, involved mainly project managers from Poland, Germany, Great Britain, the Netherlands and France. In the case of the USA, surveys were conducted through SurveyMonkey, a company that professionally carries out enterprise surveys. The survey requirements were the same as in Europe, both in terms of organisation and respondent characteristics. The study was conducted between 2019 and 2020 and the results were obtained from 106 project managers operating in Europe and 281 project managers from the USA. A total of 387 surveys were obtained from Europe and the United States.

Survey respondents were asked to select one completed project they managed, participated in or knew very well. In the survey, they were asked to answer questions such as what type of project manager was in the project in question and whether the project was successful. It is assumed that a successful project should be completed within the planned time, fit into the assumed budget and the actions taken should lead to the achievement of the defined objectives (the effectiveness of the project is expressed by the degree of fulfilling all the assumptions that are important from the point of view of the customer) (Spalek, 2004). While, in project management methodologies, the success of a project is associated primarily with the degree to which the expectations of stakeholders (including mainly the project principal) are met, followed by the scope, cost and timing of the project (Bukłaha, 2012), meeting stakeholders' expectations was not considered because it would involve much subjectivity and could be a source of much misunderstanding. In measuring the success of the project, it was also assumed that future potential benefits related to project execution, organisation's goals or any other factors would not be taken into consideration. The project was treated as a separate endeavour, the success of which meant that the initial objectives were met.

How often the project scope, budget, and schedule were achieved in conjunction with the type of project manager is shown in Table 2.

Table 2.

Achieving the project scope, budget and schedule vs the type of project manager

Project scope			
	The project manager was a line employee who did not hold a line managerial position within the organisation.	The project manager was also the line manager.	The project manager managed only the project team and was not a line employee of the organisation or came from outside the organisation.
Number of projects	n = 102	n = 132	n = 141
Most or all of the defined components of the project scope were achieved.	81.9%	90.9%	84.6%
Project budget			
Project execution was within budget or project costs were lower than anticipated.	62.8%	66.9%	66.4%

Cont. table 2

Project schedule			
Project implementation was on schedule or project time was shorter than anticipated.	53.3	57.1%	51.0%

Source: The author's study.

Based on the empirical data obtained, it can be concluded that in terms of all three project parameters (scope, time and cost), the project manager, who is also a line manager, was the most successful. In contrast, the project manager who managed only the project team was better than the project manager who was a line employee in terms of project scope and budget and worse than him/her only in terms of completion date. Thus, the results obtained allow accepting the research hypothesis and seem to draw attention to the relationship between the type of project manager and the success of the project.

Thus, in the case of the project manager dedicated solely to project management, his/her knowledge of project management and of how to focus on a specific project does not seem to compensate for the lack of authority and influence in the organisation. First, this is due to his/her lack of a strong formal embedding in the process part of the organisation, which limits his/her ability to influence the project team. This is especially likely when employees in the project team are also line employees and must not only consider the process nature of their organisation but also respect the instructions of their line supervisors. When confronted with these line supervisors, the project manager will have less authority because the project team work is transient in nature and the employee will find his/her line position with which he/she is permanently attached more important. Second, the project manager dedicated solely to project management will have low authority among the rest of the "non-project" organisation, which may hinder his/her ability to deliver the project when, for example, he/she is struggling to secure the resources necessary to complete the project. Uncertainty about the successful project delivery can further undermine people's willingness to engage in project work within a given team.

In contrast, in the case of the project manager who is simultaneously embedded in the line structure, his/her authority is based not only on the authority he/she has been given to implement the project but also on the potential power he/she enjoys in the line structure. Thus, he/she is not a "temporary" figure to the project team members; he/she can often be their line supervisor and is able to seek the resources necessary to complete the project effectively. As a result, he/she has a greater impact on his/her subordinates than a project manager dedicated solely to project management. Furthermore, by increasing the chances of project success, he/she also makes people more involved in the team.

Finally, it is essential to note that, as predicted, project managers who were regular line employees were the least likely to meet the project scope and budget. This may be confirmed by their lack of (project) management experience, their inability to focus entirely on the project at hand as well as their relatively low authority in the organisation, which prevents them from, for instance, obtaining resources for the project effectively.

4. Concluding remarks

The empirical research indicates a possible relationship between project manager type and project success. In the analysis, it should be borne in mind that there are several internal and external factors responsible for potential problems in meeting the project scope, schedule and budget. Thus, some of those problems may be related, for example, to the fact that the workload for a task may be poorly estimated, some expenses were not included in the original scope of work and budget or there are work and tasks performed by the team that are outside of the scope approved in the project definition. External factors can include, among others, a lack of employees in the labour market or delays on the part of external suppliers. Therefore, the results obtained should draw attention to the need to complement previous research characterising the ideal or effective project manager with a new variable, the type of project manager.

Additionally, what would also need to be analysed is how the type of project manager may correlate with project success, depending on the project maturity of the organisation. A fully project-mature organisation is characterised, among other things, by a defined division of the roles of individual people in the project. In such an organisation, the person of the project manager enjoys the recognition and support of other managers.

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APPLICATION OF RISK MANAGEMENT IN DAY-TO-DAY OPERATION OF SEA-GOING VESSELS

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Purpose: reasons for writing the paper is to present, the optimal procedure to manage of risk and Risk Assessment procedures on board sea-going vessels.

Design/methodology/approach: an analysis of implemented Risk Assessment procedures on board sea-going vessels various shipping companies.

Findings: found that approach to risk management and requirements to perform Risk Assessment are varied between shipping companies and sometime varied between vessels in the same shipping company.

Research limitations/implications: management of risk based on Risk Assessment to be simplify and unified.

Practical implications: suggestion is given to unify procedures for Risk Assessment.

Social implications: reduction of risk to happen undesired events and mitigations of hazards associated with day to day operation of sea-going vessels.

Originality/value: recommendation to shipping companies for modification of Risk Assessments procedures where is necessary to improve safety on board.

Keywords: Risk Management, Risk Assessment, Safety Management System.

Category of the paper: research and viewpoint paper.

1. Introduction

Accidents happened Maritime industry are very complex and caused by a combination of events or processes that might ultimately result in the loss of human and marine life, and irreversible ecological, environmental and economic damage or damage property as vessel itself or cargo (Balmat, Lafont, Maifret, Pessel, 2009, pp. 1278-1286; Goerlandt, Montewka, 2015, pp. 115-134; Puisa, McNay, Montewka, 2021, p. 105151). The operation of a sea-going vessels is associated with risk-taking in the case of routine operations related to the routine operations as: cargo operations, manoeuvres and sea passage, emergency situations, repairs and maintenance works and non-routine jobs performed on board sea-going vessels as: hot works,

maintenance of critical equipment, non-routine repairs after breakdown. Human error as one of the main contributing factors in more than 85% of cases of maritime accidents. Furthermore, experts estimate that 30-50% of oil spills are caused directly or indirectly by human error (Dominguez-Péry, Narasimha Raju Vuddaraju, Corbett-Etchevers, Tassabehji, 2021; Puisa, McNay, Montewka, 2021; p. 105151; Zhang, Pedersen, Villavicencio, 2019). The global shipping industry is responsible for transporting as much as 90% of world trade (Dominguez-Péry, Narasimha Raju Vuddaraju, Corbett-Etchevers, Tassabehji, 2021). Over the past decade, improved ship design, technology, regulation and risk management systems have contributed to a 70% drop in reported shipping losses (Dominguez-Péry, Narasimha Raju Vuddaraju, Corbett-Etchevers, Tassabehji, 2021). Until 2010, the main and predominant risk management route has been through formalized procedures in the form of a Safety Management System (SMS) document compliant with the ISM Code (International Safety Management Code) (ISM Code, 1998; SOLAS Convention, 1998). The ISM Code is applicable to seagoing ships of more than 500 GT engaged on international voyages and was introduced to provide an international standard for managing the safety and performance of ships (Code..., 2000; ISM Code, 1998; Standard OHSAS 18001:2007). The shipping company in this document prescribes the application of well-developed procedures to risky tasks and jobs on board associated with the operation of the ship in the broad sense (Goerlandt, Montewka, 2015, pp. 115-134; Haugen, Ventikos, Teixeira, Montewka, 2016, pp. 313-321). These procedures address situations that the company identifies as critical or hazardous to the crew, the environment or property (ship itself and cargo).

International regulations and codes that have a decisive influence on "Risk Management" in the operation of merchant ships are:

- SOLAS 1960 Convention.
- MARPOL 73/78 Convention.
- ISM Code 1998.
- STCW 78/95 Convention.
- ISPS Code 2003.

The Company SMS is also influenced by the regulations of the maritime administration of the flag state under which the ship is sailing and other maritime administrations, e.g.:

- Great Britain – Maritime and Coastguard Agency (MCA).
- USA – United States Coast Guard (USCG).

It is important to note that these standards are minimum requirements for a shipping company and their ships do not guarantee “accident-free” vessels. Flag state, port state, classification society and the shipping company's own internal inspections are used to confirm that the minimum safety standards are met. Some risks arise from events outside the company and are beyond its influence or control. Sources of these risks include e.g. ecological disasters. External risks require yet another approach. Because companies cannot prevent such events

from occurring, their management must focus on identification (they tend to be obvious in hindsight) and mitigation of their impact (Montewka, Goerlandt, Kujala, 2014, pp. 77-85; Kaplan, Mikes, 2012; Risk Assessment Training Manual, 2006). Multiple studies have found that people overestimate their ability to influence events that, in fact, are heavily determined by chance. We tend to be overconfident about the accuracy of our forecasts and risk assessments and far too narrow in our assessment of the range of outcomes that may occur (Dominguez-Péry, Narasimha Raju Vuddaraju, Corbett-Etchevers, Tassabehji, 2021; Tchankova, 2002). Risk managers need to do more than identify and mitigate potential risks. They can, for example, tap into external data sources to identify digital signals that provide early indicators of potential future problems. Compliance with legal requirements does not eliminate lower-risk incidents. However, it eliminates the highest risk accidents with low or very low probability of occurrence as shown in Figure 1.



Figure 1. Possibility of Risk Management (Montewka, Goerlandt, Kujala, 2014, pp. 77-85).

The realisation of any potential risk involves a large financial outlay and it is the policy of any rational shipping company to identify and assess the risks involved in ship operations. Risk identification enables appropriate action to be taken to control identified risks by reducing the possibility of their occurrence or minimising their consequences, i.e. "Risk Management". The OHSAS 18001:2007 standard (ISM Code, 1998; Standard OHSAS 18001:2007), which has been introduced into the SMS (management system) of many shipping companies, requires the introduction of procedures for "Risk Management". Shipboard management teams are required to identify and assess risks in the planning of routine, non-routine, planned, unplanned and emergency shipboard operations and activities. It is obvious that if the risks of the work to be done are not identified, there can be no "management" in the broad sense.

Risk can be defined as undesirable events or as the probability of an unfavourable hazardous situation or an accident occurring. Thus, a risk is a combination of the probability or frequency of occurrence of a defined hazardous situation and the multiplicity of consequences resulting from its occurrence-BS 4778 (British Standards...). Risk Management based on Risk Assessment consists of a detailed analysis of the activity that involves risk and the activities or

supporting measures employed to mitigate the risk. Risk Assessment is an integral part of the SMS - Safety Management System based on ISM Code, the purpose of which is to protect against identified threats whose risk level has been determined (Code..., 2000; ISM Code, 1998; Risk Assessment Training Manual, 2006).

Risk management is the decision-making process of accepting the assessed and analysed risks and the actions applied to reduce the negative consequences of undesirable events or the likelihood of their occurrence (Embrechts, Frey, McNeil, 2005; Goerlandt, Montewka, 2015, pp. 115-134).

2. SMS requirements to mitigate high risk

Compulsory implemented on board sea-going vessels Safety Management System requires to perform by ships crew procedures described as “work permits” as a minimum to mitigate high risk for specified jobs or operations. Work Permits are confirmation that application of proper preparation procedure is fulfilled. Work Permit Most Shipping Companies implemented for this purpose e.g. (Code..., 2000; ISM Code, 1998; Safety Management System, 2015; Safety Management System, 2017; Safety Management System, 2018):

- Hot work Permit.
- Cold work Permit.
- Working aloft – Oversight Permit.
- Electrical Circuit Work Permit.
- Harmful substances Work Permit.
- Critical Equipment & System Shut Down Permit.
- Enclosed Spaces Work Permit.

Forms of “Work Permit” are only formal confirmation that procedure for preparation for particular job have been fulfilled and minimum safety standards has been followed.

Work Permits can mitigate high risk accidents and are starting step for management of risk.

Good examples of “Work permits” have been shown in Figures 2-4. Presented examples have been chosen among many of applied forms in shipping as a best examples obtained all spectrum of specific jobs (Safety Management System, 2017; Safety Management System, 2018; Safety Management System, 2020).

WORK PERMIT FOR ELECTRICAL CIRCUITS

The issue of a permit does not, by itself, make a job SAFE

Sections 1 to 4 of the Permit must be manually completed. Computerized completion is prohibited.

1st Copy : For Display at the Work Area MT: _____
 2nd Copy: For Ship's Records

This permit is to be completed by the person in charge of the work team (Head of Department concerned) before commencing the Work involving Electrical Circuits. **Equipment shall be Tagged out as required.**

GENERAL		
This Permit is valid	From _____ hrs	Date _____
(Not to exceed 12 hours)	To _____ hrs	Date _____
Location of Work _____		
Has an Enclosed Space ENTRY PERMIT been issued ? YES / NO		
Type of Work _____		
Person in charge of the work team (Name and Rank) _____		
Personnel carrying out the work _____		
(Name or Position / Sign) _____		
Section 1- GENERAL CHECKS		
1. 1	Is the scope of the job discussed with all persons concerned at the Tool Box meeting?	YES / NO
1. 2	Is the proper work force & equipment assigned to carry out the job ?	YES / NO
1. 3	Are all persons carrying out the work wearing the correct P.P.E ?	YES / NO
	Additional P.P.E. required is : _____	
1. 4	Has the communication procedures been established among the work team?	YES / NO
1. 5	Are the procedures established for checking items on completion ?	YES / NO
Section 2 - SPECIAL REQUIREMENTS / PRECAUTIONS FOR WORK ON ELECTRIC CIRCUITS		
2.1	Have necessary protective outfits such as Rubber Gloves & Boots for insulation been made ready to use (they shall be used while the work takes place)?	YES / NO
2.2	Have the Electric Circuits related to the work area been cut?	YES / NO
2.3	Have the Tags / Signs to prohibit turn ON the Switches been posted in position?	YES / NO
2.4	Has a Safety Watchman been arranged?	YES / NO
2.5	Have the Insulation Sheets been placed at the work place to prevent electric shock.	YES / NO
2.6	Have all possible alternate energising / start points been checked and tagged out?	YES / NO
2.7	List any special conditions, precautions or procedures that should be followed:	

Section 3 - AUTHORITY TO PROCEED WITH THE WORK		
In the circumstances noted, it is considered safe to proceed with the work for which this Permit is issued.		
Signed	_____ Person in charge of the work team	
	_____ Safety Officer	_____ Master
Section 4 - CONFIRMATION OF COMPLETION OF WORK		
The work for which this Permit was issued has been completed and all persons, materials and equipment have been withdrawn / Tags removed, and the work area has been left in a clean and safe condition.		
<u>Tags used for this permit should be attached to the permit and filed.</u>		
Signed	_____ Person in charge of the work team	
	_____ Safety Officer	_____ Master

Figure 2. Example of Work Permit for Electrical Circuit (Safety Management System, 2017; Safety Management System, 2018; Safety Management System, 2020).

<i>The issue of a permit, does not, by itself, make a job SAFE</i>		
<i>The Permit must be manually completed. Computerized completion is prohibited.</i>		
WORKING ALOFT, OVERSIDE PERMIT		
(For any Height above <u>2.0 meters</u> without <u>Handrail & Platform</u> - a Permit is Required)		
Vessel: _____	Date & Time _____	Checked by _____
1. Preparation		
(1) Has a Tool Box meeting been held with all crew members involved in the work & working procedure been discussed and understood? Risk Assessment Done?	YES /	NO
(2) Has a responsible person been placed in charge of the work team ?	YES /	NO
(3) Are crew members sufficiently experienced to perform the job at hand ? <i>(Personnel with less than 12 months experience at Sea are not permitted aloft)</i>	YES /	NO
(4) Are the weather conditions / vessel's movement considered suitable for the work to proceed ?	YES /	NO
(5) Have the persons doing the work, been advised of any additional personal protective equipment they must wear when carrying out this work ?	YES /	NO
(6) Has any required staging / bosun's chairs, etc. including ropes and shackles been thoroughly inspected before use ?	YES /	NO
(7) Has a deck rating been appointed to continuously support the work team from deck level ?	YES /	NO
(8) Have all the necessary tools and equipment been prepared ?	YES /	NO
(9) Is a bucket and heaving line available for the hoisting / lowering of tools ?	YES /	NO
(10) If necessary, have communications been established and tested ?	YES /	NO
Signed by Persons going Aloft or/and Overside _____ SIGNATURE SIGNATURE		
Jobs to be done: _____		
Location of Job: _____ SIGNATURE SIGNATURE		
2. Working aloft		
(1) Have all crew been provided with and are they wearing a safety belt / harness ?	YES /	NO
(2) Has the area been roped off and warning signs placed, below the work place ?	YES /	NO
(3) Have the crew members been advised to keep both hands free when climbing ladders and also not to carry tools in their pockets ?	YES /	NO
(4) If the work is being carried out at night, is the work area adequately illuminated ?	YES /	NO
VALIDITY FROM / TO _____ MASTER'S AUTHORISATION: _____		
PERMIT CANCELLED AT _____ RESPONSIBLE PERSON: _____		
3. Working over the ship's side		
(1) Has it been confirmed that the ship is not underway ?	YES /	NO
(2) If above is "NO", are the safety measures mentioned in OBP Ch.I Part1 7.2(2)(c) are taken?	YES /	NO
(3) Has a jacob's ladder been rigged to provide a means of getting to and from the work area ?	YES /	NO
(4) Have all crew been provided with and are they wearing a working lifejacket and a safety belt / harness ?	YES /	NO
(5) Has the Officer of the Watch been advised of the on going work / the time persons are outboard and the time all persons are back inboard ?	YES /	NO
(6) Has a lifebuoy, self igniting light and buoyant line been prepared close to the work area ?	YES /	NO
(7) If the work is being carried out a night, is the work area adequately illuminated ?	YES /	NO
VALIDITY FROM / TO _____ MASTER'S AUTHORISATION: _____		

Figure 3. Example of Working Aloft, Overside Work Permit (Risk Assessment Training Manual, 2006; Safety Management System, 2021; SOLAS Convention, 1998).

ENCLOSED SPACE ENTRY PERMIT

*The issue of a permit, does not, by itself, make a job **SAFE***

The Permit must be manually completed. Computerized completion is prohibited.

VESSEL

This permit relates to entry into enclosed spaces as defined in ISGOTT / OBP Manual - Ch1 Part 1, such as those spaces with restricted access in which atmosphere may be hazardous due to the presence of hydrocarbon gas, toxic gas, inert gas or oxygen deficiency. The definition includes cargo tanks, fuel tanks, water, L.O. tanks, Slop & waste oil tanks, sewage tanks, cofferdams, duct keels, void spaces & trunkings, pipeline or fittings connected to any of these. It also includes IG scrubbers, water seals & any other item of machinery or equipment that is not routinely ventilated & entered such as boilers & Main Engine Crank case. A separate permit is used for Pump Room Entry.

IMPORTANT (Permit to be prepared in Duplicate:-Original-display at the site, Duplicate-Bridge, CCR or ECR & after work completion-Ship's file)
The form PRMT-002 Must be attached to this form for Records. One permit is valid for one space only.

GENERAL Location and Name of Enclosed Space _____ (Should **NOT** be more than 1 Space)
 Reason for Entry _____
 Permit is valid **FROM** Date _____ Time _____ (See Note 1)
TO Date _____ Time _____

SECTION 1 - PRE-ENTRY PREPARATIONS (To Be Checked by Master or Safety Officer & gas readings cross checked by additional person)

Fill Y=Yes / N= No / NR= Not required / NA=Not applicable in the box. Do Not tick the box.

Has a Risk assessment been carried out? RA Reference No. _____
 Has the space been segregated by blanking off or isolating all connecting pipelines (when applicable)?
 Has the space been cleaned (when applicable)?
 Has the space been thoroughly ventilated?
 Pre-Entry Atmospheric Tests & Readings : (See Note 2) All readings **MUST** be entered. (refer to PRMT-002 for details)
 OXYGEN _____ % Vol (21%) HYDROCARBON _____ % LFL (must be less than 1%)
 (See Note 3) TOXIC GASES _____ (Name of Gas) _____ PPM TLV _____
 Instrument Serial Numbers / ID number for O2 and HC readings: _____
 Have readings been crosschecked by a second person using instruments other than those used for the initial checks?
 Average Readings at second test (record readings under "Second pre-entry check" in PRMT-002 also)
 OXYGEN _____ % Vol (21%) HYDROCARBON _____ % LFL (must be less than 1%)
 Instrument Serial Number / ID number for 2nd O2 and HC readings: _____
 Have arrangements been made for frequent atmosphere checks to be made while the space is occupied and after any work breaks?
 Have arrangements been made for the space to be continuously ventilated throughout the period of occupation & during work breaks?
 Is adequate illumination provided? Is an approved charged Torch available at the entrance?
 Is rescue & resuscitation equipment available for immediate use at the entrance to the space?
 Has a responsible person be designated to stand by at the entrance to the space?
 Has the officer of the watch (bridge, engine room, cargo control room) been advised of the planned entry?
 Has a system of communication and reporting frequency between the person at the entrance & those entering the space been agreed & tested?
 Is there a system for recording who is in the space? Recorded By: _____ (See Note 4 use PRMT-002)
 Has a meeting been held, risk assessment & operation discussed & are emergency and evacuation procedure established and understood?
 Is all equipment used of an approved type?

SECTION 2 - PRE-ENTRY CHECKS Team Leader Name:- _____ (See Note 5)

(To be checked by the team leader)

Has Section 1 of this permit been completed fully?
 I am aware that the space must be vacated immediately in the event of ventilation failure or in case of any personal monitor alarm.
 I have agreed with the communication procedures. I agree to evacuate the space in case of communication breakdown.
 I have agreed to the reporting interval of _____ mins. with the standby person / responsible person.
 Emergency & evacuation procedure have been agreed & understood.
 Appropriate PPE is worn by all team personnel.

Responsible Officer Supervising Entry _____ Date _____ Time (of signing the permit) _____
 Second Gas Check person _____ Date _____ Time (of signing the permit) _____
 Authorized Team Leader _____ Date _____ Time (of signing the permit) _____
 Master _____ Date _____ Time (of signing the permit) _____

This permit is rendered INVALID should VENTILATION of the space STOP or if any of the CONDITIONS noted in the checklist change.

The duration of this permit / work in space has been completed and all personnel / and equipment are clear off the space.
 The Permit is confirmed cancelled at _____ hrs on _____
 Remarks if any: _____
 In case of work completion all personnel are confirmed to have left the space and all equipment / work gear cleared.
 Master's sign _____ Date _____ Time _____ (of signing completion)

Figure 4. Example of Enclosed Space Entry Permit (Safety Management System, 2017; Safety Management System, 2018; Safety Management System, 2020).

3. Objectives of Risk Management on board sea-going vessels

Objectives of Risk Management is to assess potential and actual risks on board vessels, to ensure the safety of vessels personnel, relevant onboard parties, vessels, cargo, by establishing appropriate procedures and reducing Risk to As Low as Reasonably Practical (ALARP) levels.

Risk Management Program must consists of the following elements as shown on Figure 5:

- Hazard Identification and Risk assessment.
- Risk Mitigation & Action plan to avoid & minimize risk.
- Execution of risk management measures.
- Confirmation of risk management measure execution.
- Review and improvement of risk management measures.

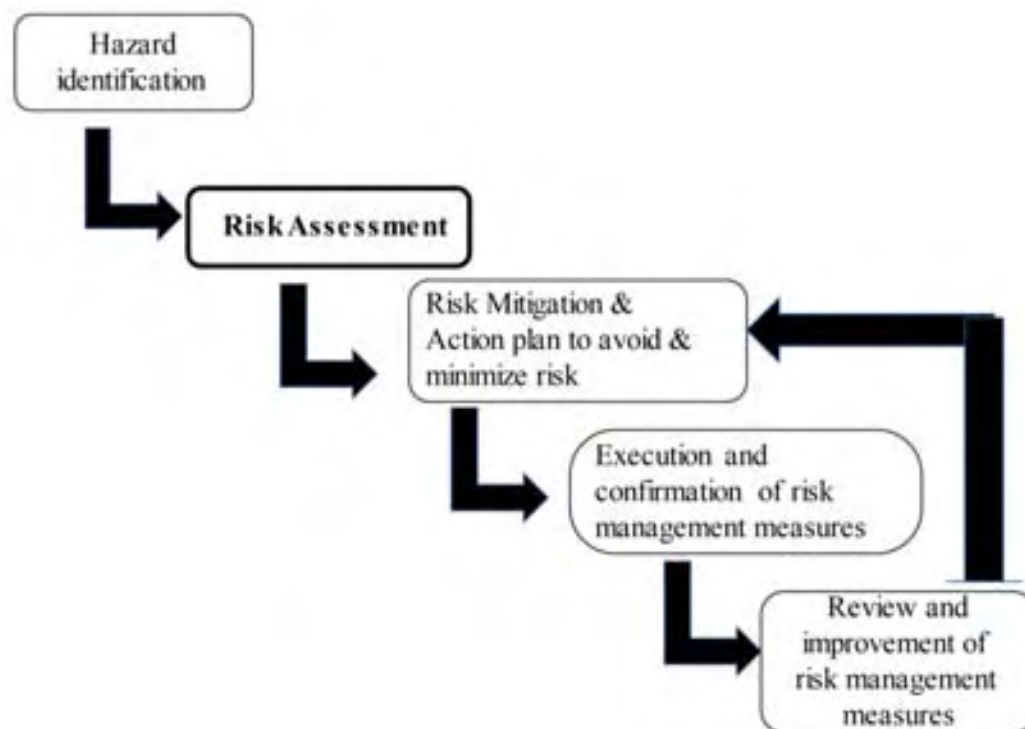


Figure 5. Model of Risk Management (Kaplan, Mikes, 2012).

During assessment of risk process on board vessels the following must be taken into account (Dominguez-Péry, Narasimha Raju Vuddaraju, Corbett-Etchevers, Tassabehji, 2021; Embrechts, Frey, McNeil, 2005; Goerlandt, Montewka, 2015, pp. 115-134; Haugen, Ventikos, Teixeira, Montewka, 2016, pp. 313-321):

- Routine and non-Routine Tasks.
- Risks recognized as undesirable operations.
- Infrastructure, equipment and materials at the workplace.

- Routine and non-routine maintenance of critical equipment or systems that should be shut down when the maintenance is executed.
- Non-routine repairs (following equipment breakdown or arising from the potential for breakdown).
- Temporary or permanent changes of shipboard equipment, activities or materials.
- Potentially hazardous operations.
- New or non-routine tasks that may be done in the future.
- Temporary or permanent change in the risk management system (manual, etc.).
- Emergencies operations.
- Activities of contractors and visitors.
- Work area design, equipment operating procedures and their adaptation to human capabilities.
- Significant safety problems that cannot be rectified by shipboard personnel.
- Human behavior, capabilities and other human factors.
- Hazards identified outside the workplace capable of adversely affecting the safety and health of persons within the workplace.
- Other possible situations that may significantly affect safety, health, environment, or quality.

4. Developing of Mitigating measures and controls of hazards

Measures to mitigate hazards, shall be developed using the Risk Assessment Evaluation-Action Plan according to the following procedures:

- Establish measures to **decrease** the “likelihood of risk occurrence”.
- Establish mitigating measures to **decrease** or **eliminate** the “consequence of Risk”. Risk to be reduced to **As Low As Reasonably Practical (ALARP)** level.
- Determining controls the following hierarchy shall be considered (Kaplan, Mikes, 2012; Safety Management System, 2015):
 - Elimination.
 - Substitution.
 - Engineering controls.
 - Signage/warning signs/administrative controls.
 - Personal protection equipment.

The idea behind this hierarchy is that the control methods at the top of the list are more effective than those at the bottom.

Elimination and substitution, while most effective at reducing hazards, also tend to be the most difficult to implement in an existing process. If the process is still at the design or development stage, elimination and substitution of hazards may be inexpensive and simple to implement. For an existing process, major changes in equipment and procedures may be required to eliminate or substitute for a hazard.

Engineering Controls involve changes in the physical features of the workplace. As an example, engineering controls might include changing the weight of objects, changing work surface heights, or purchasing lifting aids. When engineering solutions are not feasible, administrative controls offer methods to reduce the exposure of workers to the identified hazard.

Administrative controls are workplace policy, procedures, and practices that minimize the exposure of workers to risk conditions. They are considered less effective than engineering controls in that they do not usually eliminate the hazard. Rather, they lessen the duration and frequency of exposure to the risk condition.

If administrative controls are not available, work practice controls should be considered and finally personal protective equipment (PPE).

The preferred method for controlling ergonomics hazards is through engineering techniques. When the design of the workplace reduces the magnitude of risk factors, the likelihood of injury/illness is lessened. On Figure 6. is shown an example of Risk Assessment Form. At the “Stage 1” Hazards and consequences to be identified and Risk Assessment with existing already controls (safeguards) to be ranked. In “Stage 2” Risk to be re-ranked after application additional hazard controls (safeguards).

4.1. Guidance for Mitigation

When controlling risks, apply the principles below, if possible, in the following order:

1. less risky option (e.g. switch to using a less hazardous chemical) to be tried,
2. access to the hazard (e.g., by guarding) to be prevented,
3. work to be organised to reduce exposure to the hazard (e.g., put barriers between personnel and hazard source),
4. Personal Protective Equipment to be used,
5. backup facilities (e.g., first aid and washing facilities for removal of chemical) to be provided.

4.2. Guidance for Likelihood

Likelihood is based mainly on crew estimation of the chance of it happening under the conditions existing at the time of the work and does not depend upon Industry Statistics.

For Example: if we question as to what is the likelihood of having a Ship to Ship collision?

The Likelihood will change according to the situation that the ship is in for which the risk is assessed.

Case 1 – If the vessel is in the middle of the Pacific Ocean - the Likelihood will be more towards Possible but Unlikely.

Case 2- If the vessel is in the Singapore Straits the Likelihood will be more towards Quite Possible.

Case 3 – If the vessel is in Dry Dock the likelihood will be Unlikely.

The description and percentage given in available “determination charts“ for estimating the chances of it happening, for that particular case are not representing a percentage of past industry statistics. Therefore, selection of the expression for likelihood to be done which most applies to the hazard when conducting the Risk Assessment.

The following should be used as a guidance when establishing the Likelihood of Risk:

- number of personnel exposed,
- frequency and duration of exposure to the hazard,
- effects of failure of power supply,
- effects of failure of plant, machinery and safety devices,
- exposure to the elements – weather, cold, heat etc.,
- protection given by PPE and its limitations,
- possibility of unsafe acts by personnel (internal or external parties) who:
 - may not know what the hazards are,
 - may not have the knowledge, physical capacity, or skills to do the work,
 - underestimate risks to which they are exposed.
 - underestimate the practicality and utility of safe working methods.
 - think that nothing has happened so far therefore never will.

To give another example Likelihood of a situation occurring in a Cargo Tank would be higher on a product tanker than a Crude Tanker since the number of times (and therefore the exposure) tank entry is made on a Product Tanker may be higher than that on a Crude Tanker. Therefore, the frequency of the exposure is also an important factor when determining the likelihood (Culp, 2020; Kaplan, Mikes, 2012; Standard OHSAS 18001:2007).

Name of Vessel: M/T xxxxxxx
 Date: 14-Aug-20
 Reference No: E-055-20

Detail of Work Activity:
 WELDING ON E/R 3rd DECK PS
 Opened space - installation of chemical locker cage fabricated in workshop

Consequence	Likelihood				
	1: Unlikely	2: Possible	3: Quite Possible	4: Likely	5: Very Likely
1: Negligible	Low Risk	Low Risk	Low Risk	Medium Risk	Medium Risk
2: Slight	Low Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk
3: Moderate	Low Risk	Medium Risk	Medium Risk	Medium Risk	High Risk
4: High	Medium Risk	Medium Risk	Medium Risk	High Risk	High Risk
5: Very High	Medium Risk	Medium Risk	High Risk	High Risk	High Risk

All Risks must be made As Low As Reasonably Practicable (ALARP) before commencing the job

STAGE 1		1. RISK ASSESSMENT		2. RISK MANAGEMENT STAGE 1			
Sr. No	Routine or Non-routine work (R / NR)	Hazards Identified	Consequence	Existing safeguards	Risk Ranking		
		What can go Wrong? Hazard is something with the potential to cause harm. Three Questions to ask:- 1. Is there a source of harm? 2. Who (or what) could be harmed? 3. How could Harm occur?	What will happen due to the hazard? Consequence is the loss associated if the hazard happens.	[For Example] 1. Work Permit System - Specify which is applicable 2. Safety Checklists - Specify Checklist & use. 3. PPE - specify which all PPE will be used 4. Lock Out & Tag out System- specify what will be locked & tagged out and at which locations 5. SMS Procedures - specify which procedures.	Consequence	Likelihood	Risk
1	N/R	Fatigue	Personal injury	personal involved should be well rested with requirements of STCW & MLC	Moderate	unlikely	Low
2	N/R	Lack of training in welding operations	personal injury, damage of property	trained welder aware of hazard involving hot work is to perform task with supervising senior officer	Moderate	unlikely	Low
3	N/R	Poor communications between individuals and /lack of understanding procedures	Personal injury	Communications must be agreed between personnel, pre job briefing to be carry out. Concept Take 5 to be used. Senior officer responsible for operation should brief all involved abt. precautions to safely complete the operation	High	unlikely	Medium Risk
4	N/R	Inadequate PPE/ safety equipment	Personal injury	Proper PPE to be worn by all personnel involved (ref Company PPE requirements Annex 1), welder and assistant must use proper welder's gear	Moderate	unlikely	Low
5	N/R	Inadequate preparation of work location and adjoining spaces	personal injury, damage of property	The work site to be free from oil and oil residues. Surface area and adjoining space must be prepared in accordance with ISGOTT requirements	High	Possible	Medium Risk
6	N/R	Flammable materials in vicinity of the hot work location	personal injury, damage of property	All flammable materials including oil residues, chemicals, rags must be removed from site of hot work location	High	Possible	Medium Risk
7	N/R	Faulty arc welding equipment, cable and electrode holder	personal injury, damage of property	Prior and on completion of arc welding equipment must be inspected by senior officer for any damage	Moderate	unlikely	Low
8	N/R	Explosive atmosphere	personal injury, damage property	Atmosphere in work location must be continuously monitored by proper instruments	High	unlikely	Medium Risk
9	N/R	Welding flush and fumes , hot metal	Personal injury	Area to be kept well ventilated and outlets of smoke escape to be maintained. Hot debris to be extinguished by small water hose. After surface to be wiped.	High	Possible	Medium Risk
10	N/R	Hot surfaces/ hot spots	personal injury, damage property	Temperature of surfaces in vicinity of hot work to be monitored by infrared temp.gage on top and down under surface.	High	Possible	Medium Risk
11	N/R	In appropriate weather conditions	Personal injury	Work must not be carried out, if weather condition are not suitable for the operation	Moderate	unlikely	Low
12	N/R	High ambient temperature at hot work place	Personal injury	Personel involved must make frequently brakes to drink water and get rest, back up personel to be designated.	Moderate	unlikely	Low

Stage 2		2. RISK MANAGEMENT STAGE 2		3. EXECUTION			For Non Routine Jobs: Have involved personnel understood the Risks and implementation of safeguards and measures? Enter details below.		
Sr No	Additional Safeguards	Residual Risk			Name	Rank	Signature		
		Consequence	Likelihood	Risk					
	What can be done about the hazards? Consider the following: 1). Removal of the Hazard. 2). Substitution of the Hazard - reduce the Likelihood 3). Mitigation of the Hazard - reduce the Consequence 4) Use a combination of technical & procedural controls. 5). Ensure emergency arrangements are in place.								
1 to 10	Hot work permit PRMT -003 & 003A to be issued and strictly followed	High	Unlikey	Low Risk		2A/E			
1 to 10	Company approval of hot work to be obtained	High	Unlikey	Low Risk		3A/E			
3	Tool box meeting to be performed to. All aspects of work to be discussed and clarified. Full specific informations to be given to COW on Bridge	High	Unlikey	Low Risk		No.1 Oiler			
4	Senior officer have to make inspection of PPE	Moderate	Unlikey	Low Risk		Oiler A			
5,6	Proper preparation of area of hot work to be inspected and accepted by senior officer	High	Unlikey	Medium Risk		Oiler B			
8,9	Area to be kept well ventilated, atmosphere to be permanently monitored	High	Unlikey	Medium Risk		Wiper			
10	Person designated to monitor hot spots to be clearly quided by senior officer	High	Unlikey	Medium Risk					
1 to 12	Person in charge of hot work operation have to apply proper management of work	Moderate	Unlikey	Low Risk					
Add 1	Portable fire fighting equipment to be standing by close to work place. Fire lines to be pressurised. Nozzles to be ready to use	Moderate	Unlikey	Low Risk					
Add 2	Portable fire fighting equipment to be standing by close to work place. Fire lines to be pressurised. Nozzles to be ready to use	Moderate	Unlikey	Low Risk					
Add 3	Emergency action to be discussed during tool box meeting ; evacuation routes to be marked and all personel involved in hot work to be acquainted with	Moderate	Unlikey	Low Risk					

Stage 3

Recovery and Mitigation procedures: (in case of undesired outcomes: List procedures and contingency plans that must be referred to for limiting the impact of any unplanned occurrences. E.g. in case of RA for enclosed space entry, contingency for Rescue from Enclosed Spaces and Emergency Medical Treatment will apply.)

List Applicable Contingencies & Procedures: OBP I - Part 1 (7.3.3) and OBP I Annex 2 (3)

In case of undesired outcomes: OBP VI- Contingency-Shopboard -Section 3 - 3.2 Fire in Engine Room

For Routine Jobs - This form is valid till: _____ (Maximum of 6 months)
 (unless reviewed due to an incident or when there is a change in the work conditions or additional hazards associated with the work have been identified.) For Routine jobs the form must be referred to and the Control measures understood and implemented. An entry to this effect must be made in the Daily work Plan form RECO-004.

1A/E xxxxxx Capt. XXXXX C/E Kaminski Wlodzimierz C.
 Safety Officer (Name & Signature) Master: (Name & Signature) Other Officer incharge (Name, Rank & signature)

Figure 6. Example of Risk Assessment Form (Safety Management System, 2015).

4.3. Guidance for Consequence

Generally, consequences are unlikely to change between Stage 1 and Stage 2 of the Risk Assessment. Therefore, the consequence entered in Stage 1 should be that after the Existing Safeguards of Stage 1 have been put in. This will usually remain the same in Stage 2 and should not be changed.

For example: working aloft on a Mast – the consequence will depend upon how high the work location is. Low height – possible sprain, medium height – fracture, High up – multiple fractures possible death. If the person follows the work permit system, uses a safety harness properly etc. the fall will be arrested therefore in Stage 1 the consequence should be Moderate (would be high if person goes aloft without informing/no PPE etc.).

This consequence will no longer change even with the usual additional safeguards – the Likelihood will however decrease further due to the additional Safeguards. If however we were to place a good amount of mattresses/air pillows etc. all around the mast (like is done by stuntmen in movies) then and only then the consequence of his fall from the mast would change.

5. Action plan to counter risk

The action Plan to counter Risk shall be implemented and confirmed.

To confirm implementation of the action plan as determined using the Risk Assessment-Action Plan the following steps should be involved:

- Confirmation of implementation status.
- Confirmation of implementation results on completion target date.
- Review the “Risk” and “Action Plan” if countermeasures have not been completed by the completion target date.
- Confirmation the results, when the countermeasures were completed.

Action plan undertaken by vessel to perform safely any task or operation should be assessed, reviewed, and improve, if necessary, by Safety Management of Shipping Company. This assessment should consist of the followings:

- Evaluation of implemented measures.
- Review of implemented measures and examination of improvement points.
- Necessity of lateral spread to other vessels and in other divisions.
- Incorporation of implemented measures to manuals and procedure manuals.

Conclusion

1. Procedures for risk assessment on board sea going vessels are quite complicated for most crew on board sea-going vessels. Research done by authors on Risk management showed that approach to risk assessment to be simplify and unified. Suggestion is given to unify procedures for risk assessment.
2. Risk Management and associated with it Risk Assessment is a new topic which ship crews must, first of all, become familiar. If the understanding of the problem is not correct, risk management becomes a worthless process.
3. Ships crew require intensive training in Risk Management and Risk Assessment and these training must be taken as a priority.
4. Research done by authors on Risk Management showed that approach to risk management and requirements to perform Risk Assessment are varied between shipping companies.
5. Implementation in real practice Risk Management based on simplified, well understood, clear procedure for Risk Assessment will reduce of risk to happen undesired events and mitigations of hazards associated with day-to-day operation of sea-going vessels.
6. Research done by authors on Risk management in shipping companies showed that modification of risk assessments procedures must be recommended to some shipping companies to improve safety on board.

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IMPLEMENTATION OF ENERGY EFFICIENCY MANAGEMENT IN SHIPPING COMPANIES AND SHIPS IN OPERATION

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Purpose: reasons for writing the paper is to present and explained implemented on board seaging vessels energy efficiency management and give an answer to question how SEEMPs are implemented and applied in day to day operation.

Design/methodology/approach: an analysis of various shipping companies and ships Ship Energy Efficiency Management Plans.

Findings: found that application of SEEMP are varied between shipping companies and is not very well known on board vessels.

Research limitations/implications: SEEMP to be clearly explained to ships crew for better understanding and application in day to day operation.

Practical implications: suggestion to Shipping Management Companies to simplify SEEMPs.

Social implications: reduction of GHG emission.

Originality/value: implementation of best practices to improve EEOI.

Keywords: Ship Energy Efficiency Management Plan, EEOI, Best Practices

Category of the paper: research and viewpoint paper.

1. Introduction

Ship Energy Efficiency Management Plan (SEEMP) was made mandatory for all ships at IMO – Marine Environmental Protection Committee –MEPC 62 (July 2011) with the adoption of amendments to MARPOL Annex VI (resolution MEPC.203(62)), by Parties to MARPOL Annex VI. This was the first legally binding climate change treaty to be adopted since the Kyoto Protocol. In this paper authors intended to present and explained implemented on board seaging vessels energy efficiency management and give an answer to question how SEEMPs are implemented and applied in day to day operation.

The Ship Energy Efficiency Management Plan (SEEMP) is an operational measure that establishes a mechanism to improve the energy efficiency of a ship in a cost-effective manner. The SEEMP also provides an approach for shipping companies to manage ship and fleet

efficiency performance over time using, for example, the **Energy Efficiency Operational Indicator (EEOI)** as a monitoring tool. The guidance on the development of the SEEMP for new and existing ships incorporates best practices for fuel efficient ship operation, as well as guidelines for voluntary use of the EEOI for new and existing ships (MEPC.1/Circ.684). The EEOI enables operators to measure the fuel efficiency of a ship in operation and to gauge the effect of any changes in operation, e.g. improved voyage planning or more frequent propeller cleaning, or introduction of technical measures such as waste heat recovery systems or a new propeller. The SEEMP urges the ship owner and operator at each stage of the plan to consider new technologies and practices when seeking to optimise the performance of a ship.

Implemented **Energy Efficiency Design Index** is the most important technical measure and aims at promoting the use of more energy efficient (less polluting) equipment and engines. The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and size segments. Since 1 January 2013, following an initial two year phase zero, new ship design needs to meet the reference level for their ship type. The level is to be tightened incrementally every five years, and so the EEDI is expected to stimulate continued innovation and technical development of all the components influencing the fuel efficiency of a ship from its design phase. The EEDI is a non-prescriptive, performance-based mechanism that leaves the choice of technologies to use in a specific ship design to the industry. As long as the required energy efficiency level is attained, ship designers and builders are free to use the most cost-efficient solutions for the ship to comply with the regulations. The EEDI provides a specific figure for an individual ship design, expressed in grams of carbon dioxide (CO₂) per ship's capacity-mile (the smaller the EEDI the more energy efficient ship design) and is calculated by a formula based on the technical design parameters for a given ship. The CO₂ reduction level (grams of CO₂ per tonne mile) for the first phase is set to 10% and will be tightened every five years to keep pace with technological developments of new efficiency and reduction measures. Reduction rates have been established until the period 2025 and onwards when a 30% reduction is mandated for applicable ship types calculated from a reference line representing the average efficiency for ships built between 2000 and 2010. The EEDI is developed for the largest and most energy intensive segments of the world merchant fleet and embraces emissions from new ships covering the following ship types: tankers, bulk carriers, gas carriers, general cargo ships, container ships, refrigerated cargo carriers and combination carriers. In 2014, MEPC adopted amendments to the EEDI regulations to extend the scope of EEDI to: LNG carriers, ro-ro cargo ships (vehicle carriers), ro-ro cargo ships; ro-ro passenger ships and cruise passenger ships having non-conventional propulsion. These amendments mean that ship types responsible for approximately 85% of the CO₂ emissions from international shipping are incorporated under the international regulatory regime.

MEPC 70 (October 2016) adopted mandatory MARPOL Annex VI requirements for ships to record and report their fuel oil consumption, by resolution MEPC.278(70). In relation to the amendments to MARPOL Annex VI on the mandatory data collection systems for fuel oil consumption of ships, MEPC 70 also adopted the 2016 Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP), by resolution MEPC.282(70). Under the amendments to MARPOL Annex VI, on or before 31 December 2018, in the case of a ship of 5,000 gross tonnage and above, the SEEMP shall include a description of the methodology that will be used to collect the data and the processes that will be used to report the data to the ship's flag State (MARPOL Consolidated..., 2017; MARPOL Annex..., 2017; Ship..., 2008; Ship..., 2009).

2. Guidelines for Ship Energy Efficiency Management Plan (SEEMP) and Energy Efficiency Operational Indicator (EEOI)

In order to robust environmental protection in a practice, shipping company should establish Energy Management Policy as follows (tankership company as example) (Finnley, 2018; Josi, 2021; Smith, 2020):

1. The Company shall establish Ship Efficient Energy Management Plan (SEEMP) for both the Onshore and Onboard, which refers IMO MEPC.1/Circ.683 (SEEMP), OCIMF Energy Efficiency and Fuel Management (EEFM) and Intertanko Guide for a Tanker Energy Efficiency Management Plan (TEEMP).
2. The Plan shall be specific for individual vessels and reviewed regularly by both the vessel and the Company senior managements.
3. The Company shall set goals for energy management that shall be quantified Energy Efficiency Operational Index (EEOI) in accordance with IMO MEPC.1/Circ.684 (Ship..., 2009).
4. The continuous improvement process for efficiency energy management shall be based on the Company HSEQ system (IMS) that complies latest ISO 14001.

2.1. Ship Energy Efficiency Management Plan

A Ship Energy Efficiency Management Plan (SEEMP), is ship-specific document containing energy efficiency improvement measures identified by the Ship Owner, to be kept onboard each ship. A Ship Energy Efficiency Management Plan (SEEMP), being introduced as an operational measure, is a tool for monitoring ship and fleet energy efficiency performance over time and improving it with a PDCA (Plan-Do-Check-Act) cycle.

It encourages the ship-owner, to incorporate new technologies and adopt best management practices to ensure an energy efficient ship operation. It has been widely recognized that if efficiency of ship operations were improved, then carbon emissions could be reduced significantly. The purpose of introducing SEEMP is to assist Ship Owners to use it as an energy management tool in managing energy efficiency of their ships. The SEEMP approach seeks to improve a ship's energy efficiency through four steps:

- Planning.
- Implementation.
- Monitoring.
- Self-evaluation and Improvement.

SEEMP is to be available onboard during the first renewal or intermediate survey on or after 1st January 2013 and is mandatory for all ships of 400 GT and above (MARPOL Consolidated..., 2017; MARPOL Annex..., 2017).

Unfortunately, research done on board many sea-going vessel on SEEMPs gives an answer that ships crew is not well acquainted with that subject and there is still room for improvement.

2.2. Energy Efficiency Operational Indicator (EEOI)

Indicator = $MCO_2 / (\text{transport work})$

In general, cargo mass carried or work done is expressed as follows:

- for dry cargo carriers, liquid tankers, gas tankers, ro-ro cargo ships and general cargo ships, metric tonnes (t) of the cargo carried should be used.
- for containerships carrying solely containers, number of containers (TEU) or metric tons (t) of the total mass of cargo and containers should be used.
- for ships carrying a combination of containers and other cargoes, a TEU mass of 10 tonnes could be applied for loaded TEUs and 2 tonnes for empty TEUs,
- for passenger ships, including ro-ro passenger ships, number of passengers or gross tonnes of the ship should be used,
- for car ferries and car carriers, number of car units or occupied lane meters,
- for containerships, number of TEUs (empty or full); for railway and ro-ro vessels, number of railway cars and freight vehicles, or occupied lane meters.

Fuel mass to CO₂ mass conversion factors (C_F) is a non-dimensional conversion factor between fuel consumption measured in g and CO₂ emission also measured in g based on carbon content. The value of C_F is as follows:

Table 1.
Values of Conversion factors C_F depend of brand of fuel

Type of fuel	Reference	Carbon content	CF (t-CO ₂ /t-Fuel)
1. Diesel/Gas Oil	ISO 8217 Grades DMX through DMC	0.875	3.206000
2. Light Fuel Oil (LFO)	ISO 8217 Grades RMA through RMD	0.86	3.151040
3. Heavy Fuel Oil (HFO)	ISO 8217 Grades RME through RMK	0.85	3.114400
4. Liquefied Petroleum Gas (LPG)	Propane	0.819	3.000000
	Butane	0.827	3.030000
5. Liquefied Natural Gas (LNG)		0.75	2.750000

Fuel consumption, FC, is defined as all fuel consumed at sea and in port or for a voyage or period in question, e.g. a day, by main and auxiliary engines including boilers and incinerators.

Distance sailed means the actual distance sailed in nautical miles (deck log-book data) for the voyage or period in question.

Voyage generally means the period between a departure from a port to the departure from the next port. Alternative definitions of a voyage could also be acceptable.

The basic expression for EEOI for a voyage is defined as:

$$EEOI = \frac{\sum_j FC_j \times C_{Fj}}{m_{cargo} \times D} \quad (1)$$

Where average of the indicator for a period or for a number of voyages is obtained, the Indicator is calculated as:

$$\text{Average EEOI} = \frac{\sum_i \sum_j (FC_{ij} \times C_{Fj})}{\sum_i (m_{cargo,i} \times D_i)} \quad (2)$$

where:

j is the fuel type,

i is the voyage number,

FC_{ij} is the mass of consumed fuel j at voyage i ,

C_{Fj} is the fuel mass to CO₂ mass conversion factor for fuel j ,

m_{cargo} is cargo carried (tonnes) or work done (number of TEU or passengers) or gross tonnes for passenger ships,

D is the distance in nautical miles corresponding to the cargo carried or work done.

The unit of EEOI depends on the measurement of cargo carried or work done, e.g., tonnes CO₂ / (tonnes • nautical miles), tonnes CO₂ / (TEU nautical miles), tonnes CO₂ / (person • nautical miles), etc. It should be noted that Equation 2 does not give a simple average of EEOI among number of voyage i . Rolling average, when used, can be calculated in a suitable time period, for example one year closest to the end of a voyage for that period, or number of voyages, for example six or ten voyages, which are agreed as statistically relevant to the initial averaging period. The Rolling Average EEOI is then calculated for this period or number of voyages by Equation 2 above (Seah, 2009; Cooper, Gustafsson, 2017).

2.3. Monitoring System

The monitoring system, including the procedures for collecting data and the assignment of responsible personnel are described below:

1. Data collecting procedure: Calculation of fuel consumption shall be on a daily basis and entered into the Engine Room Log Book. Data collection (vessel speed, position, weather condition shall be on a daily basis by entering data into voyage log.
2. Reporting procedure: Voyage data collected by the above process shall be submitted to the Company after completion of every voyage. From the calendar year 2019, each ship of 5,000 gross tonnage and above shall collect the data specified in appendix IX to the Annex VI of MARPOL, for that and each subsequent calendar year or portion thereof, as appropriate, according to the methodology included in the SEEMP.
3. Setting Targets: The purpose of setting targets is to serve as a signal which involved people should be conscious of, to create a good incentive for proper implementation, and then to increase commitment to the improvement of energy efficiency. It shall be a specific target of Energy Efficiency Operational Indicator (EEOI). Comparison of obtained EEOI with determined the Target EEOI giving answer how effective is SEEMP implemented on particular vessel. Responsible person to determine Target EEOI is Company Management Representative

2.4. Self-Evaluation and Improvement

Self-evaluation and improvement is the final phase of the management cycle. This phase should produce meaningful feedback for the coming first stage, i.e. planning stage of the next improvement cycle. The purpose of self-evaluation is to evaluate the effectiveness of the planned measures and of their implementation, to deepen the understanding on the overall characteristics of the ship's operation such as what types of measures can/cannot function effectively, and how and/or why, to comprehend the trend of the efficiency improvement of that ship and to develop the improved SEEMP for the next cycle (Ship..., 2008; Ship..., 2009).

Self-evaluation on board for Energy Efficiency shall be done during Committee Meeting as described below:

Time of Evaluation: January, April, July and October (Every Quarter).

Opportunity: Shipboard Management Committee Meeting.

Chairman: Master.

Participants: Deck and Engine Officers, as minimum.

Agendas:

- Evaluation of achieved EEOI against the Target.
- Trends of achieved EEOI in passed year and the evaluated period.
- Comparison with the Best Practices that will be provided by the Company.
- Evaluations of the achievements on the vessel plan (Measures).

- Evaluation what types of measures can/cannot function effectively, and and/or why.
- Develop the improved SEEMP for the next cycle

Recording: Record of the Self-Evaluation shall be recorded.

3. Planning for measures to improve EEOI

Planning is the most crucial stage of the SEEMP, in that it primarily determines both the current status of ship energy usage and the expected improvement of ship energy efficiency. It is important to establish ship specific measures. Below mentioned subjects to be taken into consideration.

1. Recognizing that there are a variety of options to improve efficiency – speed optimization, weather routing and hull maintenance, for example – and that the best package of measures for a ship to improve efficiency differs to a great extent depending upon ship type, cargoes, routes and other factors, the specific measures for the ship to improve energy efficiency should be identified in the first place. These measures should be listed as a package of measures to be implemented. The overview of the recommended actions is listed in after-mentioned matrix as “Best Practices”.
2. During this process, therefore, it is important to determine and understand the ship’s current status of energy usage. The SEEMP then identifies energy-saving measures that have been undertaken, and determines how effective these measures are in terms of improving energy efficiency. The SEEMP also identifies what measures can be adopted to further improve the energy efficiency of the ship.
3. Guidance on Best Practices for Fuel-Efficient Operation of Ships set out in the matrix below can be used to facilitate this part of the planning phase (Ship..., 2009; Josi, 2021).

The improvement of energy efficiency of ship operation does not necessarily depend on single ship management only. Rather, it may depend on many stakeholders including ship repair yards, shipowners, operators, charterers, cargo owners, ports and traffic management services. The better coordination among such stakeholders is, the more improvement can be expected. In most cases, such coordination or total management is better made by the Company rather than by a vessel. The SEEMP (On Shore) is established to manage the fleets and make necessary coordination among stakeholders, etc. (Finnley, 2018; Smith, 2020; Josi, 2021).

For effective and steady implementation of the adopted measures, raising awareness of and providing necessary training for personnel both on shore and on board are an important element. Such human resource development is encouraged and should be considered as an important component of planning as well as a critical element of implementation.

3.1. Measures –Best practice guideline

Effective measures to be implemented in the various area of ship operation. In this chapter example of the measures is presented. Specific measures applied on board the vessel can be different and are not limited to measures given in the presented example (Mikulski, 2015; Danney, 2017; Finnley, 2018; Smith, 2020; Josi, 2021).

1. Voyage Planning

Vessel to optimise route plan by “avoid bad weather” or “strong adverse currents” while also maximising the use of “tidal streams” and “ocean currents”.

The above aspects shall be determined within the limitations of traffic separation scheme and safe navigation in line with the guidelines described in the publication of “Bridge Team Management (basis IMO Guideline for Voyage Planning (Ship..., 2008). Second Officer is responsible for Voyage Planning under supervision of the Master.

2. Weather Routing

Utilizing and, to monitor the weather and Hydrographic forecast and incorporate this data into the voyage plan. The Master is responsible for utilizing the weather routing.

3. Just in Time (Ship-Shore liaison)

Vessel should actively liaise with the operator/charterer/local agents/port authority to confirm required voyage schedule and set optimum speed under approval of the operator taking an appropriate safe margin into account. The Master is responsible to actively liaise with the operator/charterer for voyage schedule.

4. Speed Optimisation

The Master is responsible to optimise vessel speed Vessel to optimise the speed, where practical, maintaining the most fuel efficient speed to minimise total fuel consumed throughout the entire voyage. Optimum speed means the speed at which the fuel used per tonne mile is at a minimum level for that voyage. It does not mean minimum speed (Ship..., 2008). The Master is responsible to optimise vessel speed.

5. Optimised Shaft Power

Main engine power to be limited to 85% of the Maximum Continuous Rating (MCR) and to 90% thermal load. Vessel to reduce any Unnecessary load whenever possible. Chief Engineer is responsible for not to exceed 85% MCR and to 90% thermal load. Vessel to operation at constant shaft RPM which can be more efficient than continuously adjusting speed through engine power. The Master and Chief Engineer is responsible to set appropriate RPM taking fuel efficiency into account.

6. Optimum Trim

Vessel to ensure the appropriate optimum trim. The optimum trim for the ballast passage should be tested and compared with other ballast conditions as per the procedure required by the Company. The Master and Chief Engineer is responsible to set appropriate RPM taking fuel efficiency into account.

7. Optimum Ballast

- Vessel to ensure adjusting Ballast taking into consideration on optimum trim and steering conditions and optimum ballast conditions achieved through good cargo planning. The Plan shall meet requirements of Ballast Water Management Plan. Chief Officer is responsible for cargo planning taking optimum ballast into account.
- Vessel to ensure that present ballast conditions does not have a negative impact on steering conditions and Auto-Pilot settings. Such condition may effect deterioration of fuel efficiency, as well as the safe navigation. The OOW (officer on watch) is responsible to constant monitoring on steering and Auto-Pilot conditions and report to the Master of any negative influence. The Master is responsible to verify steering and Auto-Pilot condition and does necessary adjustment on ballast or setting Auto-Pilot.

8. Optimum use of Rudder and Heading control systems (Autopilots)

Master and Officer on watch are responsible for this measures:

- Vessel to ensure, when navigating open sea without obstruction for safe navigation, maintaining position on the course line through a close position check on “ECDIS” and the other available means.
- Vessel to ensure that the setting of Auto-Pilot is optimised considering the situation around. Especially, when the vessel is navigating open sea without obstruction for safe navigation, set in “Economical mode” as far as practicable.
- Vessel to ensure that the action to avoid a vessel is to be in ample time to avoid close-quarter situation. It is not only for the safety but also fuel efficiency, avoiding a quick load & changing engine revolution.
- Vessel to ensure changing over from Auto-Pilot to Hand-Steering in ample time when approaching to ports and confined waters. It is not only for the safety but also fuel efficiency, since the Auto-Pilot cannot always be used efficiently as the rudder has to respond quickly to given commands.
- Vessel to ensure changing over from Auto-Pilot to Hand-Steering at certain stage of heavy weather. This is not only the safety but also the fuel efficiency.

9. Maintenance General

Vessels to ensure number of outstanding tasks in Planned Maintenance System (PMS) are less then **1%** (Year to date). The Chief Engineer is responsible for PMS system with cooperation of Master.

10. Propulsion System Maintenance (Ship..., 2009)

Chief Engineer is responsible to consider additional measures to improve engine efficiency:

- Vessel to ensure Performance check of Main Engine to make sure a balanced output from all cylinders. The check shall take place which interval should not be less than 10 propelling days (or once per each Ballast and Laden voyages).
- Vessel to ensure optimizing Alpha Lubrication system by adjusting the feed rate according to the fuel quality.
- Vessel to ensure optimisation of Propulsion system using additional means to improve engine efficiency, which may include: use of fuel additives, adjustment of cylinder lubrication oil consumption, torque analysis, automated engine monitoring systems.

11. Waste Heat Recovery

Chief Engineer is responsible for this measures:

- Vessel to maintain the exhaust valves and associated piping system, etc. ensuring that the maximum amount of heat is recovered for steam and power generation.
- Vessel to ensure efficient operation of the main engine cooling water by the continued effective treatment of the cooling water to reduce scale, corrosion etc.
- Vessel to ensure efficient operation EGE by soot blowing, which minimum twice a day while at sea in the circumstance is permit.
- Soot blowing shall also be conducted, before entering and after sailing ports at an area where environmentally safe and ensure that the hot Water system is operated within the parameters required as per the SMS.

12. Energy Management

Chief Engineer is responsible for this measures:

- Vessel to inspect the insulation of the exhaust gas trunk and maintain it in good condition.
- Steam Systems (Saturated and Super-heated) Vessel to ensure that all piping continues to be maintained no leaking and insulated to retain temperature efficiency.
- Vessel to ensure the continued maintenance of the settling and service tanks etc. with particular regard to insulation, vent heads etc.
- Vessel to ensure that all piping with the insulation continues to be maintained in a satisfactory condition, able to maintain the set pressures.
- Vessel to record daily consumption, speed, vessel condition (laden or ballast), weather, sea state and wind direction into voyage record.
- Vessel to calculate on a daily basis the % power and thermal load compared to that at the MCR.

13. Improved Fleet Management

Vessel should hold Energy Efficient review committee at quarterly basis (Jan., Apr., Jul., and Oct.) for the following items. The Master is responsible to chair the committee and final evaluation.

14. Fuel Management

Vessel to ensure management of fuel on board in optimum operational condition in accordance with the Company “Fuel Management Procedure” to minimise sludge production” and “keep the plant in optimum operational condition”. Vessel to accurately measure Fuel consumption of Main Engines, Boilers and Auxiliaries and record. Chief Engineer is responsible to maintain fuel on board in optimum condition.

15. Power Generator Optimisation

Chief Engineer is responsible for this measures.

- Vessel to utilize the diesel generator(s) at their optimum load, minimizing low load operation as much as possible.
- Vessel to ensure Performance check of diesel generator engine to make sure a balanced output from all cylinders.
- Vessel to utilize the turbo generator as frequently as possible.

16. Training

Vessel to ensure awareness of crewmembers for efficient energy management using the SEEMP and the training materials. Awareness training shall take place before or after On board Management Committee Meeting. The Master is responsible for the awareness training.

4. Role of Seafarers in SEEMP

Seafarers play a crucial role in implementing the SEEMPs onboard ships and also in providing the feedback, reports, performance etc. to the shore office which is further used to enhance the plan (Finnley, 2018; Smith, 2020). Following are some of the essential roles which a seafarer plays in SEEMP:

- Implementing the procedure as laid down in the SEEMP.
- Monitoring the performance of the SEEMP procedures and how it is affecting the ship operation.
- Collecting reports, and sending the logs, performance etc. to the company for evaluation.
- Establishing a safety and sustainability culture onboard ship to add to the energy efficiency of the ship.

- Efficiently managing the cargo operation when in port and maintaining the ship's machinery to avoid breakdown and delays to the shipping schedule.
- Implementing correct and modern navigation technique for the optimized voyage planning.

SEEMP is not a set rule of operations and it has to evolve in terms of providing better energy saving solutions than the previous ones. The improvisation of SEEMP highly depends on the different parties involved in the shipping operation such as Port operator, Ship owners, shipyard, ship managers, seafarers etc.

Authors of this paper are giving strong suggestion to Shipping Management Companies to simplify SEEMPs for better understanding the goals and possible results of its application on board the managed ships. Intensive training on the subject discussed for ships crew would be recommended. Through implementation of best practices to improve EEOI reduction of GHG emission from ships will take place.

5. Conclusion

1. Ship energy efficiency management plan (SEEMP) is a ship specific plan that provides a mechanism to improve the energy efficiency of a ship in a cost-effective manner.
2. If the ship uses some innovative technology that reduces the wastage of the mechanical energy produced or that increases the efficiency of the engines, the ship would be more energy efficient and hence will contribute towards lesser attained EEDI value.
3. When a vessel complies with requirements stated in MARPOL –Annex IV and resolutions MEPC, the ship obtains a certificate named “International energy efficiency certificate”.
4. The difference between these two terms EEDI and EEOI is that EEDI is the measure of energy efficiency of the ship by design and EEOI is the measure of how efficiently the ships are operated.
5. The concept of ship energy efficiency is related to the emission of CO₂ and reduction of GHG (green house gases)
6. Research done on board many sea-going vessel on SEEMPs gives an answer that ships crew is not well acquainted with that subject and there is still room for improvement.

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ANALYSIS OF HOT WORK PROCEDURES APPLIED ON BOARD SEA GOING VESSELS REQUIRED BY SAFETY MANAGEMENT SYSTEM

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Purpose: reasons for writing the paper is to present, the optimal procedure to manage specific critical job as hot work on board sea going vessels.

Design/methodology/approach: an analysis of various shipping companies safety management systems and requirements demanded to perform hot works.

Findings: found that safety management systems and demands to perform hot works are varied between shipping companies.

Research limitations/implications: management of specific high risk job as hot work to be unified.

Practical implications: suggestion is given to unify procedures of hot work management

Social implications: reduction of risk to happen undesired events and mitigations of hazards associated with hot work.

Originality/value: recommendation to shipping companies for modification of safety management system where is necessary to improve safety on board.

Keywords: safety management system, hot work, hot work management.

Category of the paper: research and viewpoint paper.

1. Introduction

The International Safety Management Code (ISM) in its current form was adopted in 1993 by resolution A.741(18) and was made mandatory with the entry into force, on 1 July 1998. In the 1994 to the SOLAS Convention has been amended and introduced a new chapter IX into the Convention. The ISM Code provides an international standard for the safe management and operation of ships at sea (Konwencja SOLAS..., 1998; Lloyds Register of Shipping..., 2006; ISM Code IMO, 1998). The requirements of the ISM Code may be applied to all commercial ships over 500 GT. The ISM Code is a chapter in SOLAS. If SOLAS does not apply then ISM is not mandatory. Compliance with ISM Code is sometimes required by vessel client regardless

of Gross Tonnage (GT). The purpose of the ISM Code is **to ensure safety at sea and prevent damage to property, personnel and environment** (ISM Code IMO, 1998).

In order to comply with the ISM Code, the Company operating the vessel has to be audited first after they submit their Safety Management System Manual (SMS) and is approved by Flag Administration or Recognized Organization as Classification Society. Once a Company is Audited, the Document of Compliance (DOC) will be issued (validity 5 years). Every Company is subject to auditing every year (three months before and after anniversary date and before DOC expiration date). Upon issuing DOC to Company (or Managing Company) each vessel can be audited to verify vessel compliance with ISM Code. Each vessel will be issued SMC (Safety Management Certificate) valid for 5 years and subject to verification of Compliance with ISM Code between second and third years of certificate validity (Lloyds Register of Shipping..., 2006).

Safety Management System Manuals consist of the following elements (Konwencja SOLAS..., 1998; ISM Code IMO, 1998):

- Commitment from top management.
- A top tier policy manual.
- A procedures manual that documents what is done on board the ship, during normal operations and in emergency situations.
- Procedures for conducting both internal and external audits to ensure the ship is doing what is documented in the procedures manual.
- A designated person ashore to serve as the link between the ships and shore staff and to verify the SMS implementation.
- A system for identifying where actual practices do not meet those that are documented and for implementing associated corrective action.
- Regular management reviews.
- Also, the ship must be maintained in conformity with the provisions of relevant rules and regulations and with any additional requirements which may be established by the company. Comments from the auditor and/or audit body and from the ship are incorporated into the SMS by headquarters.

Recognizing that no two shipping companies or shipowners are the same, and that ships operate under a wide range of different conditions, the Code is based on general principles and objectives, which include assessment of all identified risks to Company's ships, personnel and the environment and establishment of appropriate safeguards. The Code is expressed in broad terms so that it has a widespread application. Clearly, different levels of management, whether shore-based or at sea, require varying levels of knowledge and awareness of the items outlined. The cornerstone of good safety management is commitment from the top. In matters of safety and environment protection it is the commitment, competence, attitudes, and motivation of individuals at all levels that determines the end result.

Through an analysis of various safety management systems (Ship Management System – Shipping Company A (Europe), 2018; Ship Management System – Shipping Company B (Europe), 2020; Ship Management System – Shipping Company C (Europe), 2015; Ship Management System – Shipping Company D (Asia), 2017; Ship Management System – Shipping Company E (Asia), 2021) applied in shipping companies, the best management to perform specific critical job as hot work on board sea going vessels has been chosen and described in the paper. Authors had focused on management of hot work as recognized as high-risk task performed very often during seagoing vessels operation.

2. Safety Management System on board sea going vessels required by ISM Code

Safety Management System (SMS) should contain procedures and guidance for all persons aboard the Companies' vessels for the Safe Management of all operations, work and health control. SMS applies to all persons on board our vessels including any supernumeraries and shore management personnel. All Company personnel, both onboard and ashore shall be committed to achieving safety and environmental excellence. Senior Officers on-board and Managers ashore shall demonstrate their commitment by their behavior and through giving clear guidance and directions for achieving safety and environmental excellence. They shall lead by example, set precedents for others to follow and demonstrate leadership at every level. The Management Shipping Company is responsible for implementation and application SMS should by all means reinforce efforts towards Safety and Environmental excellence by individuals and ships crew on board managed vessels (Konwencja SOLAS..., 1998; ISM Code IMO, 1998; Standard OHSAS 18001:2007; British Standards No. 4778).

2.1. Shipboard Safety Committee

In order to have Safe Shipboard operations and activities, in compliance with all applicable Safe Working Practices and with due regard to Pollution Prevention requirements, Company establishes the Safety and Health Committee on board. The Committee is established to hear opinions of crew members regarding Safety and Health, maintain and improve working and sanitary environment, and for prevention of accidents. Safety Meetings are not to be used for the purpose of training or instructions. The Shipboard Safety and Health Committee Meeting is the pre-meeting for the Shipboard Maintenance & Review Committee (ISM Code IMO, 1998; British Standards No. 4778).

Members of the Committee are: Master as a Chairman and all officers, engineers and crew (except those on duty). Safety Committee meeting:

- The Safety and Health Committee meeting shall be held once a month.
- The Chairman should hold an extraordinary committee meeting whenever requested by the Safety or Medical officer or when deemed necessary.
- Occasional Meeting.

Occasional Safety and Health Committee meeting shall be held as soon as possible and within 24 hours after any serious accident or incident on board the vessel. Personnel and vessel safety, port call, expected visitors and Media control must be discussed in this meeting. If the vessel receives any Company information regarding a serious incident or accident within the group, a Safety meeting must be held at the first opportunity and not later than 72 hours of receiving the information. The following topics should be discussed among others:

- Risk assessment for the possibility of recurrence or similar situation on board.
- Preventive measures to avoid similar accident/incident.
- Lessons learnt from the incident.

Agenda of the Committee and following points should be among those discussed (Ship Management System – Shipping Company A (Europe), 2018; Ship Management System – Shipping Company B (Europe), 2020; Ship Management System – Shipping Company C (Europe), 2015; Ship Management System – Shipping Company D (Asia), 2017; Ship Management System – Shipping Company E (Asia), 2021):

- Minutes of the previous meeting must be read and progress on items stated. Outstanding items must be indicated with their expected completion dates.
- Broadcast Messages, Marine Notices, Information sharing or other information received from the Company. The reference numbers of messages discussed must be recorded.
- Any Non-conformity, Potential Hazards, unsafe acts or Accident found/occurred on board and their Preventive measures/Corrective measures.
- Requirements towards Ship's Security.
- Findings from Safety Officers Inspection and corrective actions.
- Findings from Health & Sanitary Inspection and corrective actions.
- Requirements for Critical Passages, port calls or operation
- Preparations towards upcoming Audits, Vetting or Inspections.
- Results of any Audits, Vetting or Inspections done.
- Safety procedures, correct work practices and precautions towards use of onboard equipment or non-routine jobs and hazards.
- Appointment of ratings as Crew Safety Representatives who will accompany the Designated Safety & Pollution prevention Officers on their rounds. One member from the Deck/Galley and one from the Engine department must be nominated for the month. The names of the nominated personnel must be recorded.

- Pollution Control – Bunkering/Transfer, Garbage, Ballast & Sediment Control, Smoke/Vapor emissions & Control.
- Proposals from Crew/Safety & Pollution prevention officers/Medical Officer towards improving health, safety, work & hygiene environment on board and any newly identified hazards.
- Hot work procedures.
- Hazardous work areas, working aloft, enclosed spaces etc.
- Review of Drills carried out.
- Review of Compliance with ISM and Company's requirements on board.
- Permit to work System, Work meetings, Training, Drills etc.
- Other subjects as may be required.

The Master shall report the contents of all discussion to the Company after the required signatures have been endorsed.

2.2. Tool Box Meeting

Tool Box Meeting is purposed to ensure the safety of work for the day and improve working efficiency (ISM Code IMO, 1998; Standard OHSAS 18001:2007; British Standards No. 4778).

Interval/place of the Meeting: Every Morning at 07:45 ship's time in principle at the place where specified by the Head of Department. Members of the meeting are: Head of respective departments and all crew concerned. During Tool Box Meeting topics to be discussed:

- Instruct the crew using Daily Work Plan to confirm assignment & procedure.
- Applicable Company Check Lists to be used.
- Working clothes and protective outfits to be checked.
- Discuss and confirm the Personal Protective Equipment to be used for all the jobs planned for the day.
- Check and preparation of equipment and tools to be used and appointment of persons to handle the equipment.
- Safety precautions for jobs to be highlighted as applicable.
- Confirmation of communication method between supervisors and workers and between workers themselves.
- Risk Assessment for the jobs by brainstorming and determine the necessary precautions, if required.
- Other matters necessary to conduct the work safely.
- Any doubts concerned planned job to be clarified and strictly explained.

2.3. Morning Meeting

Morning Meeting is purposed to ensure the safe working requirement, highlight any risks associated with the intended jobs and to confirm process of the works (Lloyds Register of Shipping..., 2006; Standard OHSAS 18001:2007).

Interval/Place of the Meeting: every Morning at 10:00 ship's time in principle at ship's office Member of the Meeting are all vessel's officers at management level.

Topics to be discussed:

- Review of the works carried out on the previous day.
- The work scheduled for the next day and requirements for same in reference to Monthly Work plan from Planed Maintenance System.
- Confirmation of the Special works that the Work Permit and/or Risk Assessment are required, identification of hazards, requirement for equipment. In case of any hazards identified which cannot be safely rectified on board, they must be reported immediately to the Company and any associated work processes totally discontinued. The situation must be fully assessed by the Company and the vessel and procedures agreed prior to continuing the operation.
- The Permit to Work shall be prepared for the special works and approved by the Master and the Safety Officer if acceptable.

3. Hot work procedures

Hot Work is any work which may generate high temperatures or produce an incentive spark, involving Welding or Burning, any other work including certain drilling, chipping and grinding, operations using any mechanical tools, equipment driven by an internal combustion engine or electrical work and the use of non-intrinsically safe electrical equipment – lamps or torches, which might produce and incendiary spark. Hot Work should only be considered if there are NO practical alternate means of repair. Hot Work should be carried out only after the following precautions have been observed and confirmed (Ship Management System – Shipping Company A (Europe), 2018; Ship Management System – Shipping Company B (Europe), 2020; Ship Management System – Shipping Company C (Europe), 2015; Ship Management System – Shipping Company D (Asia), 2017):

- The work area should not be subjected to vapor release, or a concentration of combustible vapors, and should be free of combustible material.
- The area should be gas free and tests with a combustible gas indicator should give reading of not more than 1% LFL.
- There must be no cargo operation, bunkering, tank cleaning, and gas freeing purging or inerting operations in progress. Vessel must not be at a terminal or port.

- Adequate fire-fighting equipment must be laid out and ready for immediate use.
- For grit blasting, the hopper and nozzle must be electrically bonded to the deck or fitting being worked upon.

Authors of this paper performed analysis of Hot Work procedures applied in many Shipping Management Companies and found that procedures are not the same. Management Companies have different procedures and approach to this high risk job. The best practices to perform safe Hot Work on board sea going vessels has been presented below as example. That procedures can be easy applied where is necessary to improve standards of safety.

3.1. Hot Work within designated spaces

Engine Room workshop is usually designated as Hot Work space. The person responsible for Hot work within the Engine room workshop is usually the First Engineer. The workshop should be assessed for Risks and the conditions under which the Hot Work can be undertaken must be specified. Instructions stating conditions and precautions for Hot Work should be posted in the designated space. These instructions may be issued by the Chief Engineer. Hot Work in the designated space must be authorized by the Chief Engineer or the First Engineer. The responsible officer must confirm that the conditions are as specified in above, prior to granting permission. No separate Hot Work permit or company permission is required for Hot work within the designated space subject to the above requirements being satisfied and the area confirmed safe for Hot Work (Ship Management System – Shipping Company C (Europe), 2015; Ship Management System – Shipping Company D (Asia) 2017).

NO Hot Work is permitted in any area of the vessel, including the designated area during cargo, ballast, tank cleaning, gas freeing, purging, bunkering or inerting operations.

3.2. Hot work outside designated space

If the Hot work outside the Engine Room Workshop is required, the Master and the Company shall take the following process/confirmation in advance.

The Master should decide weather the use of Hot Work is justified and whether it can be safely undertaken, and no viable means of repair exist other than Hot Work. The Master shall report the situations and the plan of the works to the Company in detail for approval.

The Master shall submit:

- Hot Work Permit.
- Details of the work in particular.
- Safety measure to be taken.
- Risk Assessment.
- Consideration should be given to only performing one hot work operation at a time, due to the resource limitations usually present onboard. A separate permit should be approved for each intended task and location.

- A written plan for undertaking the work should be completed, discussed and agreed by all who have responsibilities in connection with the work. This plan should define the preparations needed before work commences the procedures for actually carrying out the work and the related safety precautions. The plan should also indicate the person authorizing the work and the people responsible for carrying out the specific work, including contractors if appropriate.
- A Responsible Officer, who is not directly involved in the Hot Work, must be designated for Safety checks and to ensure that the plan is followed. Fire safety precautions and fire extinguishing measures should be reviewed. Adequate fire-fighting equipment must be prepared and laid out and be ready for immediate use. Safety Officer must check the work site personally.
- Fire watch procedures must be established for the area of hot work, and in adjacent, non Inerted spaces where the transfer of heat, or accidental damage, may create a hazard, e.g. damage to hydraulic lines, electrical cables, thermal oil lines, etc. the fire watch should monitor the work and take action in case of ignition of residues or paint coatings. Effective means of containing and extinguishing welding sparks and molten slag must be established.
- A separate risk assessment should be carried out regarding the needs for personal protective equipment and the means of evacuation of the fire watch personnel in an emergency. The risk assessment must also address the requirement, if any, for additional PPE required to ensure Risk levels are acceptable.
- A meeting to be held before hot work commencement and Master or his Responsible Officer shall notify following items to all concerned:
 1. General Precautions for handling of fire.
 2. Details of hot work.
 3. Appointment of a responsible person for the work and procedure for a safety check.
 4. Communication procedures.
 5. Measures against emergency.
 6. Crew who are not engaged in the Hot Work shall also be notified.
 7. Isolation of the work area and fire precautions should be continued until the risk of fire no longer exists.
 8. Personnel carrying out the work should be adequately trained and have the competency required to carry out the proposed job.
 9. The atmosphere of the area should be tested and found to be less than 1% LFL. The work area must be adequately and continuously ventilated and the frequency of atmosphere monitoring must be established.
 10. The hot work permit should be issued immediately before the work is to be performed. In the event of a delay to the start of the work, all safety measures should be re-checked and recorded before work actually commences.

11. If the conditions, under which the permit has been issued, should change, hot work must stop immediately. The permit should be withdrawn or cancelled until all conditions and safety precautions have been checked and re-instated to allow the permit to be re-issued or re-approved.
12. When alongside a terminal, hot work should only be permitted in accordance with prevailing national or international regulations, port and terminal requirements and after all necessary approvals has been obtained.
13. The Master and the Company shall verify whether intended hot work may be carried out in accordance with prevailing national or international regulations and/or port/terminal requirements.
14. The Company may consider permitting the hot work by verifying the planned hot work is justifiable, on the extent of the precautions necessary.
15. If the Company, after internal discussion with the requisite staff, permits the Hot Work, the confirmation of approval shall be notified to the Master by e-mail or by phone in case of after office hours.

The Flow Chart and Guidance Chart has been presented on Figure 1 and Table 1 should be consulted as a guide towards Hot Work requirements.

3.3. Hot work in dangerous or hazardous areas

For ships the dangerous or hazardous area effectively means the cargo tank deck or cargo deck areas, the cargo tanks or cargo holds and pump rooms and the atmospheric space around and above them. No Hot Work should be undertaken in a dangerous or hazardous area until it has been made safe, and has been proved to be safe, and all appropriate approvals have been obtained. Any Hot work in a dangerous or Hazardous area should be subject to a full Risk Assessment and the guidelines in section 3.2 of this part must also be followed. For Oil Tankers Hot Work in Dangerous or Hazardous areas is prohibited during laden passage and can only be allowed when the ship is in ballast. For LPG vessels Hot Work in dangerous or hazardous areas is prohibited during laden and ballast passages. No Hot Work is permitted in any area of the vessel, during cargo, ballast, tank cleaning, gas freeing, purging, bunkering or inerting operations.

3.4. Hot work in enclosed spaces

Where hot work involves entry into an enclosed space, the procedures outlined in SMS for enclosed space entry should be followed. Procedures given in Figure 1 (hot work flow) shall be followed. An enclosed space which hot work is to be undertaken shall be:

- Cleaned and all sludge or substances likely to give off flammable vapor shall be removed around the area of hot work. Particular attention should also be given to the condition of any adjacent spaces.

- Ventilated until the atmosphere reaches 21 % Oxygen content and less than 1 % LFL.
- Be continuously ventilated throughout the Hot Work.
- Adjacent Fuel Oil Bunker tanks may be considered safe if atmospheric tests give readings of less than 1% LFL in the vapor space of the bunker tank.

3.5. Hot work in Cargo Tanks

All sludge, cargo-impregnated scale, sediments or other material likely to give off flammable vapor, should be removed from the work area. The extent of the cleaned area should be established following a risk assessment of the particular work to be carried out. Special attention must be given to the reverse side frames and bulkheads. Other areas that may be affected by the hot work, such as the area immediately below the work location, should also be cleaned. The Table 1 provides guidance on the safe distance for areas to be cleaned and presents minimum requirements which may need to be extended, based on the output of the risk assessment. Cleaning distances are based on the type of work being carried out and the height above the tank bottom. Cleaning is taken to mean the removal of all sludge, cargo impregnated scale, sediments or other material likely to give off a flammable vapor.

4. Best practices to manage Hot Work procedures

In order to safely perform Hot Work on board the sea going vessels following procedures to be strictly followed:

- Details of hot work to be strictly described as presented on given example on Fig. 2 and Fig. 3.
- Hot Work Flow Chart – Fig. 1 and Hot Work Requirement Table – Tab. 1 to be followed.
- Risk Assessment and its Management to be performed as shown on example on Fig. 6.
- Safety measures to be applied during the work as presented on given example.
- Fire plan and escape routes to be marked as shown on example – Fig. 4.
- Hot Work Permit to be obtained as presented on example shown on Fig. 5.
- All planned procedures applied to accomplish successfully Hot Work to be followed very strictly.
- Proper manpower management to be applied all the time during performing Hot Work.

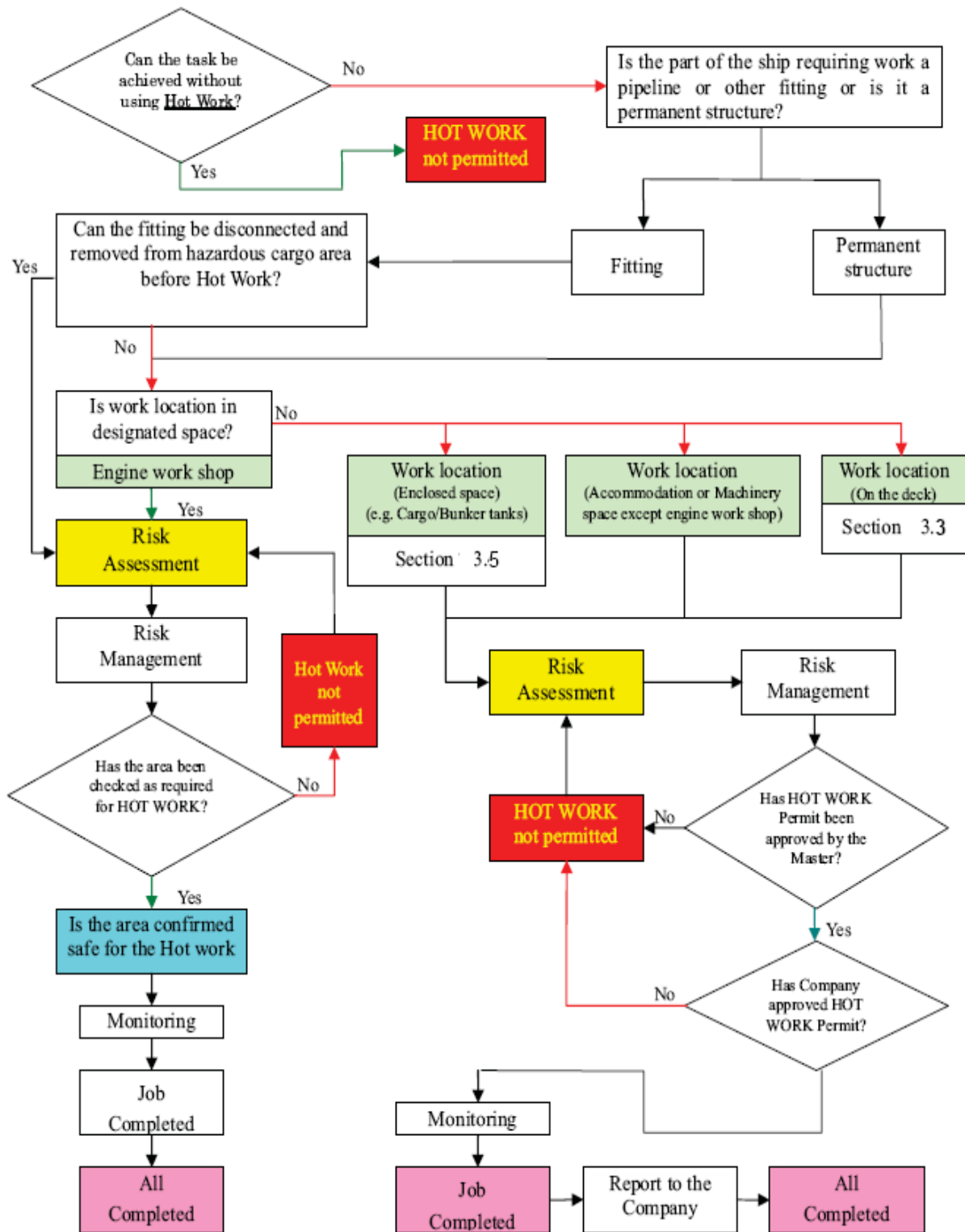


Figure 1. Hot Work Flow Chart. Source: Ship Management System – Shipping Company D (Asia) 2017; Ship Management System – Shipping Company E (Asia) 2021.

Table 1.
Hot Work requirements table

Work Location -----	ER Workshop	Other parts of non-hazardous area	Open deck aft of accommodation	In Cargo Tanks	Painting or Structure in tank <500 mm from adjacent Cargo Tank bulkhead	On cargo tank deck painting Structure within 500 mm from deck	Work on structures on the main deck area > 500 mm above the cargo tank deck	Work on any cargo-related pipe lines inside a cargo tank incl. heating coils	Cargo Pump room	In Ballast tanks, cofferdams or Voids
Work in designated space with shield or curtain erected.	✓									
Adequate ventilation.	✓	✓		✓				✓	✓	✓
Confirmation from Master / CE or designate that work is OK to proceed.	✓									
Hot work permit issued in agreement with Company		✓	✓	✓		✓	✓	✓	✓	✓
Hot work permit approved by Master or Responsible Officer.		✓	✓	✓		✓	✓	✓	✓	✓
Atmosphere checks carried out.		✓	✓	✓		✓	✓	✓	✓	✓
Enclosed Space entry Permit issued				✓				✓	✓	✓
Tank to be washed and gas freed.				✓		✓		✓		
Adjacent Cargo Tank to be washed and Gas Freed.					✓					
Cargo tanks within 30 mtrs purged to below 2% HC by vol & Inerted to < 8% O ₂				✓		✓	✓	✓	✓	✓
Work to be carried out >500 mm from the Cargo tank deck or bulkheads.				✓			✓	✓	✓	✓
Work to be carried out >500 mm from a F.O. tank deck or bulkheads.			✓	✓		✓	✓	✓	✓	✓
Local cleaning to be carried out as per requirements.				✓				✓	✓	✓
All inter-connecting pipelines flushed and drained.				✓				✓	✓	
Tank valves isolated and Locked out.				✓				✓	✓	✓
Work planning meeting to be held and risk assessment completed.	✓	✓	✓	✓		✓	✓	✓	✓	✓

Source: Ship Management System – Shipping Company D (Asia) 2017; Ship Management System – Shipping Company E (Asia) 2021

Example of DETAILS OF THE WORK (with ships nomenclatures and names)

- Job scope: Hot work, Eng. Room bottom floor STB side aft, SO_xEGCS overboard sections of pipes Fwd and Aft to be cut out, renewed sections of pipes to be welded in place. Gas Cutting and Arc Welding piping is planned on 02/Oct/2021 from 08:00LT – 24:00LT.



Area of Hot Work

Figure 2. Forward SO_x EGCS overboard pipe.



Area of Hot Work

Figure 3. Aft SO_x EGCS overboard pipe.

- Job planned to be carried out: 02/Oct/2021.
- Tool Box Meeting Crew & Subcontractors to be performed prior the job commenced.
- The vessel will be in Ballast condition, **3 m** trim by ahead. Sea water overboard outlets will be over water line.
- All COT's are inerted, oxygen content less than 5.0%, pressure released to avoid accidental pressure release.
- Insulation from underneath to be removed (photo attached).

- Cutting points cleared from paint and dirtiness prior the work.
- All necessary permits submitted Company Management for approval. Permission to perform hot work to be obtained before commencement of job.
- Company Management will be informed prior job is commenced and after the job is completed.
- Hot Work Permit, Subsequent Gas check record, Cold Work Permit, Risk Assessment.
- Vessel will take all safety precaution for carrying out hot work in the areas as per ISGOTT and Company SMS guidelines.
- Work will be conducted according to procedure for HOT WORK OUTSIDE DESIGNATED SPACES.
- All appropriate Personal Protective Equipment to be used. 1A/E in charge to ensure compliance as per PPE matrix. The individuals performing hot work should wear clothing which should be free of grease and oil and other flammable substances. During welding he must wear welding shields or welding goggles with appropriate shade.
- Person assisting/supervising the work should also wear suitable eye protection to protect them from particles of hot metal and slag, and their eyes and skin from ultra-violet and heat radiation.
- Atmosphere to be checked for explosive gasses frequently. Personal gas detectors to be hold by persons involved in hot work.

Example of SAFETY MEASURES DURING THE WORK

- Adjoining spaces will be monitored by fire patrol by engine crew.
- Fire hoses will be rigged, Fire-fighting equipment shall be in state of readiness Fire Pump will be in operation, Charged Fire hose and Fire extinguisher (dry powder) will be standing by, ready use at the scene of Hot-work.
- Foam system for engine will be on stand-by.
- Fresh water hose will be rigged as additional measure. Fire blanket also kept in near vicinity.
- Warning notice will be posted at work area. Welding cables & cable connections to be checked for insulation. Connection of cables should be done in gas free space. During any break welding or hot work equipment to be turned off. Work area to be dry. If chance of rain work to be suspended.
- Main Fire pump will be kept running till it is ascertained that there is no chance of ignition.
- Monitor weather conditions during the Hot-work. If weather deteriorates hot work to be terminated. If required adjust the heading of the vessel.
- Monitoring for hot spots from underneath.

- Extra ventilation to be provided in Hot work area.
- After job completion area to be monitored for hot spots, tools withdraw, area cleaned, relevant forms signed, SI in charge advised.
- Resource Management will be applied, work and rest hours monitored.
- No Ballasting, Tank Cleaning, Gas Freeing, Purging, or IG operations will not be performed during Hot work.

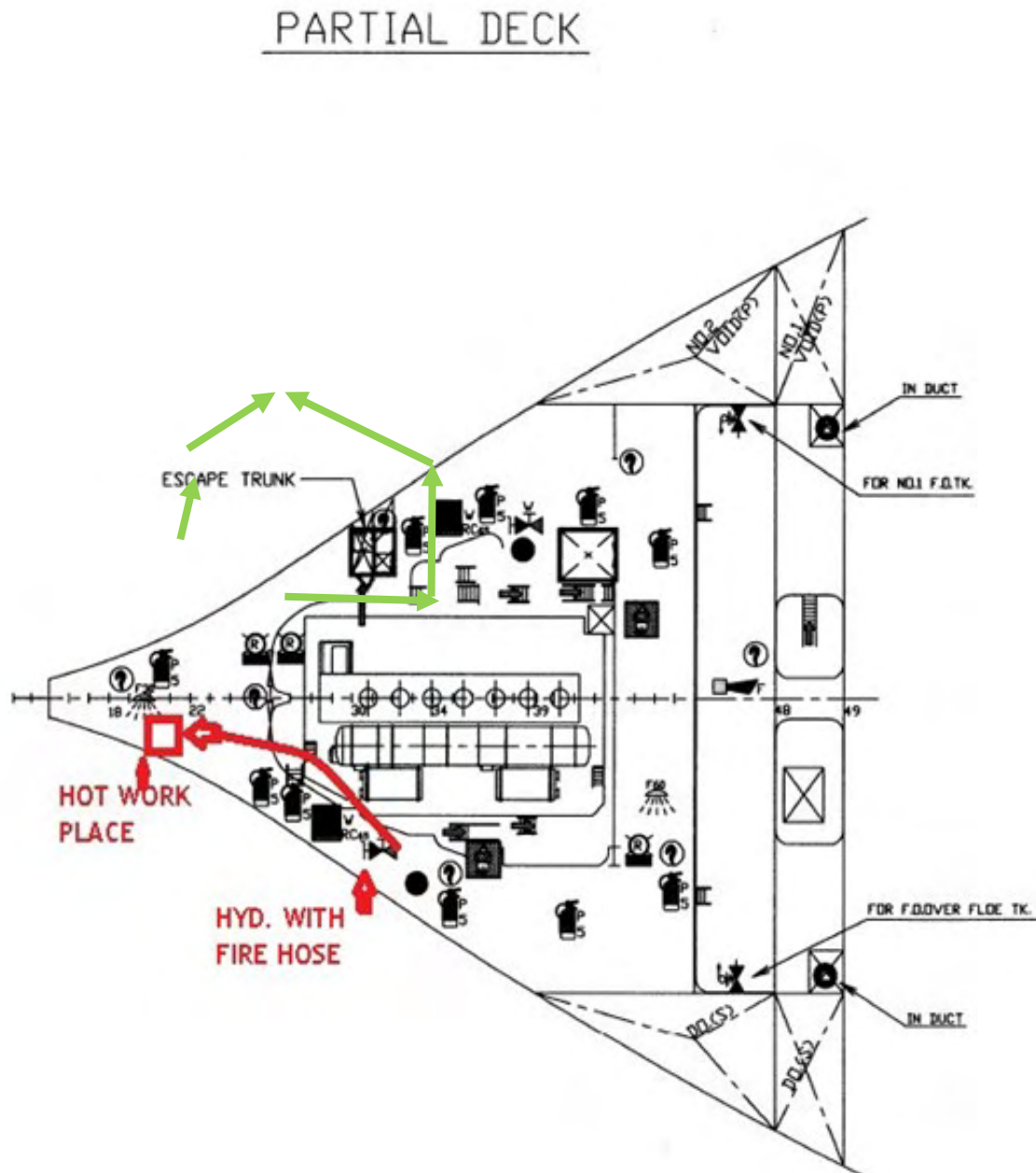


Figure 4. Example of Fire plan and Escape Roots.

HOT WORK PERMIT

Sections 1 & 2 of the Permit must be manually completed.

VESSEL M/T XXXX Reference No: 45654

This permit to work relates to any work involving temperature conditions which are likely to be of sufficient intensity to cause ignition of combustible gases, vapours or liquids in or adjacent to the area involved. Before completing this form, refer to the accompanying guidance notes, relevant section of the latest edition of International Safety Guide for Oil Tankers and Terminals, & Safety Management System - On Board Procedures (OBP), for Hot Work requirements. Company permission must be obtained and a Risk assessment done for Hot work outside the designated space.

IMPORTANT

(Hot Work Permit must be prepared in triplicate copies - Original must be displayed at the hot work site, duplicate in Bridge/Cargo Control Room, triplicate in Ship's file)

- | | | |
|---|---|-------------------------------|
| 1. Validity of the Permit | From <u>12/05/22 @ 10:00 LT</u> | To <u>12/05/22 @ 15:00 LT</u> |
| 2. Location of hot work | <u>E/R bottom floor Aft/Stbd side</u> | |
| 3. Description of work | <u>overboard pipe to be welded, found pinhole</u> | |
| 4. Personnel carrying out the job | <u>Engine crew</u> | |
| 5. Person in-charge of Hot Work | <u>I A/E X XXXX</u> | |
| 6. Independent Responsible Officer for checks | <u>C/E Y.YYYY</u> | |

Section 1: These checks must be done prior seeking Office approval & prior Issuance of Permit.

- 1.1 Has the hot work area been checked with a combustible gas indicator for Hydrocarbon Vapours and it is less than 1% LEL.
- | | | | | |
|------------------------------------|---|----------------|--|--|
| Checks for Office Approval: | DATE / TIME CONFIRMED <u>11/05/2022 16.30LT</u> | % LEL <u>0</u> | | |
| Checks for Permit Issuance: | DATE / TIME CONFIRMED <u>12/05/2022 09.40LT</u> | % LEL <u>0</u> | | |
- 1.2 Has the surrounding area been made safe?
 Date / Time: Prior Office permission: 11/5/2022 Prior Issuance 12/05/2022

Section 2

- Strike out what is not applicable.*
- | | | | | |
|----------------------|---|--------------------------------------|--------------------------------------|---------------------------------------|
| 2.1 | Has company approval been obtained ? | <input checked="" type="radio"/> YES | <input type="radio"/> NO | <input type="radio"/> N.A. |
| 2.2 | Has a Risk Assessment been done and is acceptable? | <input checked="" type="radio"/> YES | <input type="radio"/> NO | <input type="radio"/> N.A. |
| 2.3 | Has the Equipment or Pipeline been gas freed ?
or completely filled with water ? | <input checked="" type="radio"/> YES | <input type="radio"/> NO | <input checked="" type="radio"/> N.A. |
| 2.4 | Has the Equipment or Pipeline been blanked ? | <input checked="" type="radio"/> YES | <input checked="" type="radio"/> NO | <input type="radio"/> N.A. |
| 2.5 | Is the Equipment or Pipeline liquid free ? | <input checked="" type="radio"/> YES | <input type="radio"/> NO | <input type="radio"/> N.A. |
| 2.6 | Is the Equipment isolated electrically ? | <input checked="" type="radio"/> YES | <input type="radio"/> NO | <input type="radio"/> N.A. |
| 2.7 | Is the Surrounding area Safe ? | <input checked="" type="radio"/> YES | <input type="radio"/> NO | <input type="radio"/> N.A. |
| 2.8 | Is additional fire protection available ? | <input checked="" type="radio"/> YES | <input type="radio"/> NO | <input type="radio"/> N.A. |
| 2.9 | Has relevant section of the ISGOTT Guide & appropriate section in SMS manual read ? | <input checked="" type="radio"/> YES | <input type="radio"/> NO | <input type="radio"/> N.A. |
| 2.10 | Special conditions/ precautions
<u>Re-assesment of Risk to be done prior commencement of task</u> | | | |
| 2.11 | Has the hot work area been checked with combustible gas indicator for HC Vapours immediately prior to commencement of the hotwork ? | | | |
| (See Guideline No 8) | TIME CONFIRMED <u>12/05/2022 @ 09.40 LT</u> | % LEL <u>0</u> | | |
| 2.12 | Has the hot work area been checked immediately prior to the job by the responsible officer to ensure that all the requirements of | | <input checked="" type="radio"/> YES | |
| (See Guideline No 8) | TIME: <u>09.45 LT</u> | | | |

In the circumstances noted it is considered safe to proceed with this hot work.

Signed <u>Aaaaa</u>	Time : <u>09.55 LT</u>	Date <u>12/05/22</u> (Master)
Signed <u>Bbbbb</u>	Time : <u>09.50 LT</u>	Date <u>12/05/22</u> (Person in-charge of hot work team)
Signed <u>Ccccc</u>	Time : <u>09.45 LT</u>	Date <u>12/05/22</u> (Responsible Officer - safety checks)

Section 3

The work has been completed & all persons under my supervision, material & equipment have been withdrawn. (Do NOT Sign before completion.)

Authorized Person In-charge	Time	Date
Master		

Figure 5. Example of Hot Work Permit.

Name of Vessel: M/T xxxx
 Date: 17-Mar-04
 Reference: aaaaaaa

Detail of Work Activity:

WELDING ON E/R partial deck
Opened space - welding SOxEGCS
effluent water Pipe

Refer to 'Criteria of Risk' Sheet for guidance towards evaluation criteria		Likelihood				
		1: Unlikely	2: Possible	3: Quite Possible	4: Likely	5: Very Likely
Consequence	1: Negligible	Low Risk	Low Risk	Low Risk	Medium Risk	Medium Risk
	2: Slight	Low Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk
	3: Moderate	Low Risk	Medium Risk	Medium Risk	Medium Risk	High Risk
	4: High	Medium Risk	Medium Risk	Medium Risk	High Risk	High Risk
	5: Very High	Medium Risk	Medium Risk	High Risk	High Risk	High Risk

All Risks must be made As Low As Reasonably Practicable (ALARP) before commencing the job

STAGE 1		1. RISK ASSESSMENT		2. RISK MANAGEMENT STAGE 1			
Sr. No	Routine or Non-routine work (R/NR)	Hazards Identified (Use HAZD-001)	Consequence	Existing safeguards	Risk Ranking		
		What can go Wrong? Hazard is something with the potential to cause harm. Three Questions to ask:- 1. Is there a source of harm? 2. Who (or what) could be harmed? 3. How could Harm occur?	What will happen due to the hazard? Consequence is the loss associated if the hazard happens.	[For Example] 1. Work Permit System - Specify which is applicable 2. Safety Checklists - Specify Checklist & use. 3. PPE - specify which all PPE will be used 4. Lock Out & Tag out System- specify what will be locked & tagged out and at which locations. 5. SMS Procedures - specify which procedures.	Consequence	Likelihood	Risk
1	N/R	Fatigue	Personal injury	personel involved should be well rested with requirements of STCW & MLC	Moderate	unlikely	Low
2	N/R	Lack of training in welding operations	personal injury, damage of property	trained welder aware of hazard involving hot work is to perform task with supervising senior officer	Moderate	unlikely	Low
3	N/R	Poor communications between individuals and lack of understanding procedures	Personal injury	Communications must be agreed between personel, pre job briefing to be carry out. Concept Take 5 to be used. Senior officer responsible for operation should brief all involved abt. precautions to safely complete the operation	High	unlikely	Medium Risk
4	N/R	Inadequate PPE/ safety equipment	Personal injury	Proper PPE to be worn by all personel involved (ref Company PPE requirements Annex 1), welder and assistant must use proper welder 's gear.	Moderate	unlikely	Low
5	N/R	Inadequate preparation of work lokation and adjoining spaces	personal injury, damage of property	The work site to be free from oil and oil residues. Surface area and adjoining space must be prepared in accordance with ISGOTT requirements	High	Possible	Medium Risk
6	N/R	Flamable materials in vicinity of the hot work lokation	personal injury, damage of property	All flammable materials including oil residues, chemicals, rags must be removed from site of hot work lokation	High	Possible	Medium Risk
7	N/R	Faulty arc welding equipment, cable and electrode holder	personal injury, damage of property	Prior and on completion of arc welding equipment must be inspected by senior officer for any damage	Moderate	unlikely	Low
8	N/R	Explosive atmosphere	personal injury, damage property	Atmosphere in work lokation must be continuously monitored by proper instruments	High	unlikely	Medium Risk
9	N/R	Welding flush and fumes , hot debris	Personal injury	Area to be kept well ventilated and outlets of smoke escape to be maintained. Hot debris to be extinguished by small water hose. After surface to be wiped.	High	Possible	Medium Risk
10	N/R	Hot surfaces/ hot spots	personal injury, damage property	Temperature of surfaces in vicinity of hot work to be monitored by infrared temp.gage on top and down under surface.	High	Possible	Medium Risk
11	N/R	In appropriate weather conditions	Personal injury	Work must not be carried out if weather condition are not suitable for the operation	Moderate	unlikely	Low
12	N/R	High ambient temperature at hot work place	Personal injury	Personel involved must make frequently brakes to drink water and get rest, back up personel to be designated.	Moderate	unlikely	Low

Stage 2		2. RISK MANAGEMENT STAGE 2		3. EXECUTION			For Non Routine Jobs: Have involved personnel understood the Risks and implementation of safeguards and measures? Enter details below.		
Sr No	Additional Safeguards	Residual Risk			Name	Rank	Signature		
		Consequence	Likelihood	Risk					
	What can be done about the hazards? Consider the following: 1). Removal of the Hazard. 2). Substitution of the Hazard - reduce the Likelihood 3). Mitigation of the Hazard - reduce the Consequence 4) Use a combination of technical & procedural controls. 5). Ensure emergency arrangements are in place.								
1 to 10	Hot work permit PRMT -003 & 003A to be issued and strictly followed	High	Unlikey	Low Risk	xxx	2A/E			
1 to 10	Company approval of hot work to be obtained	High	Unlikey	Low Risk	xxx	3A/E			
3	Tool box meeting to be performed to. All aspects of work to be discussed and clarified . Full specific informations to be given to OOW on Bridge	High	Unlikey	Low Risk	xxx	No.1 Oiler			
4	Senior oficer have to make inspection of PPE	Moderate	Unlikey	Low Risk	xxx	Oiler A			
5,6	Proper preparation of area of hot work to be inspected and accepted by senior officer	High	Unlikey	Medium Risk	xxx	Oiler B			
8,9	Area to be kept well ventilated, atmosphere to be permanently monitored	High	Unlikey	Medium Risk	xxx	Wiper			
10	Person designated to monitor hot spots to be cleary quided by senior officer	High	Unlikey	Medium Risk					
1 to 12	Person in charge of hot work operation have to apply proper management of work	Moderate	Unlikey	Low Risk					
Add 1	Portable fire fighting equipment to be standing by close to work place. Fire lines to be pressurised . Nozzles to be ready to use.	Moderate	Unlikey	Low Risk					
Add 2	Portable fire fighting equipment to be standing by close to work place. Fire lines to be pressurised . Nozzles to be ready to use.	Moderate	Unlikey	Low Risk					
Add 3	Emergency action to be discussed during tool box meeting . evacuation roots to be marked and all personel involved in hot work to be acquainted with	Moderate	Unlikey	Low Risk					

Recovery and Mitigation procedures: (In case of undesired outcomes: List procedures and contingency plans that must be referred to for limiting the impact of any unplanned occurrences. E.g. in case of RA for enclosed space entry, contingency for Rescue from Enclosed Spaces and Emergency Medical Treatment will apply.)

List Applicable Contingencies & Procedures: OBP I - Part 1 (7.3.3) and OBP I Annex 2 (3)

In case of undesired outcomes: OBP VI- Contingency-Shopboard -Section 3 - 3.2 Fire in Engine Room

For Routine Jobs - This form is valid till: _____ (Maximum of 6 months)
 (unless reviewed due to an incident or when there is a change in the work conditions or additional hazards associated with the work have been identified.) For Routine jobs the form must be referred to and the Control measures understood and implemented. An entry to this effect must be made in the Daily work Plan form RECO-004.

1A/E xxxxx
 Safety Officer (Name & Signature)

Capt. Xxxx
 Master: (Name & Signature)

C/E xxxxx
 Other Officer incharge (Name, Rank & signature)

Figure 6. Example of Risk Assessment.

Conclusion

1. Procedures to manage hot work on board sea going vessels are quite complicated.
2. Due to this complication Tool Box Meeting to be performed professionally prior commencement of Hot Work. All doubts to be clarify.
3. Procedures for safety management during performing Hot Work to be simplified but in this process safety of crew, property and environment must be taken as priority.
4. Crew on board sea going vessels, through safety meeting and on board training, to be well acquainted with procedures to perform safe Hot Work. It is still a lot of space to improve.
5. Shipboard Safety Management system to be permanently improved by suggestions from crew to optimize complicated procedures as Hot Work but without jeopardize with safety on board.

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RISK MANAGEMENT AS A SHIPPING COMPANIES TOOL FOR SAFE MANAGEMENT OF SEA-GOING VESSELS

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Purpose: reasons for writing the paper is to present, the optimal procedure to manage of risk and Risk Assessment procedures in shipping companies and on-board sea going vessels.

Design/methodology/approach: an analysis of various shipping companies approaches to management of risk and requirements and methodology to perform Risk Assessment.

Findings: found that approach to Risk Management and requirements to perform Risk Assessment are varied between shipping companies.

Research limitations/implications: management of risk based on Risk Assessment to be simplify and unified.

Practical implications: suggestion is given to unify procedures for Risk Assessment.

Social implications: reduction of risk to happen undesired events and mitigations of hazards associated with day to day operation of sea-going vessels.

Originality/value: recommendation to shipping companies for modification of Risk Assessments procedures where is necessary to improve safety on board.

Keywords: Risk Management, Risk Assessment, Safety Management System.

Category of the paper: research and viewpoint paper.

1. Introduction

Maritime transport accidents are complex and caused by a combination of events or processes that might ultimately result in the loss of human and marine life, and irreversible ecological, environmental and economic damage (Balmat et al., 2009; BS, 2008; Goerland and Montewka, 2015; Pusa et al., 2021). Many studies point to direct or indirect human error as a major cause of maritime accidents, which raises many unanswered questions about the best way to prevent catastrophic human error in maritime contexts. Maritime transport accidents are complex and caused by a combination of events or processes involving various actors that ultimately lead to disastrous consequences including loss of human and marine life and

irreparable ecological, environmental and economic damage (Dominguez-Pery et al., 2021). Apart from uncontrollable acts of God defined as ‘an extreme interruption with a natural cause (e.g. earthquake, storm, etc.), the literature consistently highlights human error as one of the main contributing factors in more than 85% of cases of maritime accidents. Furthermore, experts estimate that 30-50% of oil spills are caused directly or indirectly by human error (Dominguez-Pery et al., 2021; Haugen et al., 2016; Puisa et al., 2021). This paper takes one of first steps towards addressing some of these questions by improving our understanding of upstream maritime accidents from an organization science perspective—an area of research that is currently underdeveloped. The global shipping industry is responsible for transporting as much as 90% of world trade (Puisa et al., 2021). Over the past decade, improved ship design, technology, regulation and risk management systems have contributed to a 70% drop in reported shipping losses (Goerland and Montewka, 2015). However, while the frequency of maritime accidents may be in decline, one single incident can have catastrophic and long-term consequences for marine ecosystems, the environment and local economies. The operation of a ship, including the operation of a ship's engine room, is associated with risk-taking, just like any other human activity, in the case of routine operations related to the operation: cargo operations, manoeuvres and sea passage, emergency situations, repairs and maintenance works. Examples of some of the common risks that lead to these consequences include ship collision and grounding (Goerland and Montewka, 2015), fire (Goerland and Montewka, 2015), flooding (Zhang et al., 2019) have been analyzed.

Risk can be defined as undesirable events or as the probability of an unfavorable hazardous situation or an accident occurring. Thus, a risk is a combination of the probability or frequency of occurrence of a defined hazardous situation and the multiplicity of consequences resulting from its occurrence-BS 4778 (BS, 2012). Engineering Council, 1993 Guidelines on Risk Issues defines risk as a measure of the probability of the occurrence of a specific undesirable event and the resulting unwanted consequences or resulting loss. Risk Management based on its assessment is based on a detailed analysis of activities that involve risks and used to reduce the risk of activities or supportive measures. The Risk Assessment is an integral component of the SMS- Safety Management System based on the ISM Code and OHSAS 18001: 2007 (BS, 2007; Josi, 2021), the purpose of which is to protect against the identified threats, the risk level of which has been defined. The purpose of the Risk Analysis is to make sure that a detailed analysis of activities and procedures related to the operation of the ship is carried out in order to identify possible hazards that may cause a hazardous situation and that the existing preventive actions are sufficient and adequate to prevent potential hazardous situations from occurring (Balmat et al., 2009; Haugen et al., 2016; Montewka et al., 2014). On Figure 1 model of Risk Management has been presented.



Figure 1. Model of Risk Management.

Effective Risk Management requires proper Risk Assessment procedures. The first step in creating an effective risk-management system is to understand the qualitative distinctions among the types of risks that organizations face (Culp, 2020). Our field research shows that risks fall into one of three categories. Risk events from any category can be fatal to a company's strategy and even to its survival. The Risk Management method which consists of identification of threats and introducing safeguards after an accident, can be called a "reactive method" of safety control and supervision (BS, 2012; Tchankowa, 2002; IMO, 1998; 1999). This method is strengthened by active monitoring (in the form of inspections) to confirm whether the introduced security measures are applied. Such inspections generate reports: NCR (Non-Conformity Reports), TLC (Total Lost Control), CAR (Corrective Action Request). Active and reactive monitoring of operational safety on board is required by the ISM Code and this is reflected in accident reports or "Near Miss" reports reported by ship crews. **Risk Assessment is an element of pro-active Risk Management** (CA, 2000; Kaplan and Mikes, 2012; Puisa et al., 2021). Risk managers need to do more than identify and mitigate potential risks. They can, for example, tap into external data sources to identify digital signals that provide early indicators of potential future problems. The shipping company is obliged to introduce an effective risk management system and is obliged to use active, re-active and pro-active systems (IMO, 1998; 1999; BS, 2007).

There are three main risk areas in the operation of a sea-going ships:

- Risk related to the ship's crew (related to health and safety at work), the consequences of which are accidents at work or, in drastic cases, deaths.
- Risk related to the property (ship operation), the consequences of which are failures of machinery and equipment ship, destruction or loss of cargo, loss of charter, sinking of a ship, etc.
- Risk related to the environment, the consequences of which are environmental pollution (water, air, land).

The Risk Analysis is designed to answer simple questions:

- What could go wrong? What hazards could lead to an accident.
- What is the probability that something bad could happen.
- What will happen if the potential danger becomes real, what will be the consequences.
- What category are these consequences?
- What can we do if we know the consequences can be significant? Eliminate some of the potential dangers, reduce or limit the effects of the potential threat.

2. Identification of activities related to the operation of the ship

Before carrying out the risk analysis, it is very important to make an inventory of activities related to the operation of the ship related to hazardous situations that may endanger people, the environment and private property or damage the reputation of the shipping company. An organizational structure exists on ships for a long time, so the categorization of the operational situation is facilitated. Figure 2 shows a diagram to illustrate the identification of risky activities related to the operation of a ship (LRS, 2006; Mikulski, 2015; Danney, 2017; Finnley 2018; Smith, 2020).

A good starting point for hazard identification is to check if there is any history or if there is an accident trend in the area of a given operational activity.

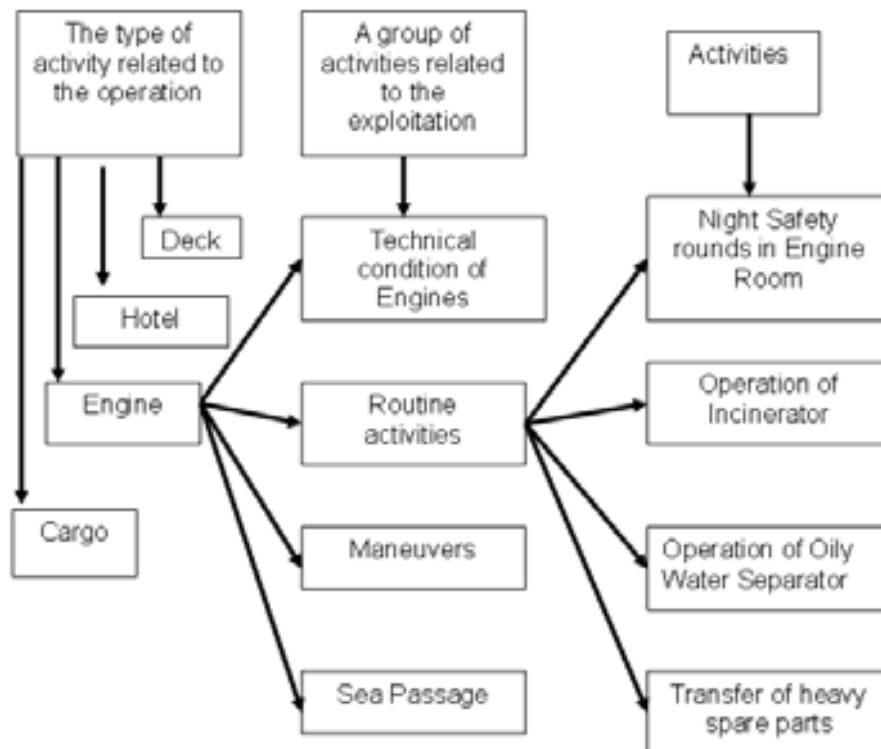


Figure 2. Example of identifying risky activities related to ship operation.

3. Hazard identification and identification of the existing control systems

Hazard in the sense of Risk Assessment can be defined as a source or situation that may cause harmful effects such as injuries or damage to the human body, damage or destruction of cargo, environmental pollution or combinations of the above-mentioned effects.

Example:

HAZARDS	CONSEQUENCES
Slippery surface	Injury of leg
Explosive atmosphere	Death-causing explosion
Toxic atmosphere	Death-causing poisoning
Darkness	Head impact with minor injury.

When identifying hazards, we should ask ourselves three questions:

- Is there any source of the hazard?
- Who or what might be at risk?
- How could this hazard occur?

Sources of hazardous situations can be distinguished as following (BS, 2007; Josi,2021):

- Materials and products used.
- Work procedures.
- Equipment/tools used.
- Personnel.
- Work site.
- Environment.

Hazards can be selected by type as follow (LRS, 2006; Mikulski, 2015; Danney, 2017; Finnley, 2018):

- Physical: noise, vibration, radioactivity, temperature, pressure, velocity, altitude, electricity, physical characteristics/properties.
- Chemical: explosives, combustible materials, corrosive agents, oxidizing agents, toxic and carcinogenic agents, gases and dust in the air.
- Ergonomic:
 - ✓ Physical: poor qualifications, unfamiliarity with routine procedures, duration of work and monotony, design deficiencies, poor posture (bad body position) incorrect lifting and lifting methods.
 - ✓ Environmental: poor lighting, poor ventilation, no possibility to control the environmental temperature, improper air humidity.
- Biological: biological waste (blood, fluids, etc.), drugs (antibiotics, marijuana), viruses and bacterias, parasites and insects, poisonous food, animals, improperly prepared food, poisoned/contaminated water.

Before determining the harmful effects of potential hazards in the event of their occurrence (the effects of potential hazards), the existing control systems should be analysed in terms of their effectiveness in reducing or eliminating hazards.

Hazard control systems can be divided into the following categories:

- Procedural.
- Environmental.
- Human relation.
- Personal protective equipment.
- Design and technical operation.

Practically, the purpose of risk analysis is to conduct appropriate preventive actions to protect against the occurrence of dangerous situations for people, the environment and private property. As shown on Figure 3 management of risk using legal regulations and work procedures cannot lower risk to acceptable Low Risk. To lower Risk to acceptable level it is necessary to use additional controls through proper Risk Assessment.



Figure 3. Possibility of Risk Management.

The risk analysis should be carried out in six stages (MCA, 2000; Montewka et al., 2014, Pusa et al., 2021; BS, 2007):

- Detailed analysis of activities and procedures related to the operation of the ship.
- Identification of possible hazards that may result in an accident.
- Assessment of the likelihood of an accident and the consequences of dangerous incidents or accidents.
- Determining whether the existing preventive measures are sufficient and adequate.
- Determining the level of risk.
- Reviewing the risk assessment performed.

4. Risk Determination

Risk Determination is a combination of:

- The likelihood that a hazardous situation will occur.
- The breadth of the consequences.

The risk can be assessed using two methods:

- **Qualitative Risk Assessment**, when we have very little or no statistical data on a given hazard, the method is cheap and fast, used in the case of personal safety risk assessment (Embrechts et al., 2005; Karaseva, 2020).
- **Quantitative Risk Assessment**, when we have statistical data on risk frequency and consequences, expensive and time-consuming method (Embrechts et al., 2005; Karaseva, 2020).

The Risk Assessments performed on board ships is based on the Code of Safe Working Practices for Merchant Seamen (BS, 2012) is a qualitative method applied to the hazards associated with the work carried out by crew members on board ships. Therefore, in shipping companies, a Risk Assessments are carry out in terms of threats related to the work carried out by crew members and environmental hazards (Mikulski, 2015; Danney, 2017; Finnley, 2018; Smith, 2020; Josi, 2021).

Assessment of the likelihood and consequences of a hazardous situation is burdened with the subjectivity of the person conducting the assessment, because there is no data, but in the future, when data banks are created, the assessment process will be much easier. The table 1 presented below is a recommended template for determining the probability.

Table 1.

Recommended table for determining the probability of a hazardous situation (BS, 2007).

Unlikely	Very low possibility of occurrence but it may occur in exceptional circumstances. It could happen but probably never will. Less than 5 % chance of occurrence. Less Than 1% chance of being experienced by individuals within their work life time.
Possible	Not expected to occur in normal circumstances but there is a slight possibility it may occur at some time. Less than 25 % chance of occurrence. Typically experienced once during the working lifetime of an individual.
Quite Possible	Could occur at some time. There is a history of casual occurrence. 25% to 50 % chance of occurring. Typically experienced once in five years by an individual.
Likely	Will probably occur in most circumstances. 50% to 75% chances of occurrence. Typically experienced once every six months by an individual.
Very Likely	Can be expected to occur in most circumstances. More than 75% chances of occurrence.

In table below (Table 2) authors present recommendations for quantifying the consequences of making a potential threat real. It is recommended to use practically in assessing the risk on board ships (BS, 2007).

Table 2.

Recommendations for quantifying the consequences of making a potential threat real

Negligible	Minor First aid Injury – cut/wound/bruise/sprain Inability to sail up to 1 hour Inconsequential impact on environment – contained in save-alls Financial loss < \$5000. Superficial damage No effect on Commercial venture.
Slight	Medical Treatment Injury Inability to sail for more than 1 hour but less than 3 hours Less than 1 barrel of oil spilled on deck Financial Loss > \$5000 but < \$100,000. Minimum damage Minor effect on commercial venture, minor local public reaction.
Moderate	Restricted Work Case Injury Inability to sail for more than 3 hours but less than 12 hours More than 1 barrel oil spilled on deck Financial loss > \$100,000 but < \$1000,000. Minor Damage Some local public reaction. Minor National media coverage.

Cont. table 2

High	Lost Workday Injury Inability to sail for over 12 hours but less than 24 hours Less than 1 barrel of oil spilled into the water Financial loss > \$1 million but < \$10 million. Damage that temporarily threatens Safety and the Environment Threat to future commercial business. Major media coverage.
Very High	Fatality, Serious Body injury Inability to sail for over 24 hours More than 1 barrel of oil spilled into the water Financial Loss > \$10 million. Damage that seriously threatens Safety and Environment Severe pressure on commercial business. Major National and International media coverage, public outcry.

When the probability of a hazardous situation has been assessed and the consequences that may occur when a hazardous situation occurs, then assess the risk can be done using the recommended presented below table (Table 3).

Table 3.

Risk ranking matrix (BS, 2007; Josi, 2021)

RISK MATRIX		Likelihood				
		1: Unlikely	2: Possible	3: Quite Possible	4: Likely	5: Very Likely
Consequence	1: Negligible	Low Risk	Low Risk	Low Risk	Medium Risk	Medium Risk
	2: Slight	Low Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk
	3: Moderate	Low Risk	Medium Risk	Medium Risk	Medium Risk	High Risk
	4: High	Medium Risk	Medium Risk	Medium Risk	High Risk	High Risk
	5: Very High	Medium Risk	Medium Risk	High Risk	High Risk	High Risk

Assessed according to Table 3, risk is combined with the recommended management practices to bring the risk down to the level of tolerable risk. The recommended actions are presented in Table 4. Where the risk is at an unacceptable level, additional preventive measures should be put in place to reduce the risk to an ALARP (as low as reasonable practicable) level, as low as reason and practice allow (Embrechts et al., 2005; Kaplan and Mikes, 2012; LRS, 2006; BS, 2007). This applies to any work related to the operation of the ship, repair and maintenance works, cargo operations.

The idea of ALARP allows for the analysis of costs related to increasing the level of safety and determines possible financial outlays to achieve a satisfactory level of safety ensuring a reduction in accident rates.

Table 4.

Recommended actions depending on the risk level (LRS, 2006; BS, 2007).

Risk category	Measures	Work authorization
High Risk (Unacceptable risk)	Risk cannot be justified. Eliminate or mitigate risk. Reduce risk to ALARP Level using risk controls.	Work is NOT to be carried out. Contact Company for assistance/further assessment.
Medium Risk (Tolerable risk)	Eliminate, mitigate risk, or wear protective equipment. Risk to be in ALARP level. Tolerable only if further risk reduction is impracticable.	Work is Possible (with conditions). Control measures to be monitored. Shore assistance may be sought in cases when only inadequate risk reduction is possible on board.
Low Risk (Broadly acceptable risk)	Manage by documented procedures. Monitor progress. Maintain assurance that risk remains at this level.	Work is permitted provided conditions do not change requiring a reassessment of the Risk.

The benefits of using the Risk Assessment performed by crew on board are as follows:

- minimizing the risk of hazardous situations for people, the environment and private property,
- improving the quality of work,
- improving the awareness of ship crew members, orienting ship crews towards safety,
- improving the image of the shipping company as safety-oriented in the broad sense.

Risk assessments should be undertaken by (Balmat et al., 2009; LRS, 2006; BS, 2007):

- people with appropriate operational experience,
- old and young crew members, which combine experience with objectivity and avoid of routine,
- small teams of 2-3 people.

Risk Assessments performed on board the ship related to a specific activity, work or task related to with danger should be collected in the company data banks as examples of Generic Risk Assessments. Such exemplary risk assessments can be readily adopted on sister ships when performing similar tasks after analysing that the risks have not been changed.

Conclusion

1. Procedures for risk management on board sea going vessels are quite complicated for most crew on board sea -going vessels. Management of risk based on risk assessment to be simplify and unified. Suggestion is given to unify procedures for risk assessment.
2. Risk management is a new topic with which ship crews must, become familiar with and then apply in order to reduce the number of accidents in the fleet. If the understanding of the problem is not correct, risk management becomes a worthless process and becomes pure bureaucracy.

3. At the initial stage of introducing risk management on ships, the number of opponents to this process was greater than the supporters. Currently, it can be observed that the understanding of the problem is greater and the favor of the sailing crews is greater, which does not mean satisfactory. Ship crews require training in risk management and these training must be taken as priority.
4. Research done by authors on Risk management showed that approach to risk management and requirements to perform risk assessment are varied between shipping companies
5. Implementation in real practice pro-active Risk Management will reduce of risk to happen undesired events and mitigations of hazards associated with day-to-day operation of sea-going vessels.
6. Research done by authors on Risk management in shipping companies showed that modification of risk assessments procedures must be recommended to some shipping companies to improve safety on board due to applied unclear procedures.

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HISTORICAL ASPECTS OF MANAGEMENT, TECHNOLOGY, INNOVATION AND ECONOMIC GROWTH IN GREAT BRITAIN

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Purpose: The purpose of the work is to present historical aspects of management, technology, innovation and economic growth in Great Britain based on international literature and articles.

Design/methodology/approach: Due to the cognitive nature of the work, the aim of the work will be achieved using the method of analyzing the literature and overview international articles to present results on the subject. Literature studies includes only foreign publications.

Findings: Historical aspects of management, technology, innovation and economic growth in Great Britain is widely described in international and British literature. Many articles provided value information's and researches to get to the conclusions and summary. Based on the reliable results scientist assess every aspects of provided subject.

Originality/value: The analysis international and British literature and articles shows all aspects of historical management, technology, innovation and economic growth in Great Britain and helps to improve knowledge and assessment of past to present and to predict future.

Keywords: Management, Technology, Innovation, Economy, Growth, History.

Category of the paper: Research paper.

1. Introduction

Great Britain, and England in particular, became one of the most prosperous economic regions in Europe between 1600 and 1700, Industrialization in the UK from the mid-eighteenth century resulted in economic developments described by many historians as the British industrial revolution. These developments resulted in Britain becoming one of the premier economies in Europe during the first half of the 19th century, the most prominent industrial power in the world economy, and a major political power (Baten, 2016, p. 13).

Economic growth can be driven in the short run by factor accumulation or by utilizing factors more efficiently, but permanent increases can only result from management to technological innovation. Given Britain's loss of industrial preeminence from the late

nineteenth century, an absence in new technology formation is as natural an explanation for British failure as cultural interpretations that emphasize a weakness of the industrial spirit (Wiener, 1981, pp. 3-18). While Britain was the first “workshop of the world” its lagging position behind the technology frontier during the drive to industrial maturity is a topic of some debate in economic history. Accounts of technological progress during industrialization emphasize that Britain’s rise was defined by capabilities in a broad array of industries and by a culturally enlightened and technically competent stock of human capital that could translate new ideas from home, or abroad, into commercially viable innovations (Mokyr, 2010, pp. 5-23).

It is a commonplace of management literature that Taylor, along with Fayol and Weber, was one of the principal architects of modern management (Cole, 1990, pp. 6-19). Drucker described scientific management as our most widely practiced personnel management concept and the most powerful contribution America has made to Western thought since the Federalist Papers and a popular text book on organizational behaviour asserts that The influence of scientific management pervades management thinking and organization functioning in all industrialized countries of the world (Huczynski and Buchanan, 1991, pp. 277-278).

Before the late 18th century, per capita growth rates were either zero or miniscule and average per capita incomes in different regions of the world were quite similar (Galor, 2005, pp. 171-293). Galor and Weil (2000), Hansen and Prescott (2002) and Galor (2005) argue that this period of stagnation can be described as the Malthusian epoch. Instead of resulting in improved standards of living, technological progress led to increased population. However, with the onset of the Great Divergence was around 1760, on the eve of the First Industrial Revolution in Britain, the British economy began the transformation from the Malthusian trap to the post-Malthusian epoch during which the rate of technological progress outpaced the population growth drag, resulting in positive per capita growth rates. Yet the transformation of the British economy is still one of the great mysteries in the history of human evolution (Galor, Weil, 2000, pp. 806-828).

Economic growth literature contains extensive coverage of Britain due mainly to its preeminent position in the First Industrial Revolution and the availability of well-documented historical facts and data. However, despite being one of the most significant events in economic history, little is known about the role played by innovation in freeing the British economy from its Malthusian straightjacket. While the literature suggests different roles played by technology during the Industrial Revolution, technological progress has also been deemphasized as being important for the British growth experience by some economic historians (Madsen, Banerjee and Ang, 2010, p. 2). R.C. Allen notes that “recent research has downplayed the importance of technological progress and literacy in explaining the British industrial revolution”(Allen, 2003, p. 405). Furthermore, N.F.R. Crafts suggests that the augmented neoclassical growth model is the appropriate tool for modeling growth during the Industrial Revolution and that the most important innovations were exogenous during that period. Based on the statistical properties of

productivity data, historiography and growth accounting exercises, N.F.R. Crafts concludes that both the AK model of Rebelo (1991) and the endogenous growth model of Grossman and Helpman (1990) are incapable of explaining the growth rates experienced by England during the Industrial Revolution (Crafts, 1995, pp. 745-772).

R.J. Sullivan describes the period 1762-1851 as the 'Age of Invention' for England' during which patentable inventions increased markedly (Sullivan, 1989, p. 424). D. Greasley and L. Oxley demonstrate that output fluctuations were very persistent during the period 1780-1851, and use this as evidence to argue that endogenous growth models are more relevant in accounting for the glorious period of Britain's industrialization than the neoclassical growth model. In a similar vein, using cointegration and causality techniques, L. Oxley and D. Greasley suggest that the Industrial Revolution was shaped mostly by technological progress (Greasley, Oxley, 1997, pp. 935-949).

N.F.R. Crafts and L. Oxley and D. Greasley focus on the validity of the first-generation endogenous growth models of Grossman and Helpman (1990) and Rebelo (1991) in explaining the Industrial Revolution (Madsen, Banerjee, Ang, 2010, p. 3). However, following C. Jones famous critique, the first-generation endogenous growth models are no longer acceptable to have any empirical validity. In particular, Jones notes that the number of R&D workers increased substantially during this period, while the US post-WWII growth rates have remained relatively constant. This observation is inconsistent with the predictions of the first-generation endogenous growth models that productivity growth is proportional to the number of R&D workers (Jones, 1995, pp. 495-525).

The second-generation endogenous growth models overcome this unwarranted property of the first-generation growth models by abandoning the assumption of constant returns to scale in ideas production (semi-endogenous growth models) or by assuming that the effectiveness of R&D is diluted due to the proliferation of products when an economy expands. Thus, given the shortcomings of first-generation endogenous growth models earlier findings based on them, the second-generation endogenous growth models may be more consistent with the British growth experience since 1620. However, it remains to be seen whether any of those modern innovation-based growth models, extended to allow for population growth drag, are capable of explaining the glorious period of Britain's industrialization (Madsen, Banerjee, Ang, 2010, p. 3).

2. Industrial Research and Management Practices

In an important study, D. Edgerton and S. Horrocks document the early history of R&D in Britain. They maintain that British firms invested quite heavily in in-house R&D, especially in the chemicals industry. Networks of technical experts facilitated spillovers of technological

knowledge which were also promoted by inter-firm linkages. An early contributor to the British R&D effort was United Alkali which had centralized R&D as early as 1892 (Edgerton and Horrocks, 1994, pp. 213-238). Firms like ICI (formed in 1926 as a merger of United Alkali and three other chemicals companies), GEC and Metropolitan-Vickers were R&D pioneers, a point noted in Hannah's (1976) work on the rise of the corporate economy (Hannah, 1976, pp. 4-19). D. Edgerton and S. Horrocks' revisionist evidence represents a counter to D. Mowery's traditional argument that British R&D was weak (Mowery, 1986, pp. 4-25) and A. Chandler's implicit assertions that British firms also failed to generate large returns from R&D because they underinvested in the complementary capabilities of production, distribution and management (Chandler, 1990, pp. 3-10).

In line with the revisionist view, there is anecdotal evidence to show that British R&D could be innovative and well-managed. T.C. Barker's study shows how Pilkington developed the Float Process after extensive R&D over a decade, which was facilitated by family ownership and 15 control of the company and a commitment by the company to harnessing applied science and technology. Another prominent example of British success is the pharmaceuticals and biologics industry, where Glaxo-Wellcome, Smithkline-Beecham (these two companies merged in 2000 to form GlaxoSmithKline) and AstraZeneca have created a portfolio of some of the world's best known drug innovations such as Tagamet, Zantac and Nexium for the treatment of gastrointestinal problems. Equally there is anecdotal evidence of British R&D failure. Notably the British inventor Geoffrey Hounsfield, a scientist employed at the Central Research Laboratories of EMI, developed the profoundly significant CT Scanner, but EMI did not have the managerial capabilities to keep pace with demand. During the 1970s and 1980s it lost out to organizationally efficient U.S. companies like Technicare and General Electric (Barker, 1977, pp. 2-15).

Beyond individual case studies, S.N. Broadberry and N.F.R. Crafts argue that a critical set of drivers of firm performance are related to industry structure and the operating environment more generally, and these in turn influence incentives and management capabilities. For example, the British regulatory environment during the interwar years tolerated collusion between firms and provided subsidies for incumbents, so competition was absent as a disciplinary device in product markets. Furthermore, labor unions created an unproductive bargaining situation and constrained the reallocation of resources from poorly to better performing firms, which had a strongly depressing effect on productivity (Broadberry and Crafts, 1992, pp. 3-10). It is well-known that if managers of incumbent firms do not face the threat of replacement then their preferences can tend towards the Hicksian "quiet life". On the other hand, competition can encourage innovation especially if firms are already close to the technological frontier. In this case, firms have more incentives to invest in R&D to capture the incremental profits deriving from innovating (Aghion et al., 2005, pp. 701-728).

The notion that such factors were influential in Britain's more recent innovation performance is evidenced by the uptick in productivity as a consequence of more favorable competitive dynamics in British business. Deregulation, the liberalization of capital markets, better industrial relations standards and the strengthening of legislation with respect to product market competition all had positive effects (Crafts, 2012, pp. 17-29). At the same time, it is worth noting British weaknesses in the management and diffusion of technology still persist. Insofar as the main determinants of rapid TFP advance are the diffusion of innovations and the effectiveness of factors that affect the efficiency with which new technologies are used (Comin and Hobijn, 2010, pp. 2031-2059), the evidence suggests a large gap exists between Britain and the United States. N. Bloom and J. Van Reenen find that competition in recent years is still relatively milder in Britain than in the United States and when combined with the preponderance of British family firms, this has led to a prominent and persistent tail of badly managed medium-sized firms (Bloom and van Reenen, 2007, pp. 1351-1408). Among larger firms, N. Bloom, R. Sadun and J. Van Reenen find that U.S. multinationals operating in Europe were far more able to benefit from technology diffusion as manifested in the implementation of ICT advances compared to otherwise equivalent European firms. Weaker diffusion and inept management practice capabilities help to explain performance defects, although in a Europe wide context, these are not uniquely British problems (Bloom, Sadun, van Reenen, 2012, pp. 3-24).

3. Examples of history statistics in United Kingdom

The United Kingdom is particularly interesting as it was the first economy that achieved sustained economic growth and thereby previously unimaginable prosperity for the majority of the population (Roser, 2021).

The first part is the very long time in which the average person was very poor and human societies achieved no economic growth to change this. Incomes remained almost unchanged over a period of several centuries when compared to the increase in incomes over the last 2 centuries. Life too changed remarkably little. What people used as shelter, food, clothing, energy supply, their light source stayed very similar for a very long time. Almost all that ordinary people used and consumed in the 17th century would have been very familiar to people living a thousand or even a couple of thousand years earlier. Average incomes (as measured by GDP per capita) in England between the year 1270 and 1650 were £1,051 when measured in today's prices (Roser, 2021).

The second part is much shorter, it encompasses only the last few generations and is radically different from the first part, it is a time in which the income of the average person grew immensely – from an average of £1051 incomes per person per year increased to over

£30,000 a 29-fold increase in prosperity. This means an average person in the UK today has a higher income in two weeks than an average person in the past had in an entire year. Since the total sum of incomes is the total sum of production this also means that the production of the average person in two weeks today is equivalent to the production of the average person in an entire year in the past. There is just one truly important event in the economic history of the world, the onset of economic growth (Roser, 2021).

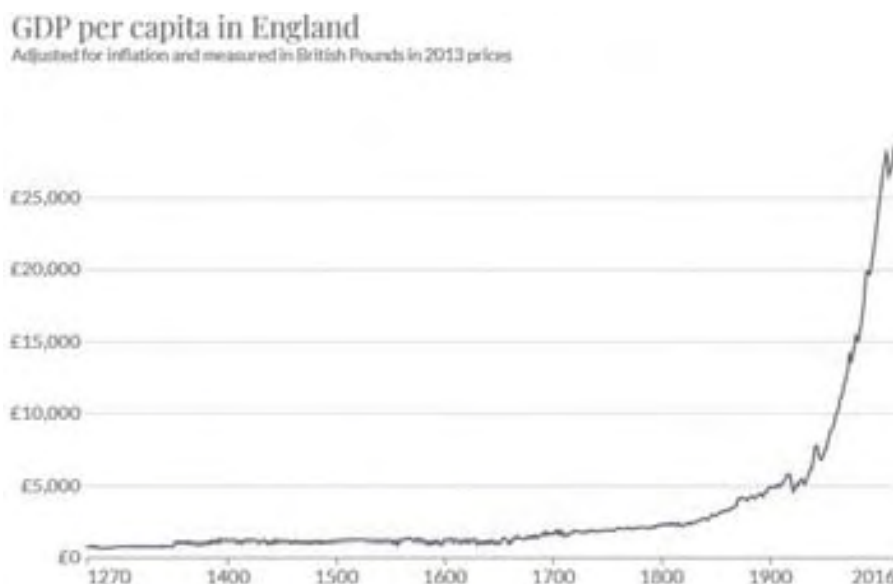


Figure 1. GDP per capita in England. Source: Bank of England 2020.

S. Broadberry, B.M.S. Campbell, A. Klein, M. Overton and B. van Leeuwen presented in his work output of key industries in England in years 1270 to 1870. All key industries have developed and increased since it had begun. Although printed books started by end of 1400's it showed the biggest increase through all centuries. Iron, Metals and Mining are on the top of increase per capita by late 1870's.



Figure 2. Output per capita in England. Source: Max Roser, Economic Growth, <https://ourworldindata.org/economic-growth>, access date 28.12.2021.

Bank of England (2017) presented nominal wages, consumer prices and real wages in United Kingdom from 1750 to 2013. Until 1950 the lines are quite linear with some small increase. From around 1950 increase of nominal and real weekly wages speeds up rapidly and increase of consumer prices are going high too.



Figure 3. Nominal wages, consumer prices and real wages in United Kingdom from 1750 to 2013. Source: Bank of England 2017.

United Kingdom from 1750 to 1830 has increasing share in World Manufacturing Output. From 1830 to 1900 the share is growing comparing to other countries with some dominance close to 1900's of United States.

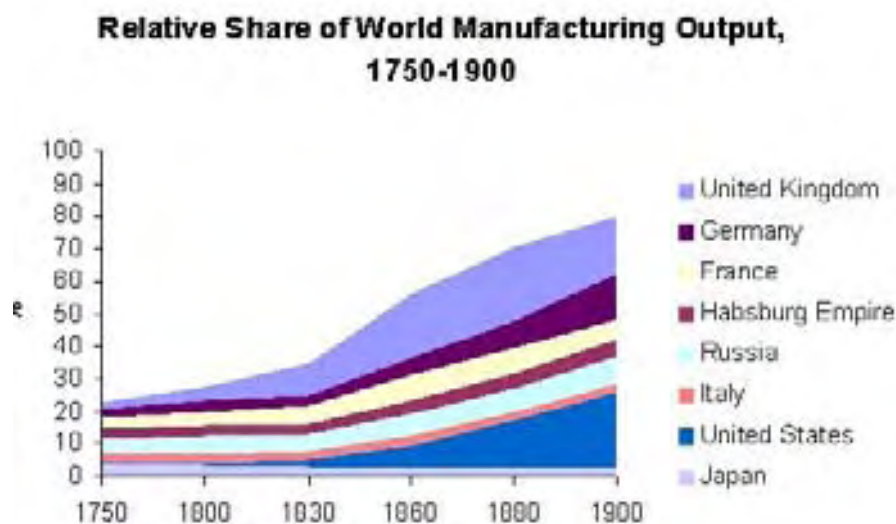


Figure 4. Relative Share of World Manufacturing Output 1750-1900. Source: https://en.wikipedia.org/wiki/Economic_history_of_the_United_Kingdom, access date 28.12.2021.

Levels of industrialization for United Kingdom compering to other countries is increasing tendence and from 1830 it becomes “rollingcoaster”.

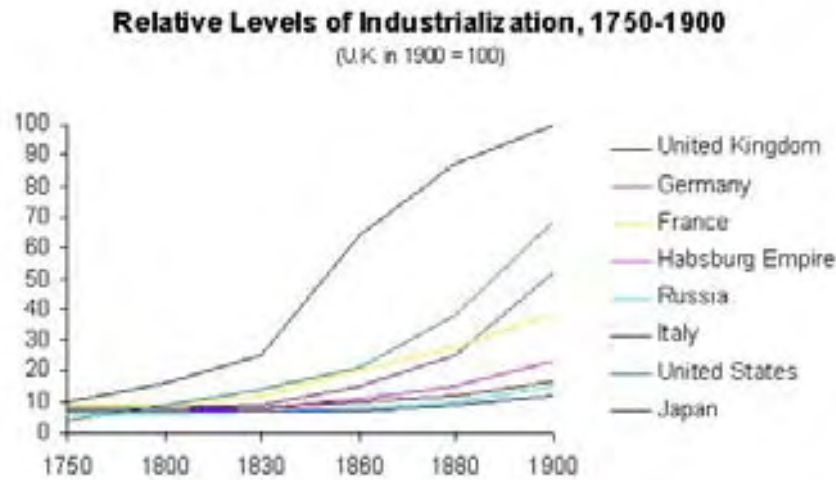


Figure 5. Relative Levels of Industrialization 1750-1900. Source: https://en.wikipedia.org/wiki/Economic_history_of_the_United_Kingdom, access date 28.12.2021.

4. Finding the right economy and technology policies for the Great Britain

The national and global landscapes have changed significantly since the events in these histories: for instance, since the creation of the DSIR in 1916, the Rothschild report, or since Thatcher’s abandonment of ‘near-market’ research. The UK’s 80% services-based economy, the social and economic contours of the UK’s regional landscape, the recent reorganisation of the research councils under UKRI, and the changes in the UK workforce that will come with Brexit, are all pressures and needs that demand consideration in the formulation of science policies today, and they take on a different character to the challenges of the past. The history of science policy nevertheless offers valuable lessons and trends for policymakers today. They are listed below (Flanagan et al., 2019, pp. 6-8):

- **science policymakers must consider how science policies align with policy goals in other areas.** Science policy does not operate in a vacuum. It is related to other realms of policy such as economic policy, higher education policy, energy policy, agricultural policy and broader industrial policy. It is not restricted to research councils; research activities situated within or in close relationship to industry make up a sizeable portion of British R&D. Science policies should take this complex landscape into account. This also points to the fact that science policy cannot be an industrial strategy on its own. It should be situated within broader policy aims in other areas;

- **training people can build absorptive capacity.** Science policies can play an important role in training people in research activities – practices, processes, and methods. As S. Clarke points out in her paper, such training is a vital way of bringing science and industry into a closer relationship. This training enables people and organisations to identify new scientific developments and innovations (that often may be external to them), integrate these into their work, and benefit from these developments by using that knowledge to meet their own needs and goals. In other words, it increases ‘absorptive capacity’;
- **absorptive capacity can help Britain benefit from a global R&D landscape.** Crucially, building absorptive capacity enables Britain to benefit from its relationship to the global landscape of R&D. D. Edgerton and K. Flanagan’s papers both prompt consideration that the UK may only be best placed to pursue innovation at home in certain areas and, by contrast, may benefit from developing processes or innovations from abroad (or importing skills/products) in other areas. Britain has historically been very good at adopting other nations’ innovations and must continue to invest in its own ‘absorptive capacity’ to benefit from them. Science policy should therefore not only foster innovations at home but also foster skills that enable external innovations to be identified, adapted, and utilised within Britain. A strong science base is key to the UK’s ability to benefit from global developments in science and technology;
- **policies can have significant long-term effects that are hard to reverse.** J. Agar points out how, in the postwar period until the 1990s, R&D in the UK was mainly financed by government but performed by industry (and half was military in orientation), but from the 1990s to the present R&D in Britain has been mostly funded and performed in the private sector. In the 1960s, the proportion of GDP spent on R&D, public and private, peaked at around 2.3%. This dropped throughout the 1980s and 1990s to 1.8% by 1999, driven by reductions in both government and company spending. David Edgerton notes that from the late 1980s, research council spending was cut much less (in some cases this increased) relative to departmental research spending cuts. This also marked a shift away from publicly funded support for ‘near market’ R&D – ‘basic’ (‘curiosity-driven’) research was to be funded by government through the research councils, whereas ‘near-market’ (‘applied’) research was to be funded by industry. The important lesson here is that the impacts of these changes still manifest today. In 2016, for example, research councils had 61% of their budgets allocated to ‘basic’ research, though it is also likely that much of the ‘applied’ research funded by the UK research councils is closer to ‘basic’ research than to the technological development prioritised by other nations. Civil department R&D, on the other hand, was allocated largely toward ‘applied’ research and ‘experimental development’. R&D in business is overwhelmingly orientated toward ‘applied’ research and ‘experimental development’. The UK R&D landscape now continues to shift –

as Kieron and Flanagan points out, today research is once again seen as a key part of industrial strategy, whereas for the past few decades, as described by Edgerton and Agar, science and innovation policy has essentially been a substitute for industrial policy;

- **brokerage and ways of convening enable the identification of valuable science policies.** C. Craig's paper highlights the need for, and value of, ways of bringing the right people together to identify, frame, and work on solutions to science questions in a collaborative way. She notes that methods are one way of doing so because they create means for 'brokerage', enabling policymakers and experts/designers to engage with one another regarding the assumptions and limitations of a given method, for example. Formal structures such as the IPCC, or informal movement of exchanges of people through travel and migration, are other ways to create these infrastructures for brokerage. A related point that emerged in the seminar discussion was that, with these structures, there also needs to be a capacity for problems to be articulated from below (for example, smaller business and wider society, and not just the large companies in, must be given ways of effectively convening with other R&D players);
- **transparency and access to decision-making help to avoid mistakes.** J. Agar discusses the impact of a switch in science policy in 1987, when there was a pivot of government funding towards the science base (branded 'curiosity-driven research') alongside a cutting of government-funded 'near-market' support. He suggests that this switch essentially ended an active, interventionist, science-based, publicly funded industrial strategy. Greater openness and access to decision-making processes would have helped avoid this mistake;
- **internal expertise can help to facilitate brokerage.** A point that emerged from the seminar discussion was that internal scientific expertise in government can be valuable in that it provides a 'connective tissue' between different framings of science policy issues. Similarly, encouraging scientists and science policymakers to train in the history of science during their education, would provide them with a better understanding of how their expertise has been situated within policy, and has related to societal demands, needs, and influences outside (and within) the scientific institution;
- **policymakers need infrastructures that can overcome institutional memory.** Another point that emerged from the seminar was that lack of institutional memory in government poses a significant challenge for a policy area that demands an infrastructure of 'connective tissue'. These issues suggest that there need to be infrastructures in place that can manage knowledge about science policy as it travels and moves in and out of government. Thinking about this knowledge as also being embodied in individuals (who are changing posts or departments regularly), this points to the importance of convening across silos/departments/institutions as well as within.

5. Summary

The work has presented the literature on some historical aspects of management, technology, innovation and economic growth in Great Britain. Despite these areas in which Britain displayed competence and distinctiveness, the management of technology has typically been weak. Organizational economists have long argued that a strong complementarity exists between technology, management practices and the demand for skilled labor, which creates a much more complex nexus through which invention contributes to productivity growth. As presented by author in last chapter the main improvements should be implemented in areas: policymakers need infrastructures that can overcome institutional memory, internal expertise can help to facilitate brokerage, transparency and access to decision-making help to avoid mistakes, brokerage and ways of convening enable the identification of valuable science policies, policies can have significant long-term effects that are hard to reverse, absorptive capacity can help Britain benefit from a global R&D landscape, training people can build absorptive capacity, science policymakers must consider how science policies align with policy goals in other areas.

As the Great Britain history in all aspects shows it has been done a lot but permanent observation and improvement is required due to fast changing world. The history can be some base to build better presence and moving forward future.

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THE GLOBAL AUTOMOTIVE CONSUMER – CASE STUDY

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Purpose: The purpose of the work is to present the research results of 26,000 consumers in 25 countries provided by the Deloitte Report from 2022 as the Global Automotive Consumer.

Design/methodology/approach: Due to the cognitive nature of the work, the aim of the work will be achieved using the method of analyzing the literature and newest Deloitte research from 2022. Literature studies only foreign publications.

Findings: The Global Automotive Consumer is very widely described in international literature. Many reports have been created and the most updated Deloitte shows overview current situation in researched matter.

Originality/value: The analysis of international literature and report from 2022 with statistics shows global automotive consumer preferences as well as most development countries next to similarities and differences between worldwide automotive community. It includes some influences due to pandemic Covid-19.

Keywords: Global, Automotive, Consumer, Trends.

Category of the paper: Research paper.

1. Introduction

Sustainable technologies hold the promise to reduce harmful emissions and use resources more efficiently (Hockerts, Wüstenhagen, 2010, pp. 481-492). Sustainable technologies often do not fit existing production methods, managerial expertise and customer preferences (Johnson and Suskewicz, 2009, pp. 52-60).

Budde Christensen put it, “it might be that innovative technologies that have the potential to meet key sustainability targets are not easily introduced by existing business models within a sector, and that only by changes to the business model would such technologies become commercially viable” (Christensen, Wells, Cipcigan, 2012, p. 499).

One barrier to market penetration is that sustainable technologies challenge prevailing business practices that depend heavily on the use of fossil fuels, especially in the oil and gas, electricity and automotive sectors (Jacobsson and Bergek, 2004, pp. 815-849).

Understanding consumer decision-making in an increasingly dynamic environment becomes of utmost concern. Henry Ford has been attributed as saying that if horse and buggy drivers had been asked what type of innovation they sought, they'd say they wanted a faster horse. For much of its history, the auto industry has followed this thinking and been driven by engineering or financial-based decisions (Townsend, Calantone, 2014, pp. 4-7).

In their paper, John R. Hauser, Songting Dong, and Min Ding investigate the role of heuristics in the development of consumer preferences. In an era when the majority of consumer research is completed prior to visiting a dealer or distributor, understanding the process by which consumer preferences are formed is an important area of study. Their research makes a significant contribution because it suggests articulated preferences are more accurate measures when engendered by self-reflection; but articulation of preferences prior to self-reflection interferes with the accuracy of preference articulation (Hauser, Dong, Ding, 2013, pp. 17-32).

Matthias Holweg in his paper, a review of the state of innovation in the United Kingdom suggests that the internal combustion engine will remain primary for the foreseeable future, mostly due to these infrastructure issues. While it is anticipated that a variety of alternatives will be available in the marketplace, the expectation is that continued incremental innovation of existing technology will forge the way forward in low-carbon emission vehicles (JBS, 2013). This is important in light of the findings of two studies undertaken as part of the research paper presented by Jonatan Pinkse, René Bohnsack, and Ans Kolk. Their research employs qualitative and quantitative methods to consider how firm-level strategies for creating both transformational and systematic innovations that are adopted by consumers are impacted by both private and public initiatives (Bohnsack, Pinkse, Kolk, 2013, pp. 1-46).

M. Berk Talay, Roger J. Calantone, and Clay M. Voorhees contribute to our knowledge of the competitive environment by considering the interactions between competitors over time. Their research shows that innovation is fundamental to the survival of automotive brands over the long term, but competitors make gains from innovations via comparative moves. An important finding is these gains are temporary. Understanding the importance of continuous product innovation is therefore critical for automotive firms operating in a hypercompetitive marketplace, with a myriad of competitors (Talay, Calantone, Voorhees, 2014, pp. 61-78).

2. Methods

Deloitte for over a decade has been exploring automotive consumer trends impacting a rapidly evolving global mobility ecosystem. From September through October 2021, Deloitte surveyed more than 26,000 consumers in 25 countries to explore opinions regarding a variety of critical issues impacting the automotive sector, including the development of advanced

technologies. The overall goal of this annual study is to answer important questions that can help companies prioritize and better position their business strategies and investments (Deloitte, 2022).

For purpose of the following thesis have been stated:

1. Willingness to pay for advanced tech remains limited.
2. Interest in electrified vehicles (EVs) driven by lower running costs and better experience.
3. Interest in EVs driven by lower running costs and better experience.
4. Personal vehicles continue as the preferred mode of transportation.

Following research questions have been created:

1. How preferences for electric vehicle look like worldwide?
2. Which factors that impact the decision to acquire an electrified vehicle?
3. Which location people expect to charge their vehicle most often?
4. What are reasons for not charging the electrified vehicle at home?
5. How many consumers would alter their decision to purchase an electrified vehicle if the electricity used for mobility was priced similar to current fossil fuels?
6. What are greatest concern regarding all battery-powered electric vehicles?
7. What are consumer expectation of driving range from fully charged all-battery electric vehicle?
8. How mobility modes to meet transportation needs?
9. What are top most important characteristics of a vehicle subscription?

3. Results

The highest interest for battery electric vehicle (23%) is in South Korea, China (17%) and Germany (15%). Plug-in hybrid electric with 37% is being preferred in Japan. In United States with 69% are still being preferred gasoline/diesel vehicles. These different preferences worldwide are differed due to:

- household budget and income,
- habits,
- education and knowledge,
- technological solutions,
- development of required infrastructure.

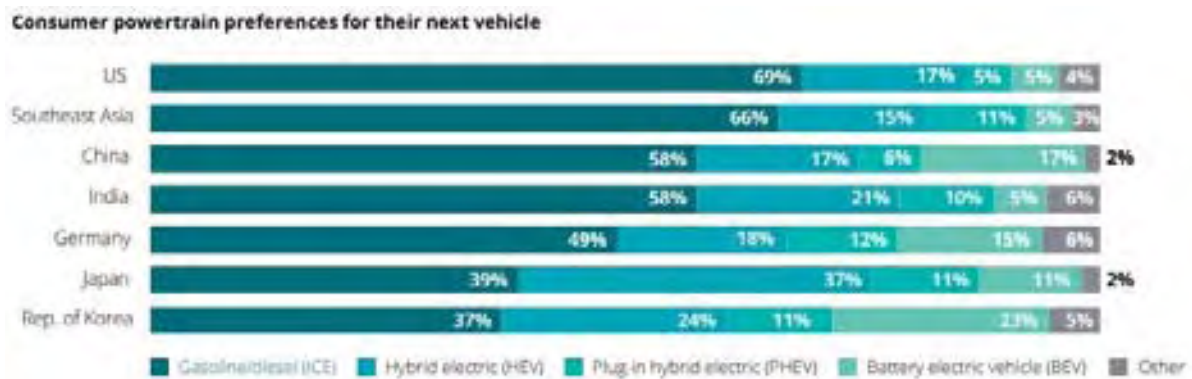


Figure 1. Consumer powertrain preferences for their next vehicle. Source: Deloitte 2022. Global Automotive Consumer Study.

For the most countries people are drawn for electric vehicles due to following reason:

- concern about climate change,
- reduced emissions,
- lower fuel costs.

Only in China for all researched countries lower fuel costs are on the 4th positions. This can be caused by lower household income and lower level of education in this matter.

Factors that impact the decision to acquire an electrified vehicle

Factors	US	Germany	Japan	Rep. of Korea	China	India	Southeast Asia
Concern about climate change/ reduced emissions	2	1	2	2	1	1	2
Concern about personal health	6	4	5	7	3	4	5
Lower fuel costs	1	2	1	1	4	2	1
Less maintenance	4	7	7	3	6	5	4
Better driving experience	3	5	3	4	2	3	3
Government incentives/ stimulus programs	5	3	4	5	7	6	6
Potential for extra taxes/ levies applied to internal combustion vehicles	7	6	6	6	5	7	7

■ Top concern

Figure 2. Factors that impact the decision to acquire an electrified vehicle. Source: Deloitte 2022. Global Automotive Consumer Study.

3 out of 4 in Japan, India and United States consumers are being prepared to charge their battery electric vehicle and plug-in hybrid electric at home. South East Region and South Korea users are willing to charge their vehicles in public. This can be caused by lower education or lower access to public charging points.

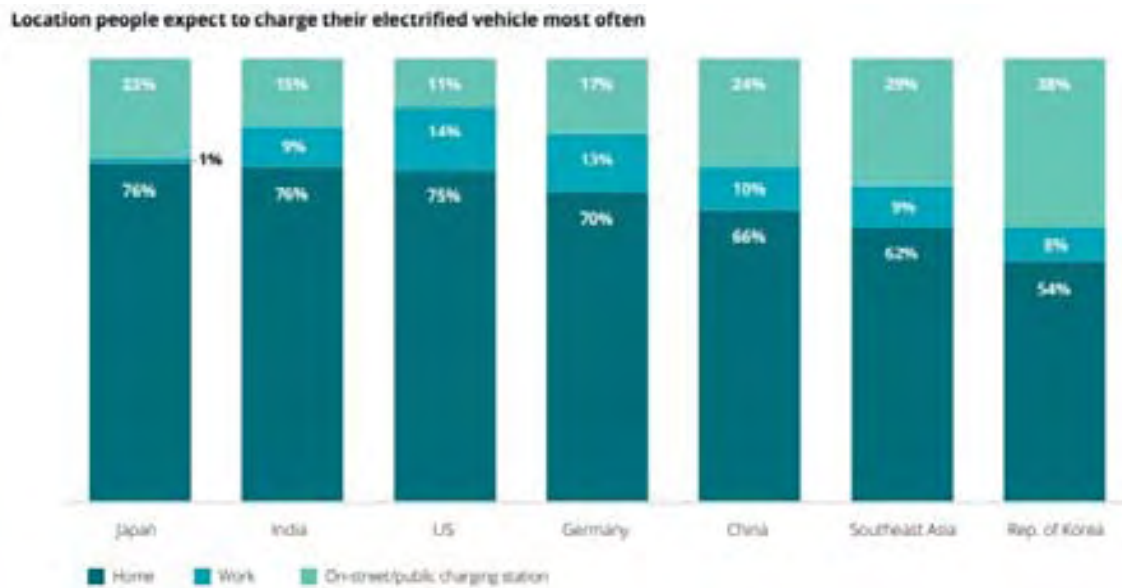


Figure 3. Location people expect to charge their vehicle most often. Source: Deloitte 2022. Global Automotive Consumer Study.

Consumers in China, India and the SEA region are planning to use both renewable power and regular grid. This is caused potentially by availability and access to resources and infrastructure development depended on region. South Korea and United States are being orientated in regular power grid due to high tech infrastructure and flexibility.

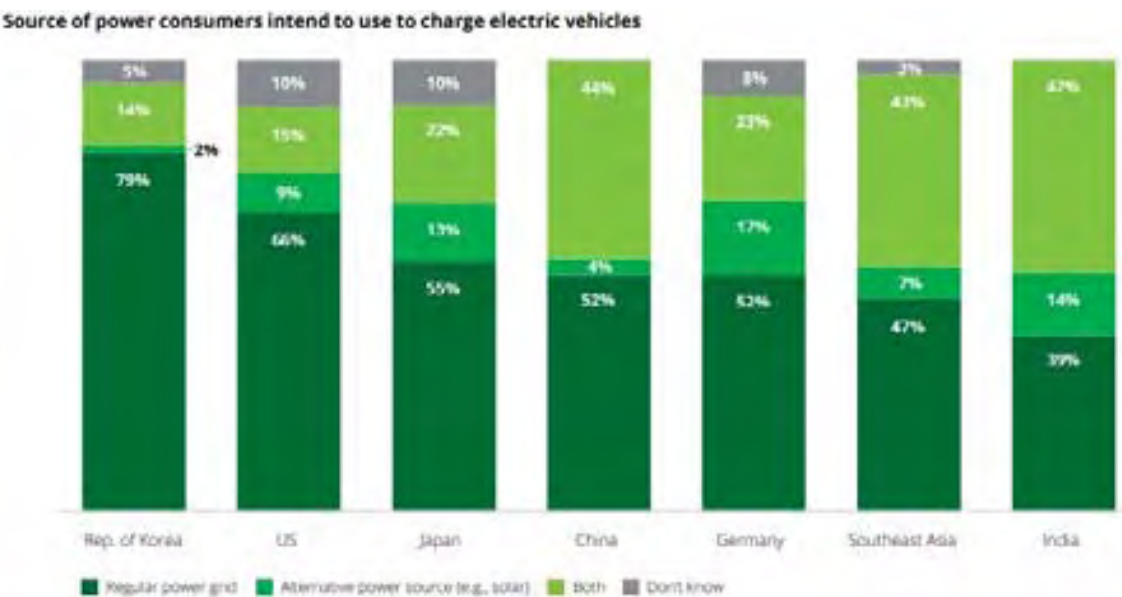


Figure 4. Source of power consumers intend to use to charge electric vehicles. Source: Deloitte 2022. Global Automotive Consumer Study.

Consumers who are not planning to charge a PHEV or BEV at home as main reasons due to the fact are giving:

- can't install a charger,
- cost of installing charger is prohibitive.

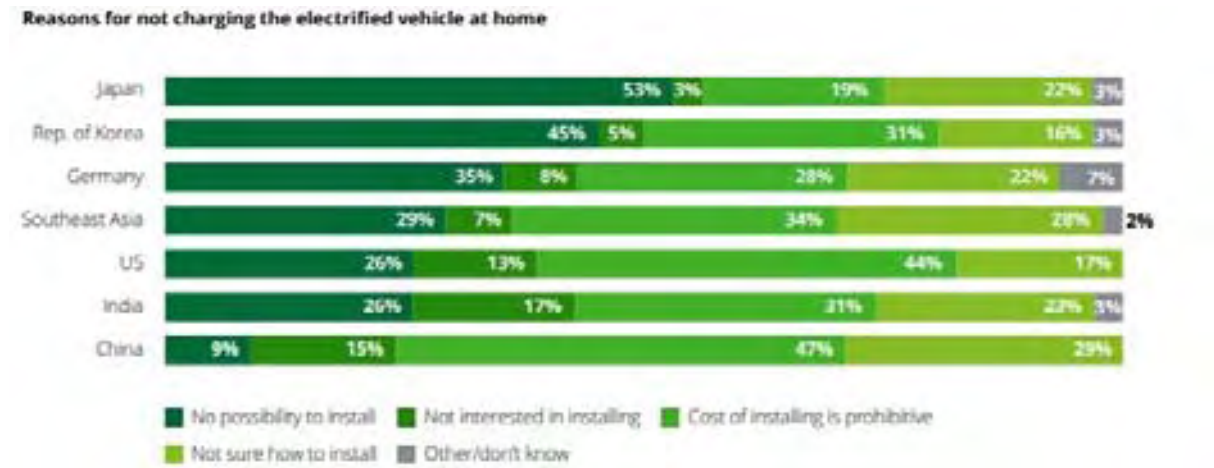


Figure 5. Reasons for not charging the electrified vehicle at home. Source: Deloitte 2022. Global Automotive Consumer Study.

Price of electricity if increases worldwide may sway a significant number of consumers away from all types of electric vehicles purchase in most global markets. Countries like China, India and United States of America and on the top of the pyramid of these decisions.

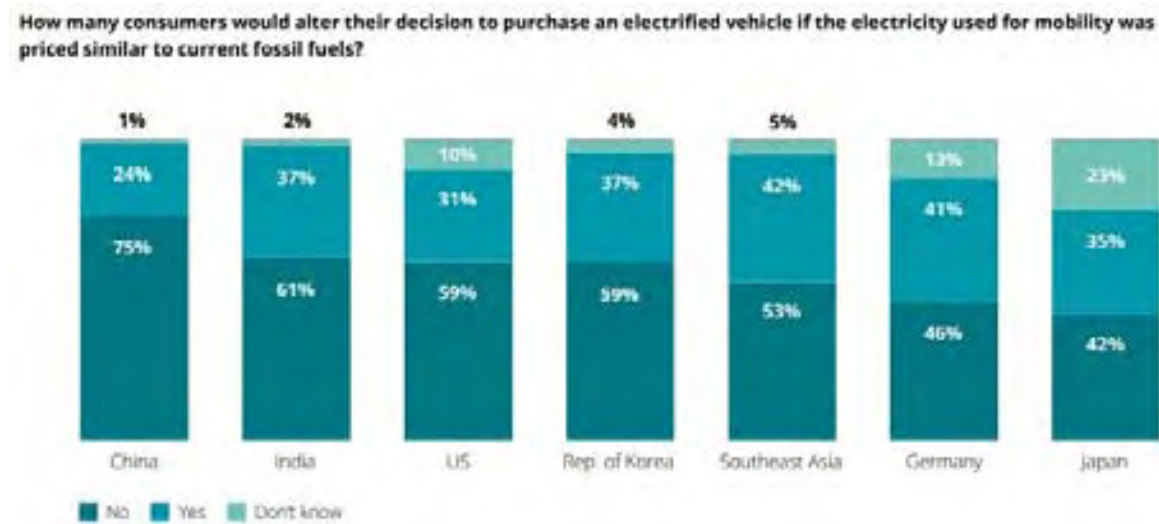


Figure 6. How many consumers would alter their decision to purchase an electrified vehicle if the electricity used for mobility was priced similar to current fossil fuels? Source: Deloitte 2022. Global Automotive Consumer Study.

Consumers who are concerned about considering an electric vehicle have declared this is due:

- driving range (US, Germany, China),
- lack of public electric vehicle charging infrastructure (Japan, South Korea, India and Southeast Asia).

Some other reasons for this matter are:

- lack of charger at home,
- time require to charge,
- safety concerns with battery technology.

Greatest concern regarding all battery-powered electric vehicles

Concern	US	Germany	Japan	Rep. of Korea	China	India	Southeast Asia
Driving range	20%	24%	15%	10%	22%	10%	13%
Cost/price premium	13%	12%	16%	9%	6%	12%	11%
Uncertain resale value	2%	2%	2%	1%	4%	4%	3%
Potential for extra taxes/levies associated with BEVs	4%	2%	1%	2%	6%	5%	4%
Time required to charge	10%	9%	8%	15%	11%	11%	11%
Lack of public electric vehicle charging infrastructure	14%	14%	19%	26%	12%	23%	28%
Lack of charger at home	8%	10%	19%	7%	5%	4%	6%
Lack of alternate power source (e.g., solar) at home	5%	4%	4%	3%	4%	6%	5%
Safety concerns with battery technology	9%	8%	6%	19%	16%	14%	11%
Lack of sustainability (i.e., battery manufacturing/recycling)	6%	10%	4%	4%	12%	8%	6%
Lack of choice	3%	3%	1%	1%	3%	3%	2%

 Greatest concern

Figure 7. Greatest concern regarding all battery-powered electric vehicles. Source: Deloitte 2022. Global Automotive Consumer Study.

Consumers expectations are varied due to worldwide location and infrastructure development. Users from United States are expecting to full charge electric vehicles for over 500 miles and users in China, Japan and India are content with range of around 250 miles.

Consumer expectation of driving range from a fully charged all-battery electric vehicle

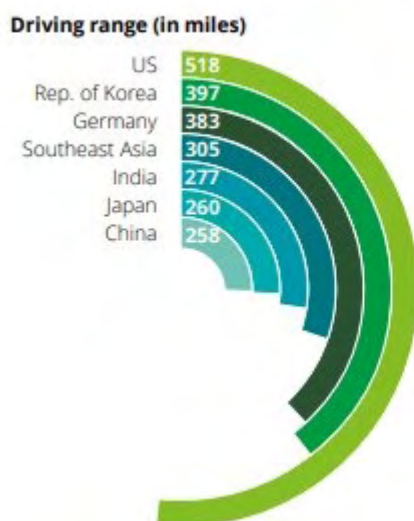


Figure 8. Consumer expectation of driving range from fully charged all-battery electric vehicle. Source: Deloitte 2022. Global Automotive Consumer Study.

The pandemic Covid-19 has had relative impact on next vehicle purchase. These impact is particular clearly visible in India and Southeast Asia with almost 2 out of 3 consumers. Main reason given to purchase a electric vehicle is to avoid public transportation. Germany, Japan and United States are still on the top of pyramid of purchasing electric vehicle by consumer. This can be caused by higher household income, development of infrastructure and higher percentage of education in the field



Figure 9. Future vehicle intentions. Source: Deloitte 2022. Global Automotive Consumer Study.

The main reason to acquire next vehicle via a virtual process for consumers are:

- convenience,
- speed,
- easy of use.

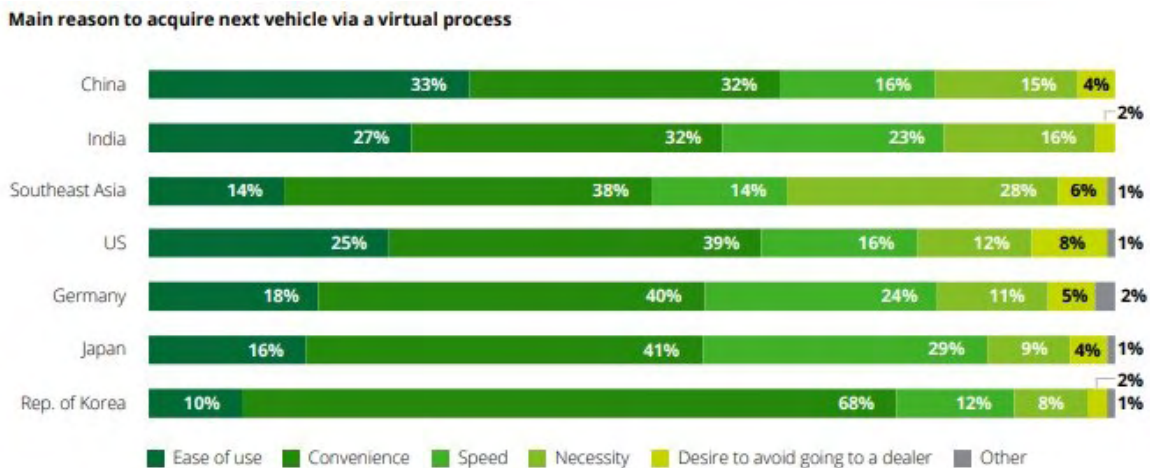


Figure 9. Main reason to acquire next vehicle via a virtual process. Source: Deloitte 2022. Global Automotive Consumer Study.

In United States, Germany and China are being preferred personal vehicles as a mobility choice across market. All these 3 countries are in this matter equal or above 60%. Public transport in the second most chosen type of transportation in Japan and South Korea.

Mobility modes to meet transportation needs

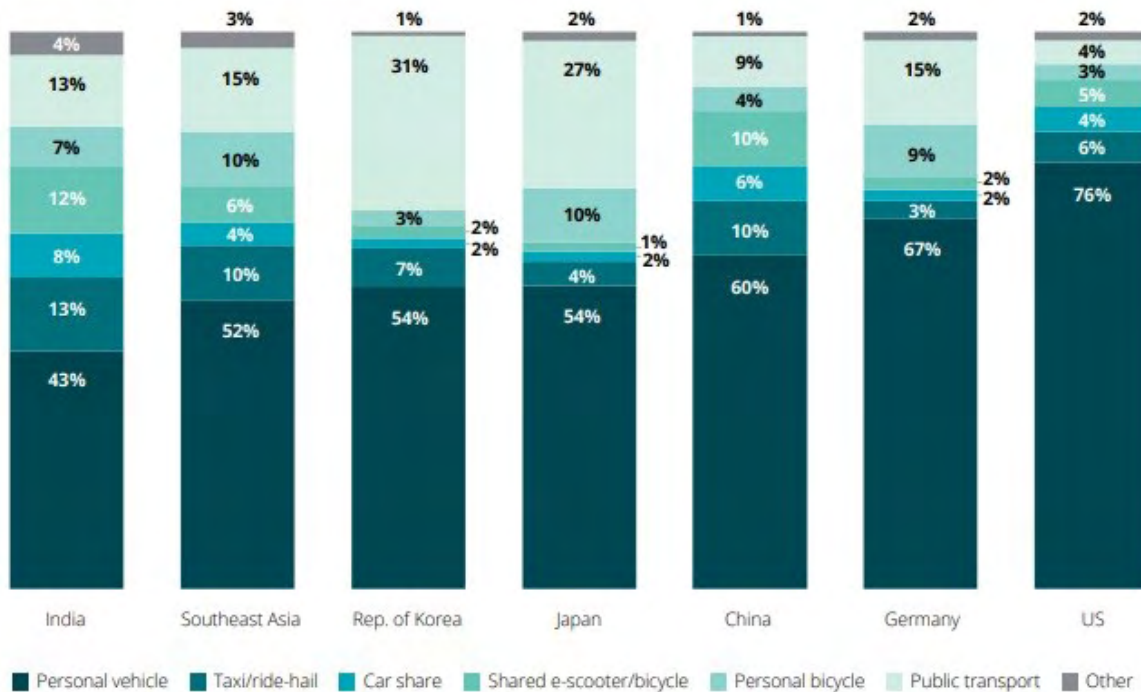


Figure 10. Mobility modes to meet transportation needs. Source: Deloitte 2022. Global Automotive Consumer Study.

The most important characteristics of a vehicle subscription which consumers would prefer are:

- flexibility,
- availability of vehicles,
- convenience.

Top three most important characteristics of a vehicle subscription

Characteristics	US	Germany	Japan	Rep. of Korea	China	India	Southeast Asia
Convenience (e.g., all relevant services included, except for fuel)	1	1	1	1	1	1	1
Increased flexibility (e.g., shorter contract durations)	4	2	2	3	2	2	2
Possibility to exchange vehicles	2	5	5	4	3	3	4
Possibility to subscribe to a vehicle segment (e.g., SUVs) instead of a specific model	7	9	10	10	5	5	7
Possibility to subscribe to a specific model instead of a vehicle segment	9	10	11	13	8	9	12
Availability of vehicles (e.g., short delivery times)	3	3	3	9	4	4	3
Home delivery services (e.g., vehicle is dropped off and picked up at desired location)	8	6	8	11	6	10	8
Hassle-free online contract closing/full digital customer journey	12	8	6	6	10	12	11
Full cost control due to transparent and predictable fixed monthly fees (e.g., no surprises via all-in offers)	5	4	4	2	9	8	5
Availability of complementary premium services (e.g., concierge services, valet parking)	14	14	14	12	11	14	14
Premium vehicles/brands offered	10	12	12	8	7	11	10
Selection of only brand-new vehicles (for a comparable higher monthly rate)	13	13	13	14	12	13	13
Selection of brand new as well as certified pre-owned vehicles (for a comparable lower monthly rate)	11	11	9	7	14	7	9
Possibility to test new vehicles for a certain period without consequences	6	7	7	5	13	6	6

Figure 11. Top three most important characteristics of a vehicle subscription. Source: Deloitte 2022. Global Automotive Consumer Study.

4. Discussion

The key conclusion based on the Deloitte 2022 Report about global Automotive Consumer Study are:

- consumer preferences are differed due to household budget and income, habits, education and knowledge, technological solutions, development of required infrastructure,
- for the most countries people are drawn for electric vehicles due to following reason: concern about climate change, reduced emissions, lower fuel costs,

- consumers in China, India and the SEA region are planning to use both renewable power and regular grid,
- price of electricity if increases worldwide may sway a significant number of consumers away from all types of electric vehicles purchase in most global markets,
- consumers who are concerned about considering an electric vehicle have declared this is due to driving range and lack of public electric vehicle charging infrastructure,
- the main reason to acquire next vehicle via a virtual process for consumers are convenience, speed, ease of use.
- in United States, Germany and China are being preferred personal vehicles as a mobility choice across market.

5. Summary

The Global Automotive Consumer Study informs about the point of view on the evolution of mobility, smart cities, connectivity, transportation, and other issues surrounding the movement of people and goods. Based on the study provided following thesis have been proved:

- willingness to pay for advanced tech remains limited,
- interests in electrical vehicles driven are running by lower costs and better experience,
- personal vehicles continued to be preferred as mode of transportation,

Due to subject of article further researches should be developed as the pandemic Covid-19 and military aggression Russia on Ukraine have been still causing many changes in the matter.

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THE IDENTITY OF THE SELECTED AUTOMOTIVE BRAND BASED ON THE ANALYSIS OF ADVERTISEMENTS

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Purpose: Specification of the identity of a selected automotive brand – Jeep on the basis of the analysis of the advertisement content and verification of its correspondence to the brand image presented in the literature.

Design/methodology/approach: In order to determine the identity of the brand we analysed the content of 13 advertisements of the Jeep brand available on YouTube. Then we conducted the quantitative and qualitative analysis of the text. In the quantitative analysis we examined the frequency of the occurrence of the attributes. We carried out a comparative analysis of the content of the advertisements and the results of the research available in the literature.

Findings: The identity of the Jeep brand corresponds to the one described in the literature. Both in the marketing message and in the analyses of the results of the study it is perceived as being connected with freedom, adventure, open space as well as the off-road style and endurance. However certain discrepancies have been observed. In the scientific literature no associations of the brand and the creation of the history and the legend has been noticed, nor the exhibition of the blood ties and attachment to the brand “family” and nor the promotion of the independent and active lifestyle has been noticed. Whereas in the advertisement message the properties of the brand concerning its roughness and harshness suggested by numerous authors do not exist.

Practical implications: We obtained information about the selected automotive brand. This information shows which attributes build its identity, i.e. the image of the brand desired by its owner. On this ground we may decide on taking up the marketing activities (promotional and others) aiming to create the image of the brand corresponding to the owners’ intentions.

Limitations: We analysed only the advertisements from the years 2007-2019 directed to the Polish market. This study should be treated as a pilot kind of the study.

Originality/value: The comparison of the identity of the brand present in the advertisement message and scientific literature. We observed the correspondence of numerous attributes, as well as differences. The conclusions may contribute to the opening up of the discussion on the creation of the brand in the passenger cars market.

Keywords: brand, automotive market, identity, image, associations, Jeep.

Category of the paper: Research paper.

1. Introduction

A brand is the entire marketing communication in a nutshell (Kotler, 2006). It contains a message, associations, emotions, it brings numerous values (Liczmańska, 2008). The identity and image of the brand are the abstract terms. They cover a set of features and visions ascribed to a brand which function appropriately in the awareness of a person who is creating the marketing message (identity) and of a consumer (image). Positive and at the same time unique identity and image are the capital necessary for maintaining the high position in the competitive market (TNS, 2011).

Numerous brands present in the automotive market have a very long history reaching even over a century. Some of them build their own identity and image based on unique attributes which allow for an express distinction from the competitors. For 80 years the Jeep brand has been establishing its identity by demonstrating its relations with freedom, adventure and passion. For many Jeep is not only a slogan, but it is the way of life. This brand has an enormous emotional charge. It is so strongly associated with an off-road car that the name „jeep” is very often used to call other off-road cars produced by other brands. The word “jeep” has become the brand in itself being one of the most renowned trade marks and at the same time one of the automotive brands deemed as a cult brand such as Harley Davidson or Porsche. Therefore, it is a brand of a very strong identity and extremely explicit image. The identity and image of the brand may come into life spontaneously for example by the informal message passed among the consumers. They may also be intentionally created by the owner of the brand and communicated in the promotional message such as advertisement. Taking the above into consideration, in this paper we examined how the owner of the brand promotes its identity in the advertisement message. We compared the obtained results with the results of the research available in the literature in order to check if the specified identity is convergent with its commonly observed and accepted, as well as verified by other researchers image. The library query has proved that certain hypotheses may be posed and verified, however simultaneously the number of elaborations concerning this matter is rather small (for example Polonsky, 2012; Wei, 2014; Henderson et al., 2002; Essamri et al., 2019; Dzyabura and Peres, 2020; Yourkston et al., 2010; Danziger, 2018; Prykop and Heitmann, 2011; Kotler and Armstrong, 2008). This is base which encouraged the author to carry out another independent study.

2. Identity and image of the brand

When building the marketing strategy an organization must make the decision concerning the brand (the brands) given to its products. The brand allows for the identification of the products, promises the benefits to the buyers, but above all it creates the image of the organization perceived by the buyers (Michalski, 2003). Already in the eighties of the 20th century the brand was presented only as the name, term, sign, symbol, drawing or combination of these elements created in order to mark the product and distinguish it from competitive products (Kotler and Armstrong, 1989). However, the definition presented later on by P. Kotler ascribes greater meaning to the brand. A brand is not „a mark” or symbolic logotype, but above all it is a pledge, a promise.

The brand includes a message, associations, emotions and numerous values. It is the total of impressions made on the customers as a results of its use (Kall, 2006). The brand of the product creates the mind of the buyer of the product, a vision concerning its value (Skrzypek and Pinzaru, 2017). Therefore it is something more than just the name of the product – it is the equivalent of company’s DNA (Kall, 2002; 2006). It is the promise of a constant supply of the specific collection of features, benefits and services available to the buyer (Liczmańska, 2008). The brand, is above all, the synonym of the quality, endurance, product guarantee (Remer, 2004). Modern marketing is however of post-material character. Therefore the customers are buying the brands and the meanings that they read subjectively using cultural interpretations. Marketing communication exists in the symbolic world. The increase of the role of the brand is one of the symptoms of this fact. The marketing as well as the brand, becomes the system of the production of symbolic signs which are socially promoted. Therefore, the brand is a symbolic, emotional, ephemeral and subjectively interpreted construct (Sułkowski, 2012).

In the literature on the subject there are two important terms particularly strongly connected with the brand. They include its identity and image. This aspect has been considered in the definitions according to which the brand is a multi-dimensional construction that integrates both the physical and non-material attributes of the product and is composed of three basic elements (Dębski, 2009):

1. The identity of the brand i.e. the manner in which the creator of the brand wants it to be perceived by the consumers.
2. The image of the brand, i.e. the manner the consumers perceive the brand.
3. The positioning of the brand, i.e. the place of the brand in the market at a given moment.

At the time of hyper competition the achievement of the desired image is one of the goals posed to the marketing communication. With approximate and comparable level of quality and functionality of the offered products, the image becomes today one of the distinguishing features of an organization against competitive products and substitutes. The image is the carrier of the character of an organization and its products and it is the factor that significantly

influences the decisions of the buyers, it offers additional non material benefits to the customers (e.g. prestige, distinction), it allows to distinguish the products, brands and enterprises. It also contributes to the establishment of the trust to the organization and it is the factor that minimizes the risk connected with the purchase (Czubala et al., 2006). The image of a company or brand is the picture of its identity in the consumer's awareness (Altkorn, 1999). Whereas the identity of an enterprise or a brand is the way of being identified by the surrounding. Therefore the identity has a normative, demanded character and the image is real. The image of an organization or brand is the picture of an organization and its offer perceived by the buyers. In other words it is the reflection of the identity of an organization or brand in the awareness of the buyers.

The image performs the following functions (Altkorn, 1999):

- the identification function which draws attention to the features of an organization or brand, emphasizes the benefits both emotional as well as functional resulting from the offer and values desired by the customers,
- the simplifying function which results from the fact that the decision concerning the selection of a given product among the huge diversity of substitutes turns out to be difficult; the consolidated image being the effect of the settled position of an organization may contribute to the direction of the said decision,
- the function supporting the decisions which consists in the receipt of information and selective evaluation of an organization or brand by comparing the existing image with ideal image or the image of competitors,
- the function reducing the risk, i.e. the guarantee of the presented offer resulting from good reputation of an organization or brand,
- the function shaping the loyalty towards the customers allowing to gain permanent, satisfied and long-term customers.

In a symbolic and post material sense, the brand is a perceived image inherent to the customers' minds (Dębski, 2009). It covers the feelings and emotions which accompany the customer who is buying given products. The customer creates the image of the brand on the basis of the experiences with it. The said image is the foundation of numerous subsequent behaviours of the customer in the market. The desired image is the target image – the organization is striving to achieve it by taking up the activities of a long-term character. It should be noticed that the image is the consequence of identity and it does not have to be the same (Altkorn, 1999; Czubala et al., 2006; Lechowski, Lotko and Lotko, 2014).

It has been proved that the image of the brand influences the cognitive aspect of customers' attitudes towards new products (Grzegorzczak, 2005). Whereas in the emotional (affective) sphere the shaped brand's image intensifies the buyer's feeling of satisfaction from the purchase and use of the product. In the loyalty sphere the brand's image constitutes the guarantee of maintaining the quality (guarantee function) and functional features of the product. The collection of previous use experiences, feelings and emotions which help in the selection

are also significant for the preferences. The customers with strongly encoded view of the brand are resistant to the promotional activities performed by the competitive brands and should they by any chance be influenced by the competitors, they tend to come back to their loyal behaviours rapidly (Grzegorzcyk, 2005).

To sum up the brand as the key instrument used in the process of shaping the image is understood as the set of features thanks to which the product ensures the functional benefits and added values which are valued enough to make the purchase (Marciszewska, 2010). It establishes a positive reputation of the product and reinforces its attractiveness, gives the feeling of safety, high values and distinction (Skrzypek and Pinzaru, 2017).

3. History and the present day of the Jeep brand

Since the 80's the Jeep brand has been inseparably connected with the freedom, adventure, authenticity and passion. Everlasting and uncompromised attachment of the brand to the considered construction solutions helped to establish a special bond between the cars and its owners. Jeep owners know that the saying „Go Anywhere. Do Anything” is not only a slogan but it means something more than just the brand logo. This is “an honourable badge” (Jeep, 2021).

The history of the make reaches the beginnings of the Second World War. In June 1940 the American army announced a tender for light exploratory vehicle. In the first place the companies such as Willy's-Overland and American Bantam Car Manufacturing Company announced their participation in the tender, and then Ford joined them. The first prototype of the car, Willys Quad, was constructed in 49 days. In March 1941 as a result of the field tests and verifications conducted by the specialists of the army, the Willy's construction had been chosen as the basic vehicle of the American armed forces. After a series of modifications, Willys Quad transformed into Willys MA, and subsequently into Willys MB. However the American army and the world named this vehicle “Jeep”. It is suggested that this name was established on the basis of the pronunciation of sound “GP”, i.e. the military abbreviation of the words *general purpose*.

When the war ended, Chrysler reserved the „Jeep” trade mark and at the same time planned to introduce the Willys cars for the agricultural purposes in the form of field-use Universal Jeep. The first civil Jeep CJ-2A was manufactured in 1945 and had been produced for four years. It was substituted by CJ-3A model. It was very similar to the forerunner. In 1953 the model CJ-3B was launched. The production of this model lasted till 1968. In the same year the company Willys-Overland was taken over by Kaiser Company for the price of 60 million dollars.

Two years later, in 1955, Kaiser presented the model CJ-5. Thanks to the introduced modifications the car was desired by the buyers interested in the off-road cars. This model was produced in the years 1954-1984 and it was the longest period of production from among all Jeep cars.

In 1970 the Kaiser Company was taken over by the American Motors Corporation. The vehicles with 4x4 drive gained more and more popularity. In 1978 600 Jeep cars were produced every day. Jeep took advantage of this fact and it introduced Wrangler model. In 1987 the American Motors Corporation was taken over by Chrysler Corporation. The Jeep brand was owned by Jeep/Eagle Division. In 1998 Chrysler Corp., together with the enterprise Daimler-Benz, the manufacturer of the Mercedes-Benz cars established a common concern named Daimler-Chrysler. In 2007 Daimler sold its shares in the company to the American investor. In 2014 after the merger between Chrysler and the Italian concern called FIAT, the brand was absorbed by the structures of the Italian enterprise. Since 2021 Jeep has been one of the 14 brands that came under the international Stellantis conglomerate (Moje Auto, 2021; Jeep, 2021).

The name „Jeep” has begun to be widely known during the Second World War when it was identified with the American military off-road car – Willys MB. There are various versions of the origin of the name “Jeep”:

- from Eugene the Jeep, a character from the cartoon „Popeye”, known for his special powers and skills,
- from the similar model of Ford GP (G – *government* (government order), P – marking of the chassis with the wheelbase of 80 inches, which was built at the same time as Willys,
- from *general purpose*, i.e. a car of general purpose, however this definition never appeared officially in relations to this model.

It is probable that the American military mechanics used this term to call every vehicle to be tested in the 30's of the 20th century and it was applied in relations to the vehicles made during the First World War (Wikipedia, 2021).

Today Jeep is the make with the biggest sale volume among the former FCA concern and it constituted 30 % of sale in 2017 and 34 % in 2018 (Marrone, 2019). In 2020 the offer of the make in the Polish market included 7 models (models marked 4xe are the models with hybrid drive of the PHEV type - *Plug in hybrid Electric Vehicle*, i.e. a hybrid with the power socket loading) (Jeep, 2021):

- Jeep Compass (from PLN 99 900),
- Jeep Compass 4xe (from PLN 185 700),
- Jeep Gladiator (from PLN 299 400),
- Jeep Renegade (from PLN 79 200),
- Jeep Renegade 4xe (from PLN 163 200),
- Jeep Wrangler (from PLN 208 500),
- Jeep Wrangler 4xe (from PLN 303 500).

The company FCA Poland closed the year 2020 with the sale of the total of 24 867 Fiat Chrysler Automobiles (FCA) cars in the Polish market, including 16 848 models of passenger cars, what constitutes 3,9% share in the market respectively. Despite difficult situation in the market, FCA recorded the increase of the share in the passenger car market by 0,3 pp (FCA, 2021). The Jeep brand has also achieved a good result and its customers registered 2 940 new cars in Poland. The following numbers of the cars of particular models were sold: (FCA, 2020):

- Jeep Compass – 1127 cars,
- Jeep Renegade – 1038 cars,
- Jeep Wrangler – 513 cars,
- Jeep Cherokee – 512 cars,
- Jeep Grand Cherokee – 49 cars,
- other – 1 car.

The share of the brand in the Polish market of the new passenger cars amounted to 0.7%.

4. Research problem in the light of literature study

The Jeep brand bears a huge emotional charge. Today Jeep is so strongly associated with the off-road cars that the name „jeep” is often used to call off-road cars of other brands. The word *jeep* has become the brand in itself being one of the most renowned trade marks and at the same tie automotive brands commonly recognized as cult brand, such as Harley Davidson or Porsche. It is also found in dictionaries as the ordinal noun meaning „robust off-road car” (Edmark, 2021).

A library query carried out with the use of the Google Scholar portal has revealed, against the expectations, a very small number of studies on the perception of the Jeep brand in the global literature.

In particular among the identified studies there are the ones concerning the *brand concept mapping* – BCM) in the concept of the brand extension (here: automotive Jeep on man’s clothing). It has been proved that strong associations with the basic brands are transferred to the extended brand. What is more the personality of the brand plays an important role in the acceptance of the brand by the customers (Liu, Wei and Hang, 2018).

The attempts to identify strategic directions of the development of the brand are also made, on the example of the brands of the former FCA concern: Alfa Romeo and Jeep (Marrone, 2019).

Other author (Polonsky, 2012) indicates the connection of brand's personality with the personality of the buyers, in particular in the case of the Jeep brand by indicating the extroverted personality. It has also been proved that the customers may accurately perceive the personality of other customers and their preferences towards other brands.

Y. Wei (2014) in the interesting study on the perception of two American automotive brands: Ford and Jeep, with the use of the above mentioned BCM technique, has proved that low efficiency, ability to drive off-road, four wheels drive, steeliness, endurance, classic style, roughness and harshness are the associations that most frequently accompany the perception of the Jeep brand.

The authors of the next study (Henderson et al., 2002), point out the presence of such attributes as speed, American origin, classic style.

Taking into consideration the modern trends within the scope of the creation of the identity of the brand and its image in the *on line* societies, it has been proved that the role of such informal societies is also crucial in the creation of the image of the Jeep brand (Essamri et al., 2019).

Subsequently D. Dzyabura and R. Peres (2020) have proved that the Jeep brand is perceived as the brand distinctly connected with the outdoor scenery, open space and it is not associated with urban landscape.

Whereas E. Yourkston with the team (2010) conducted the study on the susceptibility of the brands to the extension strategy of the brand and they also proved the same susceptibility for the Jeep brand (from automotive brand into the clothing brand).

P. Danziger (2018) identifies the Jeep brand as the American, rough, reliable, resistant brand, in one word the trustworthy brand. This author has also conducted the research on the attitude of 8 different segments of customers towards the brand.

Other researchers (Prykop and Heitmann, 2011) notice that brands very often represent a specific set of values, in particular the Jeep brand is often associated with freedom and adventure as well as with endurance and reliability. P. Kotler and G. Armstrong (2008) find that on a global scale the Jeep brand is a rough, harsh and reliable.

In the course of carrying out the study on the establishment of the society of the users around the brands, J. McAlexander with his colleagues (2002) proved that among the owners of the Jeep brand vehicles there is a distinct influence exerted on the family members and friends within the scope of recommending the brand and the conversion, i.e. the change of a vehicle of other brand to a Jeep brand vehicle. In this way the conceptualization of the term of customer loyalty as their integration in the society gathered around the brand has been enriched.

These observations are shared by K. Keller (2003), who identifies the Jeep brand as one with the most loyal customers who additionally manifest their loyalty in everyday behaviours. This opinion is also shared by other researchers (Bennett and Rundel-Thiele, 2005) who claim that the products, whose image corresponds to the personality and lifestyle of the customers,

achieve particularly high level of the loyalty among the buyers. The Jeep brand is one of the examples.

The review is exhausted at this point. The number of publications on the considered subject must be assessed as small. Therefore the scope of this research deserves the discussion.

The above analyses gave the basis for the formulation of the research question-problem: *Does the identity of the Jeep brand correspond to the one described in literature?* And in consequence to formulate a working hypothesis:

H₁: The identity of the Jeep brand corresponds to the one described in literature.

This hypothesis has been verified in the course of this study.

5. Methodology of the study

In order to identify the research problem, its scope and rank in the literature a library query has been carried out in the Google Scholar service. The service was searched for three phrases:

- “automotive brands perception Jeep”,
- “Jeep brand associations”,
- “Jeep brand perception”.

Literature study was carried out on the 8th November 2021. The results from two first websites returned by the search engine were selected in order to undergo the literature analysis.

In order to identify the attributes of the identity of the brand (i.e. the picture created by the owner) a compilation of all Polish advertisements of the Jeep brand displayed in the years 2007-2019 on YouTube and MistakTV channel was applied (Mistak, 2021). This paper is inspired by this particular material. In total we analyzed 13 advertisements. Subsequently we carried out the analysis of the text, both the quantitative (statistical) analysis and quality analysis. In the first case we applied the frequency analysis carried out in MS Excel 2016. The cloud of tags was generated in Word Art program.

The obtained identity of the brand was compiled with the results obtained by other researchers and this allowed for the verification of the working hypothesis.

6. Analysis of the results

The Jeep brand present in the Internet website shows its unbreakable connection with freedom, adventure, authenticity and passion (Jeep, 2021). We analyzed 13 advertisements of the Jeep brand broadcast in the Polish television in the years 2007-2019 (Mistak, 2021). We selected the terms concerning the brand and the cars. We analyzed the text read by the

reader. The record is not the precise transcript, for the purposes of the study some terms have been modified and then fitted in the text according to the grammar rules. Identified attributes of the brand identity are presented in Table 1 with short comments.

Table 1.

Attributes of the Jeep brand based on the analysis of advertisement content

No.	Attributes of brand identity	Comments
1	America, created form the bottom-up, fruit of the work of the masters, performed with passion and love for perfection, "Build to act, created to last".	Reference to the American roots of the brand, emphasis of the passion in the striving for improvement, endurance, reliability, simply longevity (duration) as the attributes of the product.
2	Pioneer, other than the others, creates the history, sets new routes, gives real freedom, since 1941, the legend.	Distinction from competition, distinction from the „crowd”, seventy years of directing the course in which the legend, which gives the users to make their dreams of freedom come true, is developing.
3	It is in our blood, destiny’s paths, four wheels drive, power, independence, history of our family, „Freedom is in our blood”.	Native attributes of the brand, „blood ties” with the users, affiliation with the „family” – both the models and users society. Highlighting of the technical characteristics – drive and power.
4	Mysterious, exciting, unpredictable, life, “Life. Take it!”.	Passion and variability as attributes of the surroundings. Life requires a warlike, decisive approach in order to tame it. Products of the brand are meant to help in it.
5	Conqueror’s nature, desire for freedom, DNA, acquisition, improvement, „Perfection led us here”.	Gaining the desired freedom is inscribed in the genetic code. Technological improvement as well, which leads to the “top”.
6	New horizons, life whirlpool, to discover anew, terrain, „Wild is beautiful”, „Jeep – this is your time”.	Changeability of life, discovering anew, taking users time in terrain, in the beauty of “wildness”.
7	History, adventure, “Your history is awaiting You”.	Creation of the history and at the same time inviting the users of the brand to it. History co-produced by the brand (giving the opportunities) and the users (taking the advantage).
8	History, I don’t accept compromises, goes to the top, the space is its home, freedom is its kingdom, soul, „Nature’s new dimension”.	The brand creates the history according to which products and users are the “heroes”. Reference to the ideals of infinity, freedom which are „home, soul and kingdom”.
9	Challenge, training, you don’t give in, ride, „Get off the track”.	Speed, intensity of life. Encouragement to face the challenges and a ride on “own routes”, going beyond regular roads, going off-road at the same time; going beyond (boring) patterns.
10	Choice, technology, sense of security.	Possibility of choice as the desired and attainable condition, technology which guarantees safety to the users.
11	Brave, interesting, curious about the world, unstoppable, four wheels drive, stylish, self-confident, inside always 4x4, „Born to be wild”.	Promotion of personality features as the attitude towards life: curiosity, courage which are “supported” by technical and stylistic solutions. Legendary four wheels drive and legendary slogan.
12	Curious, unstoppable, 4x4 since childhood, stylish, technological, inside always 4x4.	As above.
13	„Legends are not born, they are created”.	Legend as a story created by the owner of the brand as well as by the users.

Source: author’s own study.

On the basis of Table 1 we stated that the owner of the brand is trying to create it at first through the reference to the lifestyle of the users of the Jeep cars. In general the word “life” frequently appears in the advertisements. Even one of the slogans sounds aggressively and combatively: „Life. Take it!” (advertisement 4), the famous „Born to be wild” (advertisement 11) or the paraphrase “Wild is beautiful” (advertisement 6). The noun “routes” also appears both in literal sense and “routs of destiny” (advertisement 2 and 3). Jeep user may discover these routes as well as map them out. The DNA terms are similarly connected with life and the manner it is perceived and handled (advertisement 5), the slogan „we have it in our blood” (advertisement 3), the whirlpool of life (advertisement 6) or attachment to the “family” (advertisement 3). This group of associations determines the lifestyle character of the brand. Additionally it is directly emphasized through the message of the brand “stylishness” (advertisement 11 and 12). The brand encourages to the adventure – „New dimension of adventure” (advertisement 7 and 8). However this character is not shallow, superficial. It very often refers to the lofty term of freedom – the slogan “Freedom is in our blood”, “freedom is its kingdom” (advertisement 3, 5, 8). The identity message of the brand covers the reference to the history and its continuation also through the creation of users’ own histories „Your history awaits You” (advertisement 7 and 8) and it should be realized by way of discovering new horizons, discovering anew (advertisement 6), pioneer activities, gaining (advertisement 6). The brand promotes curiosity, taking up difficult challenges, courage, intransigence, self-confidence, nature of a conqueror (advertisement 5, 8, 9, 11, 12). This is the profile of the recipient of the brand. The message also presents the “outdoor” character of the brand, its connection with the nature by highlighting such associations as terrain (advertisement 6), beyond the known track (advertisement 9), space (advertisement 8), wildness (advertisement 6 and 11). Being aware of and entitled to this, the owner of the brand builds its identity as legendary and appropriate for the heroes – „Legends are not born, they are created” (advertisement 2, 8, 13).

The second group of advertisements is concentrated on useful values of the Jeep brand vehicles rather than on the abstract constructs. Improvement and striving for perfection is emphasized here (advertisement 1 and 5). Four wheels drive is highlighted from technical side (advertisement 11 and 12), as well as the power (advertisement 3) and safety or technology in general (advertisement 10 and 12).

Table 2 presents the attributes of the brand identified on the basis of the analysis of advertisement content and frequency of their broadcasting. It presents the attributes that occur more than once. The remaining attributes occurred only once.

Table 2.

The most frequent attributes of the Jeep brand on the basis of advertisements

No.	Attribute	Number of occurrences
1	Four wheels drive	5
2	History	4
3	Freedom	3
4	Technological	3
5	Life	3
6	Routes	2
7	Legend	2
8	Improvement	2
9	Stylish	2
10	Unstoppable	2

Source: author's own study.

The analysis of incidence of the brand attributes in advertisements carried out on the basis of data included in Table 2, leads to the conclusion that the most frequent terms are four wheels drive (5 occurrences), history (4 occurrences), freedom (3 occurrences), technological (3 occurrences) and life (also 3 occurrences). The remaining terms occurred twice. It is observed that the terms on position 2 (history), 3 (freedom), 5 (life), 6 (routes) and 7 (legend) are abstract, metaphoric, therefore they concern the creation of the identity of the construct and the „soul” of the brand, whereas the terms on position 1 (four wheels drive), 4 (technological), 9 (stylish) and 10 (unstoppable) concern the products – the cars.

The most frequent associations with the Jeep brand obtained from the analysis of advertisements and presented in the form of the cloud of tags are included in Figure 1.



Figure 1. The cloud of tags of associations with the Jeep brand generated on the basis of the analysis of the advertisements. Source: author's own study.

The cloud of tags presented in Figure 1 shows that the Jeep brand, in the message of its identity, promotes above all the references to freedom, history and four wheels drive. It also refers to the routes of life and at the same time it emphasizes the technological character of its products.

7. Discussion of the results

The discussion of the results was carried out with the results obtained from the study conducted by various authors, according to the procedure mentioned in the part of this paper concerning the methodology of the study.

When analysing the obtained results with publications of other authors we observed that for example in the papers written by Y. Wei (2014) the attributes of the Jeep brand include the off-road style, endurance and manhood. The perception of the Jeep cars as the off-road cars is confirmed in the advertisements especially by promoting the four wheels drive (3, 6, 11, 12). The endurance attribute does not appear directly in the advertisements. Taking up the challenges (advertisement 9) and being unstoppable (advertisement 11 and 12) may be regarded as analogies. Also the manhood does not appear directly in the advertisement message, but it is indirectly present by promoting the „manhood” handling of life (advertisement 4, 6, 8, 9).

Other authors pay attention mainly to the roughness and harshness of the Jeep brand (Henderson et al., 2002; Danziger, 2018; Kotler and Armstrong, 2008). This feature does not appear directly in advertisements but the terms connected with it are the active, simply warlike attitude towards life (advertisement 4 – „Life. Take it!”), attribute of „wildness” (advertisement 6) or „going off the road” (advertisement 9).

Endurance and reliability are also frequent associations (Danziger, 2018; Prykop and Heitmann, 2011; Kotler and Armstrong, 2008). These features have been identified in the advertisements as improvement (advertisement 5), “not giving in” (advertisement 9) and being “unstoppable” (advertisement 11 and 12).

In many quoted results a frequent association is the American origin of the brand (Wei, 2014; Henderson et al., 2002; Danziger, 2018). In the analysed advertisements it occurs in advertisement 1 (America) and the reference to the historic roots of the brand in advertisement 2 (since 1941).

The next authors observe the associations with adventure, open space, freedom (Dzyabura and Peres, 2020; Prykop and Heitmann, 2011). These attributes occur in the advertisement message very often. The associations with adventure and open space are included in advertisement 6 (new horizons), 7 (adventure), 8 (“New dimensions of adventure”, the space is its home). Reference to the term of freedom is observed in advertisement 2 (gives real freedom), 3 (“Freedom is in our blood”), 5 (desire for freedom), 8 (freedom is its kingdom).

When comparing the results obtained from the analysis of advertisements with the attributes of the Jeep brand present in the literature, we observed the compatibility concerning the identification of the brand as the one connected with freedom, adventure, open space as well as the off-road style and endurance. Whereas when analyzing the scientific literature the brand has not been associated with:

1. The creation of the history and the legend, highly promoted in the advertisement message (terms: pioneer, history, legend, hero in advertisement 1, 2, 7, 8, 13).
2. The exhibition of blood ties (between the brand and the users) as in advertisement 3 and the attachment to the “family” and brand DNA (in advertisement 3, 5, 11, 12).
3. The promotion of an independent and active lifestyle (in advertisement 5, 6, 7, 8, 9).

Whereas these features are expressly promoted in the advertisement message. On the other hand the occurrence of the features of the brand concerning the roughness, harshness of the brand suggested by many authors was not observed (Henderson et al., 2002; Danziger, 2018; Kotler and Armstrong, 2008).

The above observations should be deemed as the element of novelty obtained from the carried out comparative analysis.

8. Conclusions

In general, on the basis of the analysis of results obtained from the study on the advertisements it may be stated that the hypothesis has been verified, according to which the identity of the Jeep brand corresponds to the one described in literature. Both in the marketing message ad in the analyses of the results obtained from the studies, it is perceived as being associated with freedom, adventure, open space as well as the off-road style and endurance.

However the results of the carried out comparison showed the occurrence of certain discrepancies. In particular in the scientific literature no associations of the brand with the creation of the history and the legend, exhibition of the blood ties and attachment to the “family” of the brand as well as the promotion of the independent and active lifestyle have been observed. The features of the brand concerning the roughness and harshness of the brand suggested by numerous authors have not been reported in the advertisement message.

These conclusions constitute author’s contribution to the discussion on the identity of the brand in the passenger cars market.

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CULTURAL AND SPORTS ACTIVITY OF SENIORS IN THE MAŁOPOLSKIE VOIVODESHIP

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Purpose: The discussion of issues related to the seniors' participation in cultural life. An indication of the possibilities of free time management, the current level of participation of older people in culture, sport and recreation, and comparing them with the point of view of communes.

Design/methodology/approach: The seniors' cultural activity was presented from the perspective of data from the Polish Central Statistical Office. A survey conducted in 2018 among the communes of the Małopolskie Voivodeship in cooperation with the Regional Audit Chamber in Kraków was used to develop detailed analyses.

Findings: The surveyed local government units positively assessed their activities in the area of culture and entertainment of the elderly. The vast majority of the LGUs surveyed have no problems with the low level of participation of older people in cultural, recreational and sports life.

Research limitations/implications: The survey was conducted in the Małopolskie Voivodeship. The research could be extended to the whole country. In the future, the point of view of officials could be correlated with the opinion of residents.

Practical implications and social implications: Paying attention to the seniors' low cultural and sports activity. The result of this study is to draw attention to the differences in the perception of the issues of seniors' cultural and sports activity in terms of statistical data and surveyed local government units. The consequence should be a re-analysis of the problem in communes and the correction of relevant documents in this field.

Originality/value: The questionnaire research in which the author participated presents the issues of seniors' cultural and sports activity from the perspective of local government units in the Małopolska region. The article is addressed to all people who have an influence on making decisions in the field of promoting seniors' active lifestyle.

Keywords: seniors, social activity, physical activity, culture and entertainment, free time.

Category of the paper: Research paper, case study.

1. Introduction

Participation in culture and entertainment is one of the many possibilities of spending free time. Recently, a lot has been said about it, especially in the context of the additional amount that society has gained as a result of the COVID-19 pandemic. Participation in culture and entertainment or sport can be a supportive element in the fight against the effects of social exclusion. However, in order to present the topic in an appropriate way, it is necessary to consider what the participation of Poles in culture and entertainment has looked like so far. At what level it was shaped, what they were more willing to participate in and what they did not feel like doing. These considerations can be a starting point for local government units in the context of making decisions on allocating funds for tasks in the field of culture and entertainment, as well as sports. Due to the growing negative demographic changes, the data analyses carried out in this study refer to the cultural activity of the elderly. In the face of the problem outlined, among others, the research question appears about the role of the commune – as a local government unit that is closest to the local community – in promoting activities aimed at supporting the participation of older people in all social activities, which include cultural, entertainment and sports activities. Relevant statistical information of the Polish Central Statistical Office (GUS) was used to present selected statistical data on the use of free time. The source of data for the detailed analyses presented in the study is a survey conducted in 2018 among the communes of the Małopolskie Voivodeship in cooperation with the Regional Audit Chamber in Krakow.

2. Literature review in the field of activity

Activate, that is, make active, stimulate to action, enliven. Activity itself means the ability to act intensively; activity, active participation in something (Słownik wyrazów obcych, 2002). People's activity, according to P. Sztompka, is the only inspiration that causes that something constantly happens in society." Society exists only as long as some people act in relation to each other. " This interconnected community, which is constantly changing, does not exist without acting people. Everything that exists in it is a symptom or result of human activity (Sztompka, 2021). The mere activation of elderly people may be a chance for successful aging (Kaczmarczyk, Trafiałek, 2007). For this to happen, all possible steps should be taken that may contribute to reaching old age with a low risk of diseases and infirmity, with high mental and physical efficiency and sustained life activity (Gryglewska, 2006).

The inevitable process of aging of the population has many consequences. One of them is the increasing attention given to seniors. There are more and more studies on the issues of older people, also in the context of ensuring them appropriate leisure time management. The article by A. Jakubowska et al. (2015) was based on the nationwide research project "Why do seniors need culture?" The research focused on the diagnosis of the cultural needs of seniors as well as the types of activities and places preferred by seniors. The forms and methods of activating the elderly are discussed, among others, by K. Pędziwiatr (2015), pointing to, for example, senior clubs, Universities of the Third Age or the functioning of Social Time Banks. Activities undertaken by the elderly and their lifestyle represent a great research potential, which is reflected, for example, in the publications of A. Błachnio (2019) or T. Róžański (2016, 2020).

It is also worth mentioning here the publications of D. Ortenburger, A. Tsos (2021), R. Ng, et al. (2021), T. Tsuji et al. (2022) or S. Yang, S. Ye, H. Li (2022).

Physical activity is one of those possibilities of managing seniors' free time, which arouses particular interest in the Author. The literature often confirms the positive effect of physical activity on health. Systematic physical training helps to normalize, among others, diabetes, atherosclerosis, osteoporosis or hypertension, and to fight stress or obesity. It also helps to reduce pain in the locomotor system. Visual perception and psychomotor coordination are also improved. The medical community recognized regular physical activity as a universal medicine, inexpensive and accessible to all, and pleasant and without side effects. Its effectiveness has been confirmed by various studies. However, it is necessary to note the lack of scientists' agreement as to the precise indication of the type, intensity, frequency, duration and number of repetitions of "this drug" (Marchewka, 2013). For instance, Mazurek et al. (*Gereontologia Polska*, 2014), Sparling, Phillip, et al. (*Bmj* 350, 2015), Nelson, et al. (*Circulation*, 2007), Elsayy and Higgings (2010), Taylor (2014) wrote about the recommendations concerning physical activity of the elderly. In 2018, Physical Activity Guidelines for Americans (U.S. Department of Health and Human Services) were also published. The impact of physical activity on Hungarian seniors became the subject of a study prepared by K. Lampek et al. (2021).

The issue of Poles' participation in sport and physical recreation was raised, for example, in the work of Lenartowicz, Dziubiński and Jankowski (2017).

The problem with encouraging Poles to be physically active and participating in culture is still present, and the pandemic may have a variety of consequences. On the one hand, isolation can have a positive effect, because the society, hungry for contacts, will participate more actively in cultural life. On the other hand, you need to pay attention to its negative effects, including closure and other restrictions, fear of contagion, maybe depression, financial problems, etc. B. Mucha and M. Mucha (2021) express the similar opinion, noting that the time of the pandemic brought many benefits for some in terms of maintaining their form. There were also those who lost the will and motivation to be active, which in the long term may have serious consequences for human health (Mucha, Mucha, 2021). Isolation caused by the COVID-19

pandemic did not exclude the possibility of taking up physical activity at home, as indicated by, for example, K. Wolnicka (2021) or "Stay physically active during self-quarantine". Moreover, the publication by Arai et al. (2007) is important, for example, because of its links with depression, which may appear more often in a pandemic situation and be its consequence.

Seniors' activity can take many forms such as pro-social, intellectual or physical activity. This study focuses on the cultural and sports activity of the elderly. The relationship between seniors' activity and health was presented by A. Gębska-Kuczerowska (2002). The results of her research indicate, inter alia, that:

- active people assessed their health much better,
- active people used hospital care less often,
- active people were less burdened with cardiovascular diseases (or more stable in them),
- active people (physically or socially) were more physically fit, which translated into less frequent declarations of difficulty in moving around,
- activity had a positive effect on seniors' mental condition and maintaining a proper body weight.

At this point, it is worth mentioning the publication by John C, Woolcott et al. (2010), in which the authors point that the lack of physical activity is statistically significantly associated with an increase in the number of hospitalizations, length of stay and medical visits. The average cost of caring for physically inactive people was higher than the cost of health care for active people

Lack of physical activity is also associated with a higher risk of having a severe course of COVID-19 (Sallis et al., 2021).

3. Seniors and the level of participation in cultural life

Demographic changes taking place in Polish society require adaptation of the conducted public policy at all levels to the growing and changing needs and expectations of the elderly. At the end of 2015, the population of Poland was 38.4 million, including nearly 9 million people aged 60 and over (almost 23%), as shown in Table 1. Observing the changes in this regard, it can be noticed that at the end of 2020 there were nearly 1 million more seniors. The results of the Population Projection for 2014-2050 show that this process is deepening. It signals that the share of people aged 65 and more in the total population in 2035 may be 24.5%, and in 2050 32.7%. (GUS, 2014). However, they did not take into account the arrival of the COVID-19 pandemic, which significantly contributed to the change in the world's population¹.

¹ Data from the portal <https://www.worldometers.info/coronavirus/#countries> discussing: Coronavirus Cases: 404,430,275; Deaths: 5,798,611, Recovered: 324,411,750. In Poland: Coronavirus Cases: 5,313,111; Deaths: 107,466, Recovered: 4,451,403 (Access: 10.02.2022).

The information on the preliminary results of the 2021 National Census of Population and Housing (GUS, 2022) shows that as of March 31, 2021, 21.8% of the population was in post-productive age (60/65 and more), and in 2011 it was 16.9%.

Table 1.

Changes in the population of Poland in 2015-2020 (as of December 31)

Specification	60-64 years	65-69 years	70 and more years	Total	Total population of Poland	change in the total population	share of seniors in the total population	population share aged 65 and over in the total population
2015	2 726 536	2 161 758	3 914 660	8 802 954	38 437 239	-	22,9%	15,8%
2016	2 751 811	2 272 891	4 030 514	9 055 216	38 432 992	-4 247	23,6%	16,4%
2017	2 773 345	2 353 970	4 166 277	9 293 592	38 433 558	566	24,2%	17,0%
2018	2 776 033	2 412 936	4 319 424	9 508 393	38 411 148	-22 410	24,8%	17,5%
2019	2 756 726	2 462 437	4 484 582	9 703 745	38 382 576	-28 572	25,3%	18,1%
2020	2 680 248	2 505 595	4 614 390	9 800 233	38 265 013	-117 563	25,6%	18,6%

Adapted from: Baza Demografia Głównego Urzędu Statystycznego; <https://demografia.stat.gov.pl/BazaDemografia/CustomSelectData.aspx?s=lud&y=2020&t=00>.

The COVID-19 pandemic has caused great confusion in economic and social life. Long-term isolation has continuous and unfavourable psychological and social consequences. The loneliness of the elderly, which was a problem before, is now becoming an increasing challenge. The answer to this state of affairs should be extensive activities for the broadly understood activation of the elderly, i.e. social, civic, educational, cultural and sports activity. There is a need to take care of society as a whole, but special measures should be directed at the elderly due to the growing number of people belonging to this group. Actions to reduce this loneliness can be carried out in various types of social projects developing bonds in communities. People participating in such activities can acquire knowledge, skills and social competences through practical training. Older people may also become involved in the activities of various organizations, self-help groups, or fulfil new family and social roles. Daily activity gives energy, creates an opportunity to meet other people. Being active gives the elderly a sense of being needed in the local community or a sense of acceptance. For this reason, all measures to avoid loneliness and social isolation are so badly needed. Table 2 presents various forms of cultural activity of seniors along with the data on their response.

Table 2.

Participation of people aged 60 and more in forms of cultural activity organized by senior citizen houses, centers and cultural centers, clubs and community centers in 2016-2020

Specification	2016	2017	2018	2019	2020
members of artistic groups in senior citizen houses, centres and cultural centres, clubs and community centres:					
total	50 212	52 345	54 402	54 656	48 011
including: theatrical	3 767	3 634	4 192	4 084	3 729
musical, instrumental	4 030	4 227	3 927	4 192	4 234
vocal and choirs	20 430	20 869	21 492	22 088	18 547
folkloristic	17 622	18 310	18 923	18 220	16 831
dance	2 957	3 618	3 616	3 589	2 668

Cont. table 2

members of circles/clubs/sections in senior citizen houses, centres and cultural centres, clubs and community centres:					
total	169 901	185 483	199 005	210 406	169 758
including: artistic / technical	6 678	7 640	8 212	8 800	6 881
dance	4 194	4 590	4 793	5 985	4 169
musical	-	-	-	4 300	3 445
IT	2 449	2 244	2 681	2 265	1 268
photographic and filmmaking	949	995	1 061	1 414	770
theatrical	2 113	2 305	2 644	2 037	1 773
tourism and sports and recreation	12 408	17 253	16 580	17 812	14 723
senior / Third Age Universities	95 173	99 254	108 168	114 150	88 240
discussion clubs	2 157	2 644	2 875	2 285	1 286
rural housewives' circles	32 174	33 549	35 062	37 056	36 153
literary	1 572	1 607	1 807	1 612	1 316
graduates of courses organized by senior citizen houses, centres and cultural centres, clubs and community centres:					
total	17 266	17 520	18 491	19 886	10 776
including: foreign languages	3 721	4 622	5 469	4 664	3 285
arts	2 166	1 988	1 925	2 096	1 164
learning to play instruments	179	476	151	171	186
practical knowledge	1 948	1 534	1 670	2 116	953
dance	2 765	1 732	2 093	2 348	1 190
IT	4 652	5 110	5 428	6 471	2 594

Adapted from: „Informacja o sytuacji osób starszych w Polsce za rok 2016, 2017, 2018, 2019, 2020” by Ministerstwo Rodziny Pracy i Polityki Społecznej.

In the years 2016-2019, an increase in the interest of seniors in various forms of cultural entertainment can be seen. Older people took an active part in them not only because there was a suitable offer near their place of residence. An important reason was also the access to public facilities (cultural centers, senior citizen houses and centers as well as clubs and clubs) adapted to seniors' needs, in which classes could be conducted. These types of activities enable support. In 2020, less participation in classes is visible. The reason was probably the spread of the SARS-COV2 virus.

Table 2 presents the number of members of tourist and sports and recreational circles/clubs/sections in senior citizen houses, centers and cultural centers, clubs and community centers. In the years 2016-2020 it was respectively: 12,408, 17,253, 16,580, 17,812, 14,723. The topic of sports activity will be raised in the next part of the study.

According to the Social Cohesion Survey conducted in the first half of 2018, 92.2% of people aged 60+ watch TV every day, of which 42.2% of them over 4 hours a day. 34.4% of seniors spent watching TV for 2 to 4 hours a day, and 15.6% less than 2 hours. Only 2% of the respondents have never or almost never watched TV. 62.9% of respondents listen to the radio every day, and 13.4% of the respondents a few times a week. In the group of people aged more than 60, 11% read books every day, and 47% never or almost never (GUS, 2021b). The data collected in Table 3 reflect the fact that seniors are not always eager to take advantage of other opportunities to participate in cultural life.

Table 3.*Share of people aged 60 and more using selected forms of participation in culture in 2019*

Specification	Cinema	Theatre, concerts	Matches/ sports competition	discos/ dances	Museums/ Art Exhibition
At least once a month	4,3%	2,8%	2,8%	1,2%	1,5%
Less often than once a month but at least once a year	23,0%	20,10%	10,60%	6,20%	21,60%
Never or almost never	72,7%	77,20%	86,60%	92,50%	76,80%

Adapted from: „Sytuacja osób starszych w Polsce w 2019 roku by Główny Urząd Statystyczny (GUS), Warszawa, Białystok 2021.

4. Seniors' sports activity

Movement is extremely important due to the impact it has on seniors' health and fitness. The Act on sport considers sport as all forms of physical activity which, through ad hoc or organized participation, influence the development or improvement of physical and mental condition, development of social relations or achievement of sport results at all levels (Act on Sport, 2010). Physical activity is one of the inseparable elements of maintaining a satisfactory state of health and functional fitness of the elderly. The broad definition of physical activity includes all forms, i.e. not limited only to recreational activity (e.g. sport, dance, fitness), but also professional activity and activities related to everyday movement (for instance, transport) (GUS, 2021c).

One should carefully analyse the information according to which in the fall only 14% of people aged 60-69, 11% aged 70-79 and 7% aged 80+ decided to engage in sports, fitness or other physical recreation (activity requiring at least moderate exercise). On average, 51, 46 and 30 minutes a week were spent on exercises, respectively. In the case of the society as a whole, the data indicate that slightly more than a quarter of people aged 15 and more spent their free time in this way, and it lasted about 63 minutes a week (GUS, 2021c).

It turns out that 74.7% of them never or almost never play sports, and only 12.2% once a week and more often. There are also people who never or hardly ever go for walks and do not spend their free time outdoors. They constitute 18.6% of the respondents. In contrast, 55.1% do it once a week and more often (GUS, 2021 b). This information basically coincides with the results of the survey of the participation of household members in sports and recreational activities in 2016. In the 60+ group, 10.6% regularly/often exercise, and 14.5% of seniors occasionally (GUS, 2017).

Meanwhile, the WHO recommends that adults 18-64 years of age engage in at least 150 to 300 minutes of moderate-intensity aerobic exercise per week, or 75 to 150 minutes of high-intensity aerobic physical activity, or an equivalent combination of these. On the other hand, adults aged 65 and over should take up 3 or more days a week of physical activity that emphasizes functional balance and moderate or greater intensity strength training to increase functional capacity and prevent falls (World Health Organization, 2020).

5. Role of the commune in activating older residents

In 2010, the Malopolska Marshal Office prepared a document entitled *Challenges of Malopolska in the context of an aging population. Strategic approach* (Wyzwania..., 2010). The sources of the strategy are in the concept of so-called silver economy. This strategy makes ones aware that the active preparation of the economy for changed, new demographic relations is an opportunity for changes not only in terms of quality of life. It is characterized by two directions of recognition, i.e. concerning the tendency of aging and the needs of the population in various dimensions of human life, as well as resources enabling meeting the needs of the aging population at a level that generally allows the assessment of an elderly-friendly region (Szopa, 2016). The strategy uses English experiences aimed at activating the older generation, thus exposing the first type mentioned at the time, i.e. one-sided adjustment. At present, one should know the state of progress of tasks related to the second challenge.

The above message should be reflected in the local dimension of activities in this field, i.e. in "local caring regimes". They are not homogeneous, because it is difficult to introduce one common model of operation in each commune. Irrespective of the above challenges of commune in Poland – as basic local government units - are obliged to carry out various tasks that are largely related to the use of leisure time by residents. In accordance with art. 164, par. 1 and 3 of the Polish Constitution (Konstytucja..., 1997), communes perform all public tasks of local significance, not reserved for other LGUs (Local Development Units), which is reflected in constitutional laws (Ustawa z dnia 8 marca 1990 r...). In particular, the commune's own tasks include meeting the community's collective needs. The organization of society in self-government communities should therefore contribute to the implementation of "such an important social goal as comprehensive human development, which is conditioned by the development of the productive forces of society" (Piekara, 2005). In general, the commune is responsible for a number of tasks in the socio-cultural field related to social care, health care, education and culture and art at the basic level as well as social infrastructure. In particular, it concerns expenses related to the improvement of broadly defined social infrastructure, e.g., roads, street lighting, parks and greenery, community centres, common rooms, social assistance, most of which are located within the commune's own tasks, and some of them are

commissioned, of mandatory or optional nature. In practice, commune's expenditure on social purposes is characterized by great diversity. On the one hand, this is due to their financial capabilities, depending on their own income. On the other hand, it is influenced by the adopted policy of local authorities regarding the financing of various social enterprises and investments. Communes with high own income, mainly urban, are much more likely to spend money on social purposes related to education, construction and modernization of roads, lighting of streets and squares, maintenance of greenery, as well as for sports facilities, cultural institutions, or the implementation of other tasks in physical culture and sport (Zarębski, 2009). In the case of most rural communes, their income is relatively lower, which is mainly due to their lower level of socio-economic development. Such a situation usually means prioritizing expenditure directed at increasing economic potential, which enables subsequent increase in expenditure for strictly social purposes.

6. Activities in the field of culture and sport in the communes of the Małopolska region in the light of the survey results

In the face of the problem outlined, a research question arises about the role of the commune – as a local government unit closest to the local community – in the promotion of activities to ensure the management of leisure time of the elderly. Are actions taken in this area present and sufficient? To achieve the set goals, it is helpful to verify three basic research hypotheses based on the opinions of representatives of local government units (LGUs) indicated in the survey used:

H1: Communes carry out tasks in the sphere of culture and entertainment to varying degrees.

H2: The level of debt has an impact on the degree of implementation of tasks in the sphere of culture and entertainment.

H3: The level of participation of the elderly in cultural life is low.

The surveys were carried out by the staff of the Faculty of Finance and Law at the University of Economics in Krakow in cooperation with the Regional Accounting Chamber in Krakow in September-December 2018 as part of the project "Problems and challenges of local government units in the age of an aging society". The subject of the study was the opinion of representatives of local government units on the opportunities and threats that the progressing aging of the society and the development of the silver economy bring to the implementation of commune tasks.

Within the mentioned two groups of activities in Małopolska there are, among others: adapting the cultural offer to the ways of spending leisure time by the elderly, active support for participation in various workshops, educational activities, creating clubs and senior

councils, supporting physical activity (reduced admission tickets, preferential sport hall rental, senior activity centres).

As a starting point for further considerations, it seems reasonable to note that the share of communes' expenditure on achieving these goals in total expenditure – also in Malopolska – has been decreasing over the last decade, from 3.5% in 2010 to 3.1% in 2018 in the sphere of culture and national heritage, and from 3.0% to 2.4% respectively in the field of physical culture. In rural communes – dominating in Malopolska – the decrease in this percentage concerned expenditure of the first type (from 2.5% to 2.1%), and expenditure related to physical culture was characterized by stabilization (2.1-2.3%). In the urban-rural communes in the years 2010- 2018, the downward trend of both types of expenditure was dominant (from 4.5% to 3.8% and from 3.4% to 2.0). In the least numerous urban communes of Malopolska, the decrease in the percentage concerned expenditure on physical culture (from 5.9% to 4.7%), while the share of expenditure on culture and national heritage in total expenditure increased at that time (from 4.5% to 5.8%) (Budżety jednostek...).

The study was conducted using the CAWI² method among all communes (182 +3 cities with powiat status) of the Malopolska Voivodship. 131 units provided full answers. The answers came mainly from rural communes - 7.17% - and urban-rural – 25.19% - while from urban communes there were 5.34%, and from cities with powiat rights – 2 .29%. The debt in the examined communes was in the range of 21-30% (in the case of 29.77% of respondents), 11-20% (24.42% of respondents) and 1-10% (17.55%).

In the conducted research, an attempt was made to verify the research hypotheses formulated above on the basis of an analysis of the distribution of answers to individual questions, while the answers "I do not know" or "I have no opinion" were omitted. For the analysis of results, the χ^2 independence test was used, in which the null hypothesis is tested about the lack of relationship between the analysed variables³. The H0 hypothesis should be rejected if the statistics χ^2 given by the formula:

$$\chi^2 = \sum \frac{(E_i - O_i)^2}{O_i} \quad (1)$$

where

E_i is the empirical value;

O_i theoretical value⁴

² CAWI, i.e. Computer Assisted Web Interview - conducting an online survey <https://www.webankieta.pl/blog/metoda-cawi/>; access: 26 February 2020. In a few cases, given the technical conditions, it was also possible to provide a survey in the form of a questionnaire on a paper form containing a set of questions identical to the electronic version. During the research, it turned out that in some communes, answering individual questions required the exchange of information between physically distant departments, and the survey available at one computer station hindered the formulation of reliable answers.

³ This is one of the most commonly used tests in statistical surveys (Zimny, 2007).

⁴ E_i – observed values, i.e., those obtained in the study; O_i – expected values, i.e. those assumed by the test if there were no relationship between the variables. https://www.naukowiec.org/wiedza/statystyka/chi-kwadrat-test-niezaleznosci_741.html, accessed: 20 February 2020.

exceeds the table value for the assumed level of significance and the number of degrees of freedom given by the formula:

$$r = (k-1) * (w-1)^5 \quad (2)$$

The level of significance in the studies was 0.05. During the interpretation, it should be noted that empirical values were >5 .

The H1 hypothesis was verified based on the distribution of responses of the units surveyed to the question: *How do you assess the degree of implementation of tasks by the community in the following areas?* One of the studied areas was broadly understood culture and entertainment. Respondents answered this question: very bad, bad, medium, good or very good.

The obtained results indicate that the degree of activities related to culture and entertainment is assessed as very good by 24.66% of respondents. 47.95% of respondents rated the activities of communes well, and 25.34% on average. 2.05% of respondents indicated poorly implemented tasks in the field of culture and entertainment. Referring to the research hypothesis (H1), there are grounds to conclude that the degree of implementation of tasks in the sphere of culture and entertainment in communes is varied. It may result from various premises. Therefore, it was decided to check whether the type of entity may be related to undertaking activities in the field of culture and entertainment.

Table 4.

The results of the χ^2 test in the analysis of independence between the LGUs type and the degree of implementation of tasks in the field of culture and entertainment

LGUs type	E _i				O _i			χ^2 test
	Very good	good	medium	total	Very good	good	medium	
Urban and rural commune	10	17	8	35	9	17	9	2,41
Rural commune	22	48	28	98	25	48	25	
Total	36	70	37	143	36	70	37	

Adapted from: own study.

Table 4 shows the values necessary to calculate the χ^2 statistics. Due to the fact that $\chi^2 = 2.41$ is less than the critical value of 5.99 (for significance level $\alpha = 0.05$ and 2 degrees of freedom), the null hypothesis on the independence of variables should be confirmed. This means that the LGUs type has no effect on taking action and their diversity in sphere of culture and entertainment.

The next part of the study undertakes the verification of H2: *The level of debt affects the degree of implementation of tasks in the sphere of culture and entertainment.* It seems obvious that the amount of financial resources is important for LGUs to take action, and in particular the area related to culture and entertainment depends on them. With the need to reduce expenditure, the easiest way to achieve that is through cuts on culture and entertainment, or sport.

⁵ k – number of columns, w – number of lines.

Table 5.

The results of the χ^2 test in the analysis of independence between the debt level and the degree of implementation of tasks in the field of culture and entertainment

Debt level	E _i				O _i			χ^2 test
	Very good	good	medium	total	Very good	good	medium	
11-20%	7	18	8	33	8	16	9	1,01
21-30%	10	21	13	44	11	22	11	
Others ⁶	18	31	16	65	16	32	17	
Total	35	70	37	142	35	70	37	

Adapted from: own study.

The calculations in Table 5 indicate that the statistics $\chi^2 = 1.01$ and it is smaller than the critical value of 9.49 (for significance level $\alpha = 0.05$ and 4 degrees of freedom). Therefore, the null hypothesis on the independence of variables should be confirmed, which means that the level of debt does not affect the degree of implementation of tasks in the sphere of culture and entertainment. In the next stage of the study, in order to verify the H3 hypothesis, the answers to the question: How do you assess the scale of occurrence of social problems in the commune? One of them was the low level of participation in cultural life (e.g. a small number of inhabitants participating in cultural events). Respondents answered this question on a scale of 0-3, where:

- 0 - no opinion on this topic,
- 1 – the problem does not occur,
- 2 – the problem occurs,
- 3 – the problem is very severe.

The answers obtained (see Fig. 1) indicate that 60.77% of the LGUs surveyed have no problem with the low level of participation of the elderly in cultural, recreational and sport life (including all 3 cities with poviats status). In 36.92% of communes this problem occurs, and in 2.31% surveyed it is very severe (of which 2/3 are rural communes).

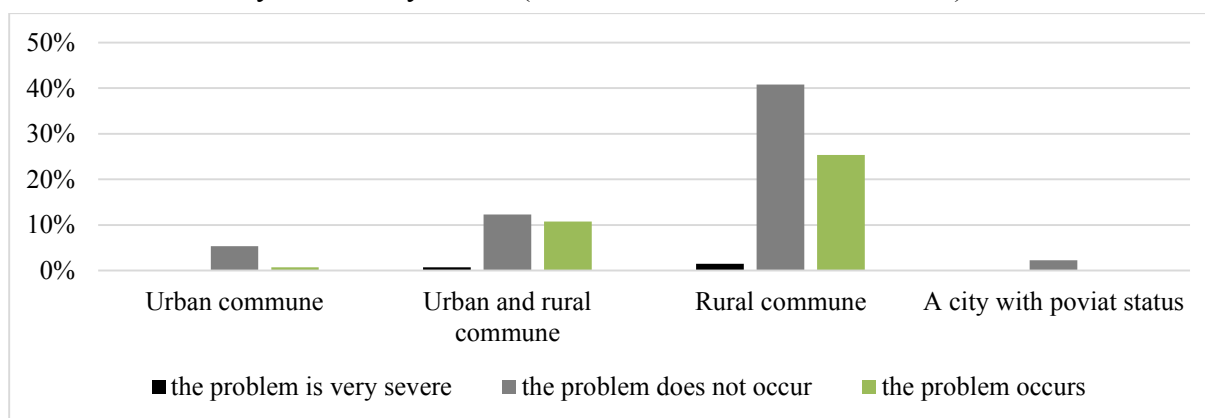


Figure 1. The level of LGUs debt and the problem of low participation in cultural life. Adapted from: own study.

The results obtained above are surprising and cannot be left without a comment. First of all, the form of the survey should be emphasized; answers were given by employees of the commune office. The text uses fragments from it mainly covering questions that require

⁶ Others include the following indebted levels: 0%, 1-10%, 31-40%, 41-50%, 51-60% and > 60%.

evaluation, and this has caused a significant problem. It is simply a natural phenomenon that answers predominate in them, creating a dominance of positive assessments of LGUs activities in the areas of interest to us; the concentration of "flattering" assessments relates generally to the various tasks carried out by communes (see Table 6).

Tabela 6.

Problems of the elderly in communes

specification	unadjusted cultural	limited access to sports infrastructure	loneliness	poverty
are not a problem	48,63%	42,47%	5,48%	13,70%
affect modertaely	35,62%	43,15%	65,75%	68,49%
are a serious problem	4,79%	6,16%	23,97%	12,33%

Adapted from: own study.

It is therefore necessary to continue the survey – which was also planned – regarding entities located on the other side, i.e. that is the elderly using the offer of communes. Above all, however, a solid economic and financial analysis is necessary, based on specific statistical data of communes, regarding income, operating result, expenditure directed at various purposes, all the more so as surveys (so-called "soft" data) usually complement the analyses based on "hard" data. The first, initial step has been taken in this direction, and next ones are needed. It is not only about the financial condition of the commune, exposed above, but also other expenditure determinants, such as the degree of adaptation of the cultural offer to the needs of the elderly (e.g. preferences for the younger part of the community), limited access to sports infrastructure (e.g. reservation of facilities for schools or sports clubs), poverty or loneliness, which are further demotivators of participation in cultural life, thus affecting the isolation of the individual from the external environment.

7. Conclusions

Aging should be carried out in a way that is as least harmful to people and their surroundings as possible. Low risk of diseases and infirmity, high mental and physical efficiency, maintained life activity. It would be an ideal solution. Unfortunately, this is not always the case. It is worth doing everything possible so that successful aging is not just a scientific term, but something that can be seen in practice. In order for this to happen, it is necessary to take care of the prevention of the elderly. In 2019, 34.9% of people aged 60-69 (similarly in 2014) and 21.7% aged 70-79 (similarly in 2014) experienced good or very good health. In the oldest group of people (at least 80 years old) it was only 15.7% (an increase compared to 2014). 16.7% of people aged 60-69, 27.2% in the group of 70-79 years and 39.5% of those aged 80 and more described their health as poor or very bad (a decrease compared to 2014). Most adults (15 years of age and over) experienced high blood pressure and lower back pain (over 1/4 of the total).

One should remember about the change in the demographic structure between 2014 and 2019 and the increase in the number of people aged 60+ (GUS, 2021a). Sometimes, deteriorating health does not allow the full use of leisure time opportunities offered to seniors by the environment. There are more and more programs aimed at helping the elderly and public facilities are adapted to their needs. The results of the research carried out prove, in their opinion, the positive actions of communes.

Satisfaction with life in general in 2018 (% of people aged 16 and more) was expressed by 83% of Poles aged 16 and more (82% of men and 83.8% of women). As for the age groups, it was 79.4% in the 55-64 age group; in the group 65-74 it was 81.2%, and in the group 75 and more 76.6%. 62% of respondents felt satisfaction with the way of spending free time, and about 60% of the respondents with the amount of free time (the Polish Central Statistical Office, Quality of life and social capital in Poland. The results of the social cohesion survey 2018, Warsaw 2020, p. 240). People are satisfied, and so are local governments, but there is a problem with cultural or sports activity.

In conclusion, one should pay attention to:

1. discrepancies in the results obtained on the macro and micro scale,
2. re-examinations necessary - not only the employees of the commune, but also users,
3. the need to develop common solutions in the field of senior policy by public and non-public entities,
4. developing national recommendations for physical activity and ensuring their dissemination to key audiences.

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MINING MUNICIPALITIES AND DISTRICTS IN POLAND IN THE PERSPECTIVE OF EQUITABLE TRANSFORMATION

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Purpose: On the basis of their own research, the authors of the article undertook to determine the factors determining future social and economic development and to develop recommendations for strengthening active economic, social and labour market policies in mining municipalities and districts in Poland – in the perspective of the "European Green Deal" plan and "Just Transition"

Design/methodology: the results presented in the article were obtained on the basis of the implementation of questionnaire research, expert interviews, literature review, critical literature analysis, documentation analysis, statistical descriptive analysis.

Findings: As a result of the analyses and surveys carried out, the article presents an extensive set of conclusions, the most important of which are those relating to social. The presented attempt of the prospective approach to the phenomena and processes which may result from the transformation of the hard coal mining in Poland is aimed at better understanding of the role which may be fulfilled in the future by the local self-government in the area of which the operating or disused mines and mining enterprises are located. Secondly which are related to the perspective of the hard coal mining transformation process, first of all showed terms the scale of challenges faced by mining municipalities. The indicated processes are nowadays dominated by the challenge of creating new ecological solutions of high quality both in the sphere of their social acceptance in the utilitarian dimension. It is a process that allows for a better understanding of the role of local government in the transformation process, which will probably take up, in a fragmentary way, economic, social and environmental challenges resulting from the contemporary development of economy based on knowledge and determined by the Industrial Revolution 4.0.

Originality: the findings and recommendations of the study may become relevant for practitioners and researchers dealing with climate change mitigation, strategy implementation, cross-sectoral partnerships and sustainable development of transformed areas.

Keywords: Industry 4.0, climate, transition, mining, labour.

1. Introduction

The reform of hard coal mining in Poland is an important social and economic issue. This issue is particularly linked to the process of implementing the 'European Green Deal' plan. The plan has a key focus on accelerating the reduction of greenhouse gas emissions. The European Green Deal – as its authors note – is necessary for Europe to become the first climate-neutral continent by 2050, and they are pleased to note that the plan puts sustainable development at the heart of the European Union's policy-making process. The Green Deal should be a tool to shape the agenda and lead to the integration of sustainability criteria into all EU policies, macroeconomic priorities and financial instruments. The Plan stresses that it should be an instrument to achieve the objectives of the Biodiversity Strategy and the Paris Agreement and to fully implement the UN 2030 Agenda for Sustainable Development and the Sustainable Development Goals, as well as to make an ambitious EU contribution in the context of the post-2020 policy framework for international biodiversity conservation (Communication From The Commission, 2019). Further decarbonisation of the energy system is key to achieving the 2030 and 2050 climate targets. Energy production and consumption in economic sectors is responsible for more than 75% of EU greenhouse gas emissions. Energy efficiency must be prioritised. An energy sector based largely on renewable sources must be developed, complemented by the rapid phase-out of coal and the decarbonisation of gas. At the same time, the EU's energy supply must be secure and affordable for consumers and businesses (Marszowski, 2020, pp. 1-131).

It seems that the objectives of the Green Deal quoted above enforce the need for a diagnosis of the social and economic implications that may arise from the process of transformation of the hard coal mining sector and its environment. It is worth noting that in the case of the sector under study, restructuring processes take place in an area of very high concentration of social and economic resources. It is related to the social and economic structure of the Silesian Voivodeship, which is the most populous voivodeship in Poland, and at the same time to the concentration of industries related directly and indirectly to the hard coal mining sector (Babbie, 2005). In this context, an assessment of the public perception of the process of fair transformation may be important for the condition and development prospects of this sector – and may be a fundamental recommendation for the creation of programmes aimed at strengthening the national energy policy based on clean technologies. Bearing in mind the effects of many years of transformations of the hard coal mining sector in Poland, it should not be overlooked that further reform of this important sector of the national economy may result in social acceptance or rejection of the directions of its further transformation (Lipiński, 2017, pp. 1-17). This becomes particularly important for the sector and its environment, which are

systematically subjected to pressure resulting from its adaptation to changing political, economic and social conditions¹.

2. Materials and Methods

In order to determine the factors determining future social and economic development and to develop recommendations for strengthening active economic, social and labour market policies in mining municipalities and districts in Poland - in the perspective of the "European Green Deal" and "Just Transition" plan - survey research was conducted in the 3rd quarter of 2020. According to the assumptions adopted in the research, the study focuses on selected 28 mining municipalities from the area of the Lower Silesian, Lublin, Silesian and Lesser Poland Voivodeships. In 2019, the study area had a population of 702404 people. The area was divided into small rural municipalities (Puchaczów 5081 inhabitants), medium urban municipalities (Knurów 39207) and large urban municipalities (Rybnik 141347) (Table 1).

Table 1.

Breakdown of the analytical area by administrative units based on EUROSTAT and Central Statistical Office statistics and NUTS²

Lp.	Jednostka administracyjna	Podział administracyjny	Obszar analityczny	Powiat
1	Babice	gmina wiejska	Babice	Chrzanowski
2	Bestwina	gmina wiejska	Bestwina	Bielski
3	Bieruń	gmina miejska	Bieruń	Bieruńsko-Lędziński
4	Chelm Śląski	gmina wiejska	Chelm Śląski	Bieruńsko-Lędziński
5	Cyców	gmina wiejska	Gmina Cyców	Łęczyński
6	Czerwionka-Leszczyny	gmina miejska	Czerwionka-Leszczyny	Rybnicki
7	Gierałtowice	gmina wiejska	Gierałtowice	Gliwicki
8	Grębocice	gmina wiejska	Grębocice	Polkowicki
9	Jastrzębie-Zdrój	gmina miejska	Jastrzębie-Zdrój	Jastrzębie-Zdrój
10	Knurów	gmina miejska	Knurów	Gliwicki
11	Lędziny	gmina miejska	Lędziny	Bieruńsko-Lędziński
12	Libiąż	gmina miejska	Libiąż	Chrzanowski
13	Ludwin	gmina wiejska	Ludwin	Łęczyński
14	Marklowice	gmina wiejska	Marklowice	Wodzisławski
15	Miedźna	gmina wiejska	Miedźna	Pszczynski

¹ The article is the result of a research work entitled Mining municipalities and districts in Poland in the perspective of equitable transformation commissioned by the Association of Mining Communities in Poland to the Central Mining Institute, More: R. Marszowski, Mining communes and counties in Poland in the perspective of a just transformation, Katowice-Jastrzębie Zdrój, 2020.

² In the NUTS classification (Classification of Territorial Units for Statistics) three levels are distinguished: the first one - covering 6 regions grouping voivodships, the second one - 16 voivodships and the third one - 72 subregions grouping poviats. These three levels also correspond to the three regional levels in the national NTS nomenclature (Nomenclature of Territorial Units for Statistics). The NTS classification also includes two local levels: the fourth - counties and the fifth - communes. More information on the territorial units classifications applied by the NTS is available at: www.stat.gov.pl/statystyka-regionalna/jednostkiteritorialne/.

Cont. table 1

16	Mszana	gmina wiejska	Mszana	Wodzisławski
17	Pawłowice	gmina wiejska	Pawłowice	Pszczynski
18	Pilchowice	gmina wiejska	Pilchowice	Gliwicki
19	Polkowice	gmina miejska	Polkowice	Polkowicki
20	Pszów	gmina miejska	Pszów	Wodzisławski
21	Puchaczów	gmina wiejska	Puchaczów	Łęczyński
22	Radlin	gmina miejska	Radlin	Wodzisławski
23	Rybnik	gmina miejska	Rybnik	Rybnik
24	Rydułtowy	gmina miejska	Rydułtowy	Wodzisławski
25	Siemianowice Śląskie	gmina miejska	Siemianowice Śląskie	Siemianowice Śląskie
26	Suszec	gmina wiejska	Suszec	Pszczynski
27	Świerklany	gmina wiejska	Świerklany	Rybnicki
28	Żory	gmina miejska	Żory	Żory

Source: Poland in numbers 2019, Local Data Bank, Central Statistical Office, Statistical Office of the European Union EUROSTAT.

The research was conducted on a purposive sample of 105 experts according to the following criteria: commune, Local Government Unit (hereinafter referred to as JST), workplace. In the research the methods of descriptive and comparative statistics as well as literature review, critical analysis of literature, research of documents and comparative analysis were applied. Out of the sample of 105 experts, 100% accepted the invitation to participate in the research. The purposive sample of experts from the surveyed mining municipalities and districts by gender in the study was as follows: 58 interviews were conducted by women (55.24%) and 47 by men (44.76%). Respondents with higher education constituted a population of 104. Only one respondent had secondary education. On the other hand, with regard to the type of work performed, in alphabetical order the persons surveyed were: mayor, director, chief specialist, inspector, head of the department Chairman of the Municipal/City Council, secretary, treasurer, village head, specialist. In this light, only the indicated persons – as demonstrated by the pilot study of the research tool – could fully address the issues and problems posed in the study, such as e.g. the impact of the EU energy and climate policy on the need for economic transformation of mining communes and districts, the financial and organizational preparation of mining communes and districts for the economic transformation, whether mining communes and districts have a vision for economic development unrelated to mining, how the quality of life in mining communes and districts after moving away from coal to alternative energy sources will change, etc.

Analysing the distribution of the persons surveyed according to the criterion of place of work, in relation to the municipality – in alphabetical order – they represented: Babice, Bestwina, Bieruń, Chełm Śląski, Cyców, Czerwionka Leszczyny, Gierałtowice, Grębocice, Jastrzębie-Zdrój, Łędziny, Libiąż, Ludwin, Marklowice, Miedźna, Mszana, Pawłowice, Pilchowice, Polkowice, Pszów, Puchaczów, Radlin, Rybnik, Rydułtowy, Siemianowice Śląskie, Suszec, Świerklany and Żory. According to the criterion of administrative unit, experts represented the following counties: Bielsko-Biała, Bieruńsko-Łęczyński, Chrzanowski, Gliwicki, Jastrzębie-Zdrój, Łęczyński, Polkowicki, Pszczynski, Rybnicki, Siemianowice Śląskie, Wodzisławski, Żory. The research used the method of questionnaire interview with the use of a questionnaire and CATI interview technique (Babbie, 2005).

The knowledge on factors determining the future social and economic development of mining communes and districts in Poland - in the perspective of the "European Green Deal" and "Just transition" plan was expanded by individual expert interviews, which were conducted using the CAWI method – i.e. an online expert interview questionnaire. Local experts (institutional leaders) representing deeply diverse social backgrounds, occupation and professional experience were invited to participate in the interviews. When building the methodology of the study, it was assumed that the experts would have a university degree, be characterized by extensive life and professional experience, recognition in their social and professional environment, and through their profession they directly or indirectly create the socio-economic image of municipalities and mining districts and are direct stakeholders in the process of equitable transformation. All experts participating in the research held managerial positions in the examined territorial self-government units – who were at the same time representatives of municipalities associated in the Association of Mining Municipalities in Poland (gives SGGP). In total we obtained 10 complete – and acceptable due to methodological correctness – expert interviews in the research.

Describing the methodology of the conducted research it is worth noting that the term transformation has its source in Latin – "transformation" and means a transformation – relating to social, economic, political, technological or IT areas. As numerous sources indicate, the term transformation is most often a synonym of another term, i.e. change. Indeed, it is less often associated with the term development or progress. In this context, it should be noted that the term transformation is perceived as more complex, and at the same time narrower, than the above-mentioned term change. On this basis, therefore, it is possible to formulate the conclusion that known transformations are changes, while not every change will be a transformation. This is how this term is perceived by R. Lipiński, who at the same time defines the term change in the following way: change is any noticeable modification of any element of reality. Meanwhile, transformation in its source should be perceived as a non-trivial and intentional process of changing one fragment of the environment realized at a given time, which is aimed at creating a new and, above all, permanent state of the environment (Lipiński, 2017, pp. 1-17).

However, Jan Szczepański defines the term transformation in a different way. He perceives transformation as one of three fundamental ways of transforming reality, including (Szczepański, 1999):

- reforms,
- revolutions,
- transformations.

The term transformation defined in this way is a process changing the state of objects existing in the real world, a change transforming the nature or essence of something, aiming to change the existing order.

3. Discussion

In the light of the definition of the term transformation – while maintaining the hierarchy of objectives described in the "European Green Deal" plan – the need arises in the areas of mining municipalities that will undergo transformation for authoritative cooperation between the three key stakeholders in this process, i.e. local communities (representation of local – territorial government), employers and representation of state policies. To conclude, the changes induced by the transformation in mining municipalities concern, in particular, aspects of the activities of companies in high-carbon economic sectors, taking place in their civilizational, cultural and socio-economic area. The increase in their novelty and speed, as well as the increase in the intensity and complexity of the environment of the high-carbon economic sectors, leads them to be described as turbulent. Thus, it becomes almost certain that transformed areas must be equipped with strategic solutions responding to the very extensive, diverse, unstable and complex socio-economic changes in their area and environment. Hence, assuming that the decision-making processes shaping the dynamic or even "turbulent" changes which may occur in the high-carbon economic sectors – will create a coexistence mechanism which should fit into the indicated dimensions and make dependent the occurring relations between mining municipalities, high-carbon sectors, enterprises and their environment.

The question that arises in this context is what instruments should be the key content shaping the indicated mechanism? It seems that the factors determining the ability of future actions to shape the indicated mechanism – characteristic for creative thinking about the relations taking place between mining municipalities, high-carbon sectors, enterprises and their socio-economic environment will be: an appropriate level of coherence of actions taken in line with the monitored area, an appropriate level of coherence of actions in line with the expectations of mining municipalities, high-carbon sectors, enterprises and their environment, ensuring, through actions taken, an increase in knowledge about the changes taking place caused by the transformation and the possibility of effectively responding to the challenges faced by stakeholders in transformed areas (Communication From The Commission, 2019).

In the light of the above theses and regularities, as a result of the research carried out, conclusions determining the main directions of development of mining communes, strategic areas of development challenges and recommendations strengthening the development of mining communes and districts in the perspective of the fair transformation process were defined as precisely as possible.

On this basis, we formulate the first of numerous conclusions, which proposes that the SGGP consider making 2021 the year of full participation of mining municipalities in the fair transformation process – according to the principle that since transformational changes cannot be stopped, one should learn to benefit from them. The main message of the year of full

participation of mining municipalities in the process of equitable transformation should be the recognition that the overarching goal of the year is to strive to secure better living conditions and fuller social inclusion for the residents of mining municipalities through full participation in the labour market – thus promoting social and professional activity among the residents of mining municipalities to give them a fuller life.

On the other hand, on the basis of all the trends, processes and forecasts observed as a result of the research, it seems that in the perspective – as experts point out – of the inevitable occurrence of the transformation process, it may turn out to be important for mining municipalities to promote actions aimed at an evolutionary, not short-term, transition from coal-based energy sources to low-emission sources – if it is possible, striving for it to be a multi-stage and long-term process. It may be equally important to strive for solutions in accordance with which the principle will be adopted of introducing directly to individual communes – or their unions – funds for implementation of the fair transformation process, on the basis of a list of indicative projects entered at the stage of creating the TPST and indicating their support, so that the social effects of the departure from coal are as low as possible. At the same time, consideration should be given to the need for mining municipalities to seek state intervention appropriate to the scale of challenges – in the areas of transformed municipalities – with simultaneous provision of mining municipalities with reliable and comprehensively planned proposals for transformational measures limiting their spontaneity. The indicated action should be supported by the development of programmes for diversifying the dynamics and pace of the fair transformation process, which will take into account the developmental conditions specific to mining municipalities – which at the same time differentiate them (Frankowski, Mazurkiewicz, 2020).

On the basis of the above initial findings of the research, it should be clearly emphasised that in all debates and discussions the representatives of the local government should clearly and determinedly present the position that the transformation process is coexisting in the face of already defined challenges, which exceed in every organisational and management dimension the possibilities of their stimulation by mining municipalities. Examples: development of Renewable Energy Sources and other low-carbon technologies, natural, environmental policy challenges, high CO₂ emissions, depletion of minerals, systematic increase of coal mining costs.

These processes are currently dominated by the challenge of creating new quality ecological solutions. It is a phenomenon that allows for a more complete understanding of the role of local government in the transformation process, which will probably – to the best of its abilities – take up, in a fragmentary manner, economic, social and environmental challenges related to ecology, resulting from the contemporary development of economy based on knowledge and determined by the Industrial Revolution 4.0 (Marszowski, 2020, pp. 1-131).

In this light it will be extremely important to promote knowledge among TSU employees on the concept and vision of shifting from coal to alternative energy sources. Employees of territorial self-government units should be given an opportunity to participate in educational programmes presenting knowledge about shifting from coal to alternative energy sources. This objective is strengthened by the research participants' recognition that the transformation process is a long-term solution from which there is no departure. In this perspective, the Silesian Voivodeship as an energy resource and guarantor of energy security of Poland gives way to the vision of a region with innovative industry with disappearing mining. This is confirmed by the vision, in which in mining communes and districts the economic transformation in the coming years is fulfilled successfully, despite such limitations as: lack of economic preparation of mining communes for the transformation, social resistance to the challenges resulting from the transformation, lack of vision of new employment for retiring professionally active mining staff (Szczepański, 1999).

In the macro dimension, the problem of destabilisation of Poland's energy security raised by experts is interesting. This current of thinking is confirmed in the context of the perception of transformation, in which the vision of a threat is rejected and the necessity of change and the development opportunities resulting from it for mining municipalities are emphasised. Nevertheless, in the light of the research carried out, it must be acknowledged that mining municipalities are not financially prepared for the transformation process. This is confirmed by the regularity in which the fact that a decisive group of surveyed experts does not know such sources is revealed. Hence, another regularity, which is the statement that the period of transition of mining communes and districts to a new model of economic development not based on mining should last for a minimum of 10 years and more and be supported by implementation of activities and legal solutions at the national and regional level, which will enable the functioning of profitable mines assuming the introduction of innovative solutions for coal enrichment, in perspectives related to obtaining hydrogen as a result of applying the process of coal gasification, technologies related to wind energy and photovoltaics. In summary, the experts concluded that mining municipalities and districts are not prepared to move to a new economic development model as a result of the transition, arguing their position as follows:

- uncertainty of tomorrow – COVID-19,
- lack of a clear national programme for the transition,
- the current situation does not allow for a smooth and efficient transition to the new model, as we do not know how the transition will take place, what is already envisaged for implementation in this sphere,
- lack of assumptions and resources to implement the transition to the new model,
- mining municipalities do not have adequate economic strength,

- in this area lack of resources to implement the transition as well as legal provisions and guidelines and regulations for financing the transition,
- the difficult and very difficult budgetary situation of the mining municipalities blocks their readiness for the transition for an extended period,
- municipalities will be deprived of serious budgetary revenue,
- loss of municipal functions for many municipalities, for which the transition period will result in depopulation and an economic crisis,
- in mining municipalities there is too much tradition and long-standing form of functioning on the basis of mining and there is no alternative to the transition,
- lack of mental preparation of the inhabitants of mining municipalities – social resistance,
- lack of implementing measures and regulations, e.g. for the development of post-mining areas,
- lack of alternative jobs for employees of closing mines.

The above conditions are confirmed by another regularity related to the lack of knowledge among territorial self-government units' employees about programmes which would present a concept and vision of shifting from coal to alternative energy sources in the form of strategic solutions.

Taking into account the area of development opportunities, special attention in mining municipalities should be paid – taking into account their developmental directions – in the perspective of transformation to the following areas: supporting activities in the field of searching for new coal enrichment technologies in order to produce environmentally friendly fuel and development of ecological and innovative coal combustion installations, consolidation and development of common thermo-modernisation of buildings and improvement of energy efficiency in industry and services, zero waste policy – more recycling and reasonable utilisation of waste, supporting development of cheaper modern energy technologies, and development and implementation of the concept of ecological education – covering the population from the youngest age (Impact transforming business, 2021).

As the research results indicate, these solutions are not facilitated by the lack of an appropriately developed social dialogue in the area of economic transformation of mining communes and districts, the voice of social organisations and local communities unnoticed in discussions on the shape and direction of economic transformation, the impact of transformation on the quality of life in mining communes, especially determining the crisis situation in the labour market. In connection with a potential crisis situation in the labour market, experts have concluded that it is necessary – in the perspective of the transformation – to promote retraining and other forms of active labour market policy treated as a model of support only for those leaving mining jobs and unable to find a new job, to guarantee aid measures encouraging former miners to remain active on the labour market, to limit the number

of students educated in mining professions, to stimulate demand for labour in areas integrated with coal mining, especially in manufacturing and construction, and to promote professional training for former miners, with the necessity of their certification.

In conclusion, on the basis of the research carried out, the following fundamental conclusion can be drawn. Planning a complete withdrawal from coal mining in municipalities and mining districts in Poland in the opinion of experts is impossible and involves acceptance of the challenge of a just transition (Nowakowska, Rzeńca, Sobol, 2021, p. 25).

Assuming a successful scenario for the development of the activities outlined above, it seems that the following further activities can be given priority in the perspective of a just transition. First of all, the development of guidelines for a horizontal and coherent programme for the SGGP preparing all policies implemented in transformed municipalities for the transformation phenomenon. Simultaneously, together with the programme under development, preparation of proposals for activities to strengthen the participation of transformed mining municipalities in decisions shaping their present and future – at the regional and national levels – in the perspective of fair transformation (e.g. Forum for Fair Transformation of Mining Municipalities at the Polish Prime Minister's Office). Strengthening the measures taken, it would be appropriate to give the public employment services in transformed mining municipalities a superior role in the work on preparing thematic proposals for social and professional activation of municipal communities. The need to prepare guidelines for a programme of intergenerational integration, in particular based on the diversity management method, in the area of activity of the SGGP could be included in this activity (Korhonen, Hankasalo, Seppälä, 2018, pp. 37-46).

Without waiting for developments, it is worth considering the development of an educational programme presenting the economic and social consequences resulting for mining municipalities from the fair transition process – further determined by demographic and technological changes (Communication From The Commission, 2019). In view of demographic changes and specific cultural and social conditions, it may be important to prepare a package of economic and social measures dedicated primarily to women in mining municipalities. In this context, the issue of education and health should be given priority in mining municipalities in activities promoting social and professional activity in the process of equitable transformation.

At the same time, in order to strengthen the social perception of the activities undertaken in mining municipalities, it is worth considering the preparation of an information campaign presenting the effects of the transformation on small and medium-sized enterprises (SMEs), the consumption model, public finances, health and social protection policy and migration. Continuing, taking into account the social sphere in the process of fair transformation, it seems that it would be required to consider developing a programme to counteract marginalisation, differentiation and social exclusion of the inhabitants of transformed mining municipalities (Frankowski, Mazurkiewicz, 2020)

The above-mentioned actions should, above all, be conducive to minimizing the fear of unemployment, social unrest, the outflow of young and most mobile qualified personnel from mining municipalities to development centres. This would mean unfavourable changes in the population living in mining municipalities.

Focusing on the strategic activities outlined above for the development of mining communes, it seems extremely important to focus attention and effort on the postulate on the need to give a new dimension to communal policies in order to link them more fully with European Union Strategies – in particular the European Green Deal Programme. This postulate may more fully incorporate mining municipalities into the development process, which will be determined by larger structures – and through the participation of mining municipalities in the creation of European policies, become a key impulse for their position within the structure of the European Union and for the benefits derived from the implementation of an action strategy shaped in this way (Marszowski, 2020, pp. 1-131).

It seems that equally important in light of the above conclusions is the need to focus on the need to strengthen and develop social capital in mining municipalities. As numerous experiences prove, without the participation of social capital one cannot count on the creation of externalities – particularly in the labour markets. It seems that this is a necessary condition for achieving the goal assumed in the optimistic forecast scenario for mining municipalities, i.e. a permanent increase in employment and successful development of the SME sector in these municipalities. Therefore, it is recommended to consider the need to develop a programme for the growth of social capital of the inhabitants of mining municipalities (Szczepański, 1999).

In conclusion, the need to take up the activities and challenges outlined above can be justified by the fact that, as experts point out, Poland is currently not fully prepared to develop alternative energy sources to coal. The sector of new energy sources is only just developing and can only draw on the experience of other European Union countries in this development.

In the context of the above-described regularities determining the process of drawing conclusions, the strategic areas in which the greatest challenges should be expected in mining municipalities – in the experts' opinion – are:

- the evolutionary transition in mining municipalities from a high-emission to a low-emission economy,
- protecting the transformed mining municipalities from potential shocks,
- moving away from employment in mining towards a smooth and controlled transfer of qualified staff,
- shift of qualified staff to other economic sectors,
- optimising the readaptation of post-mining areas,
- social security for those losing their jobs, respect for property and the common good, and concern for the development and interests of the inhabitants of mining districts.

On the basis of the determination of the areas of intervention in the analysed mining municipalities, a concept and a vision of the planning and project anticipation process are formed on the basis of the research results, which may make up the entirety of the objectives to be achieved – often referred to as strategic objectives. The above thesis determined – on the basis of the research results – the development of a set of project proposals that are dedicated to the SGGP and individual mining municipalities. This action was accompanied by the conviction that a correct reading of the meaning of the perspective of just transformation allows the formulation of the following further thesis - the design concept is primarily associated with the exemplification of a strategic transformation objective and is contained in the content of the design vision (Stalewski, Szpak, 2000).

Considering the fact that the considered solutions should be implemented in the dimension of the local government unit, which is the commune, it is worth noting, following Ślusarz and Brodziński, that the essence of strategic planning of the area (region, voivodeship, powiat and commune) is the optimisation of the processes of its functioning and development (Impact transforming business, 2021; Nowakowska, Rzeńca, Sobol, 2021, p. 25). The continuation of the above approach is another one, which states that the main function of strategic planning of the development plan of a given area is to maximize the effectiveness and efficiency of management of the object of the strategy by the subject of the strategy in order to develop the economic, social and environmental plane of this object (Korhonen, Hankasalo, Seppälä, 2018, pp. 37-46). As a result of the anticipation of the planning function, it is assumed that its subject is first of all the self-government authorities, but also co-operating partners, first of all institutions and inhabitants, including entrepreneurs. The task of local government is, among others, to prepare goals and tasks and to ensure their implementation in agreement with stakeholders. On the other hand, the subject of the strategy are all tangible and intangible elements of a given area and the processes occurring between them (Bukowski, Śniegocki, Wetmańska, 2018, pp. 1-70; Achieving Sustainable Development, 2008). It is emphasized that in the final, cumulative effect, the proper application of strategic management dynamizes and sometimes even conditions local development processes, which can be developed and strengthened through the following project proposals. In the area of evolutionary economic change in mining municipalities, these could be:

- projects aimed at creating alternative energy sources to coal,
- projects aimed at preparing programmes to strengthen alternative economic actors to the mining industry and to enable a smooth transition of underground workers from the mines to employment in new jobs,
- projects aimed at the smooth transfer of financial resources to mining districts for the reclamation of former mining sites in order to prepare them for new investments,
- projects that take action to encourage the development of new economic entities, companies and business institutions in the surrounding area,

- projects aimed at seeking opportunities for the creation of new areas of economic activity on the basis of support for SMEs and large companies already operating in transformed areas,
- projects strengthening the local government's creation of conditions for new investors and companies from the business environment to locate in the area of transformed mining municipalities,
- projects financing the opening of mining communes to innovative and experimental solutions in the R&D area – e.g. related to the use of waste, geological resources, etc.,
- projects dedicated to the objective of precisely defining - with justification - all available concessions for entrepreneurs in order to encourage them to conduct business activity in mining municipalities,
- projects financing the promotion among entrepreneurs of the idea of gaining measurable benefits from investments offsetting the outlays connected with preparing land for investments or training future employees,
- projects financing the prevention of the disappearance of economic activity in the surroundings of transformed mining.

In turn, in the area of changes determined by social processes – in the experts' opinion – the key ones may turn out to be:

- projects strengthening participation of the largest possible representation of regional leaders, municipal associations, organizations and foundations in the process of equitable transformation,
- projects ensuring the widest possible participation of territorial self-government units from the area of mining municipalities in the fair transformation process,
- projects enabling territorial self-government units to skillfully and purposefully define the problem area and cognitive framework for discussion and social dialogue on the just transition process,
- projects ensuring the widest possible social dialogue and consultation in the decision-making phase of the just transition process,
- projects financing the inclusion in the dialogue on the just transition process of associations and unions representing territorial self-government units, trade union organisations, third sector, etc.,
- projects aimed at developing a public information campaign to make communities in mining communities aware of how their future is shaped by the Just Transition process – what awaits them?
- projects aimed at strengthening efforts in mining municipalities to change the culture and social awareness of residents of transformed areas (at present, an economic monoculture is entrenched in this society, shaping a specific culture of life, choosing well-paid jobs exclusively in the mining industry, lack of involvement in the creation of

their own businesses, often associated with a family model based on a non-working woman),

- projects financing 'soft' activities aimed at cultural change associated with very strong mining traditions,
- projects aimed at skilfully and effectively raising people's awareness that there is an alternative to coal,
- projects financing changes in the education system consisting in moving away from education on mining subjects towards education developing mathematical, technical and language skills in order to achieve an increase in the supply of human resources prepared to work in the modern business services sector and information technology,
- projects dedicated to the young generation preparing them for a completely different nature of professional activity in mining communities – with particular emphasis on issues related to the knowledge-based economy,
- projects dedicated to increasing the participation of women in the labour market through increasing their employability, professional mobility,
- projects financing minimization of occurrence of social exclusion areas in mining gminas,
- projects financing the minimisation of possible escalation of social discontent,
- projects financing the reduction of possible increase in professionally inactive population as a result of deliberate deactivation of people at the age of demographic youth,
- projects financing the reduction of depreciation and decline of professional mobility and educational activity of the inhabitants of mining municipalities basing their future in particular on the sphere of social security,
- projects to finance a slowdown in the depopulation of mining districts, in particular the decline in the number of young people wishing to pursue a professional career outside mining.

The results obtained from the research have also made it possible to develop an extensive proposal of project themes in the R&D area (hereinafter R&D):

- projects financing the conduct of multifaceted monitoring of the impact of the transformation of mining municipalities on their social, economic, environmental and infrastructural environment, as well as the impact of changes on the external environment (other territorial unit closest to the transformed municipality),
- projects financing the development, on the basis of monitoring, of recommendations supporting and updating, in selected areas, the transformation program of mining communes, both at the stage of their construction and implementation, the directions of long-term activities that may limit the effects of transformation in its environment,

- projects financing the preparation of analyses and forecasts concerning the socio-economic environment of mining municipalities from the aspect of supporting them in their ability to compete on an open globalised market in the perspective of fair transformation,
- projects financing the development of programmes in mining municipalities aimed at diversifying their economic structure towards the creation of development-oriented and innovative production and service companies in their vicinity – creating alternative jobs,
- projects financing the development of programmes shaping the image of mining municipalities in their surroundings as a guarantor of the country's independence and energy security,
- projects financing the preparation of analyses concerning the costs and impact of the transformation of mining municipalities on their surroundings.

In conclusion, the phenomena and processes mentioned in the above synthesis in the perspective of fair transformation cause transformations in mining municipalities, in their labour markets, in their education system, inside economic organisations and other institutions operating in their area. Numerous of them are directly or indirectly related to three key future areas that are at the centre of attention in the context of activities undertaken by mining municipalities and districts in Poland. These include in particular:

- **Employment.** There is an undeniable regularity that determines the perception of employment as a key factor shaping full participation in the labour market and social inclusion favourable to the transformation process. In this perspective, we consider investment in human and social capital as a cornerstone for increasing employment opportunities.
- **Family.** The changes brought about by the transformation in the area of work and care for the sake of the well-being of the family and home communities challenge the working life of residents in mining municipalities and districts – and are in principle fully correlated with the need for employment.
- **Health.** The promotion of healthy and active participation in the transformations determined by the transition is relevant to all the activities and challenges undertaken for the more successful development of the societies living in the mining municipalities and districts.

In the context of the above, it should be recognised that municipalities and mining districts face the greatest challenge of modern times and their greatest responsibility is to take all measures to halt the ongoing climate change. We hope that the recommendations presented in this article will contribute to taking effective actions for the benefit of communities of mining municipalities and districts in Poland and its surroundings in the perspective of a just transition.

4. Conclusions

As a result of the analyses and surveys carried out, the article presents an extensive set of conclusions, the most important of which are those relating to social issues – also considered on a political level. In this light, it is worth quoting a view from 10 years ago, in which experts studying the issue of restructuring of the Polish mining industry note that the liquidation of an unprofitable mine is not a problem from the economic or technical point of view, but it is above all a serious social and political problem (Radulov, Ivanov, Nikolaev, Genadieva, 2019, p. 204).

The presented attempt of the prospective approach to the phenomena and processes which may result from the transformation of the hard coal mining in Poland is aimed at – as it was stated in the preface opening the article – better understanding of the role which may be fulfilled in the future by the local self-government in the area of which the operating or disused mines and mining enterprises are located. Secondly, the issues taken up in the chapter, which are related to the perspective of the hard coal mining transformation process, first of all showed in qualitative and quantitative terms the scale of challenges faced by mining municipalities. The indicated processes are nowadays dominated by the challenge of creating new ecological solutions of high quality – of an eco-innovation character – both in the sphere of their social acceptance and in the utilitarian dimension. It is a process that allows for a better understanding of the role of local government in the transformation process, which will probably – to the best of its abilities – take up, in a fragmentary way, economic, social and environmental challenges resulting from the contemporary development of economy based on knowledge and determined by the Industrial Revolution 4.0.

On the basis of the above reflection, it seems that the conclusions and recommendations presented in the article regarding the fair transformation process imply both economic and social challenges that are important for mining municipalities and districts in Poland, among which the following deserve special attention:

- an increase in the importance of mining municipalities' participation in government decision-making, in more friendly conditions shaping cooperation,
- the need for mining municipalities to implement projects based on supra-local mobility and adaptability, as well as social sensitivity,
- the need for mining municipalities to increase social awareness of their responsibility for the process of equitable transformation,
- the disappearance of state policies in the implementation of social functions during the phase of changes taking place and their assumption by local society.

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PSZCZYNA POWIAT IN THE PERSPECTIVE OF A GREEN ECONOMY. CASE STUDY IN WELL-BEING AND LIVING RESEARCH

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Purpose: light of the research results presented in this article, the research results respond to the need to create the best conditions for the development of green economy in the Pszczyna powiat in the new perspectives of economic transformation based on one's own potential.

Design/methodology: the research results presented in the article were obtained on the basis of a random-quota sample of 100 small, medium, large and large enterprises running his business activity in the area of the Pszczyna powiat. The respondents to the research were only people who own the enterprise or are responsible for its key directions of development.

Findings: in the perspective of the conducted research, it seems that the decisive factors contributing to the vision of a green economy in the Pszczyna powiat – in a dynamically changing environment – is the strengthening of sustainable environmental development, in which the needs of the present generation can be satisfied without reducing the chances of future generations to meet them.

Originality: the conclusions and recommendations of the study may be of importance to practitioners and researchers dealing with climate change mitigation, strategy implementation, public partnerships for sustainable development conducive to the well-being and quality of life of local communities.

Keywords: green economy, transition, prosperity, standard of living.

1. Introduction

In the literature there are two key definitions related to green economy green growth and green economy. Green growth in Polish means green growth. This term refers to economic growth that is environmentally sustainable. It is based on the assumption that as long as economic growth remains the main goal, it is necessary to separate growth from resource use and adverse environmental impacts (Kasztelan, 2015, pp. 185-208). Green economy is defined

differently in the perspective of the term green economy. The indicated term was defined within the framework of the United Nations Environment Programme (UNEP) (Program Środowiskowy...) during the preparations for the Rio de Janeiro Summit in 2012 as follows: the green economy increases human well-being and social equity while reducing environmental risks and natural resource consumption.

In this perspective, it seems that the decisive factors favoring the vision of green economy in Pszczyna powiat – in a dynamically changing environment – is the strengthening of environmental sustainability, in which the needs of the present generation can be met without diminishing the chances of future generations to meet them (*Nasza wspólna przyszłość...*, 1991). Another equally important factor is the impact of the green economy on increasing human welfare and social equity. The pursuit of the goals indicated above is of great importance due to such significant strategic documents as: Horizon Europe (Horyzont Europa...), the "European Green Deal" plan (Europejski Zielony Ład..., 2021) and the "Just Transition" instrument. In the content of the cited documents we find, among others, four strategic directions for investment in research and innovation (Horizon Europe), which are:

- Promoting open strategic autonomy by guiding the development of key digital, enabling and emerging technologies, sectors and value chains,
- restoring Europe's ecosystems and biodiversity and sustainably managing natural resources,
- making Europe the first digital, climate-neutral and sustainable closed loop economy,
- building a more resilient, inclusive and democratic European society.

The European Green Deal Plan makes clear that climate change and environmental degradation are a threat to Europe and the rest of the world. To meet these challenges the plan will help transform the European Union into a modern, resource efficient and competitive economy, achieving zero net greenhouse gas emissions by 2050, decoupling economic growth from resource use and leaving no individual or region behind.

These goals are underpinned by the Just Transition Mechanism, a key tool to ensure that the transition to a climate-neutral economy is fair and leaves no one behind. The Just Transition Mechanism helps to mitigate the social and economic impacts of the transition and focuses on the regions, industries and workers most affected. The mechanism consists of three pillars. Pillar one creates the New Fund for Just Transition (Komunikat Komisji...) with a budget of €17.5 billion (2018 prices, €19.3 billion at current prices), which will be used to generate €30 billion in investments. The InvestEU Fair Transition Scheme (the EU's programme for boosting investment) ([https://www.europarl.europa.eu/...](https://www.europarl.europa.eu/)) is the second pillar that will provide the InvestEU budget guarantee across all four policy segments. The InvestEU advice center will be a central point of contact to which advice can be sought. The scheme is expected to generate €10-15 billion mainly in the form of private sector investment. The third pillar includes €1.5 billion in grants financed from the EU budget and €10 billion in loans from the European Investment Bank. These funds will generate public investment of 25-30 billion euros

(Mechanizm sprawiedliwej transformacji...). In this light, the research results presented in this article respond to the need to create the best possible conditions for the development of the green economy in the Pszczyna powiat in the new prospects of economic transformation on the basis of its own potential¹.

2. Materials and Methods

In order to diagnose the directions of economic development of the Pszczyna powiat in the perspective of green economy – in the opinion of Pszczyna entrepreneurs – a survey was conducted in the fourth quarter of 2021 on a random-quota sample (Sztumski, 2010) of 100 small, medium, large and large enterprises conducting their business in the powiat.

The survey respondents were only those who owned the business or were responsible for their key developments. The choice of enterprises was dictated primarily by the purpose and scope of the questionnaire developed for the study – and the complexity of the questions contained in it. In this light, only the companies employing more than 9 people – as shown by the pilot study of the research tool – could fully refer to the issues and problems raised in the study, such as identification of factors determining the development of the company in the field of green economy, determination of the percentage of people in the company classified as green employees or identification of professions, which in the company can be classified as key from the point of view of manufacturing products, offering environmentally friendly (green) services, using environmentally friendly (green) process management, etc. In case of micro companies, among which the employment in the range of 0-1 employee is dominant, it would be impossible to obtain an answer to questions formulated this way.

As previously indicated, the research used a questionnaire survey, which was the main tool used to diagnose the directions of economic development of Pszczyna powiat in the perspective of green economy – in the opinion of Pszczyna entrepreneurs. It was formed in accordance with the set cognitive cross-section, which consists of four main parts. In the first part of the survey there are metric questions, in the second part there are questions corresponding to the functional cross-section, which are the directions of development of the surveyed companies. The third part of the questionnaire covers issues related to personnel policy, and the fourth part covers issues related to development prospects. The survey concludes with a section containing electronic control information and an accompanying pre-survey cover letter.

¹ The article is the result of a research work entitled The Pszczyna Powiat in the perspective of green economy carried out by the Central Mining Institute on behalf of the Powiat Employment Office in Pszczyna. More: R. Marszowski, Pszczyna Powiat in the perspective of green economy 2021.

The questionnaire of the survey included questions focused on specific problem areas including:

- occurrence of environmentally friendly products, services or process management in the business activities of the surveyed enterprises,
- HR policy bringing the studied enterprise closer to green jobs,
- the most important directions of economic activity for the development of green economy in Pszczyna powiat,
- barriers limiting the development of green economy in the Pszczyna powiat.

In this research, the survey method was applied, using the CATI interview technique (Babbie, 2005, pp. 297-298).

After piloting, which was conducted on a sample of three companies, the survey consisted of eight questions relating to the characteristics of the respondent and 22 essential, closed and open questions. The questions relating to respondent characteristics were:

- the respondent's professional position in the enterprise (owner or person responsible for enterprise development),
- the number of people working in the enterprise on the day of the survey (Dz.U. 2010...),
- the type of business activity carried out by the enterprise,
- control questions included the following aspects:
 - the territorial scope of the enterprise's activity (Ministerstwo Gospodarki...),
 - the year of establishment of the enterprise,
 - the economic sector in which the company operates (Rozporządzenie Rady Ministrów...),
 - the legal form of the company (Kodeks spółek handlowych...),
- essential questions – which was indicated earlier – included issues concerning:
 - directions of development of the surveyed enterprises,
 - HR policy,
 - development perspectives.

In the pilot study the following elements of the questionnaire were verified:

- technical correctness: analysis in terms of transition rules, logic and order of questions asked, instructions for interviewers, etc. (technical notes),
- linguistic correctness: analysis for complexity and logic of sentences, comprehensibility of vocabulary used and abbreviations (linguistic-editorial comments),
- substantive correctness: analysis of the selection (relevance, validity, completeness) of questions (e.g. control questions) and indicators (cafeteria) for closed questions (substantive notes).

Testing the questionnaire also made it possible to observe in practice the respondents' reactions to the survey, individual questions and alternative answers. Based on this, the comments given to the interviewers were formulated. The average duration of the interview with respondents was 26 minutes.

On the basis of comments and opinions received during the pilot study, the structure of the questionnaire, questions and cafeteria were refined and questions were standardized in terms of language and response categories used. As a result, a technically, linguistically and methodically correct research tool was obtained. This tool was used for the research proper, as a source of research material for analysis.

The results of the questionnaire survey have been processed with the division into previously adopted problem groups, according to thematic blocks, closed and open questions, with the use of statistical inference technique. Cross tabulations and descriptive statistics were used in statistical inference techniques. The main measures and parameters used in descriptive statistics are: arithmetic mean, standard deviation, median and modal.

The surveyed entrepreneurs expressed their opinions by selecting answers: "Yes" or "No" and "Difficult to answer" based on an elaborate rating scale according to the level of importance: very high, high, medium, low and no importance and the reasoning behind the answers given. This rating scale provided an opportunity to use point averaging in categorizing factor importance. Since there was a possibility of falsifying the importance of the final scoring due to the fact that for entrepreneurs the operator asked could be a barrier or determinant to the growth of the factor asked in the question, this approach was abandoned. In order to obtain an appropriate categorization, an approach was used in which responses indicating very high and high importance were summed, and responses indicating medium, low, and no importance were summed. Likert scale is the leading scale in the research – nominal and dichotomous scales are supplementary.

The statistics of the REGON database (Dz.U. z 2012 r...) (data for 2021 from the Local Data Bank of the Central Statistical Office) were used to construct the research sample. The sampling operator is a list of companies operating in the Pszczyna powiat, taken from commercial databases.

On the basis of the sampling frame and statistical data from REGON system by the random route method (Dz.U. z 1999 r...), the assumed quota-random sample of 100 companies was selected according to the following criteria: company size, number of employees and company location. Out of the sample of 100 companies, 100 companies accepted the invitation to participate in the study, i.e. a percentage of 100% (Table 1).

Table 1.

Random sample of companies from Pszczyna powiat by size, number of employees and location

Lokation	Total number	Size of enterprise/number of persons employed in %			
		small (10-49)	medium (50-149)	large (150-249)	large > 250
powiat pszczyński	100	75,0	20,0	3,0	2,0

Source: own study.

The statistical correctness of the calculations made in the study was verified by calculating the error margin of the study, which amounts to 8% with the probability of the studied sample of 100 enterprises – reflecting the general sample of 2069 business entities with legal personality – and conducting economic activity in the area of the Pszczyna powiat – at the level of 95% on the day of the study (Babbie, 2009).

Below is the distribution of the sample according to the following criteria:

- the territorial extent of the company's operations,
- ownership sector in which the company operates,
- sector of economic activity in which the company operates according to the Polish Classification of Activities (hereinafter – PKD) (Calculate your margin...),
- legal form of the company,
- type of business activity that the company conducts (Tables 2-7).

Table 2.

Random sample of enterprises from the Pszczyna powiat according to the territorial range of their activity

Range	%
local market commune or powiat	31,0
regional market province	19,0
national market	33,0
international market	17,0

Source: own study.

Table 3.

Random sample of enterprises from Pszczyna powiat according to organizational dependence

Organisational dependence	%
autonomous entity	77
head office	7
branch or subsidiary	16

Source: own study.

Table 4.

Random sample of enterprises from Pszczyna powiat by ownership sector

Ownership sector	%
private	51,0
public	44,0
mixed with private	1,0
mixed with public	4,0

Source: own study.

Table 5.

The quantitative and random sample of enterprises from the Pszczyna poviát according to the sector of economic activity

Sector of ownership	%
agriculture, hunting, forestry	8,0
industry	26,0
construction	15,0
trade and services	18,0
hotels and restaurants	2,0
transport, warehouse management and communication	2,0
banking, finance, financial intermediation	1,0
real estate and business services	0,0
public administration and defence	17,0
education	2,0
Health care and social welfare	3,0
Other community, social and personal service activities	0,0
other	5,0

Source: own study.

Table 6.

Random sample of companies from Pszczyna poviát according to legal form

Ownership sector	%
joint stock company	5,0
limited liability company	36,0
limited joint-stock partnership	1,0
limited partnership	1,0
partnership	0,0
general partnership	5,0
entry in the business activity register	52,0
other	0,0

Source: own study.

Table 7.

Random sample of enterprises from the Pszczyna poviát by type of activity

Sector of ownership	%
manufacturing	15,0
trading	2,8
services	45,0
mixed	38,0

Source: own study.

In absolute numbers, the distribution of the sample by number of employees was as follows. In the research the largest percentage were small and large enterprises employing from 10 to 49 and 50 to 149 persons, respectively 75% and 20%. The smallest share was held by large enterprises – with 150 or more employees – whose share in the sample was 5% (Table 1).

The analysis of the territorial range of the surveyed enterprises – measured by the number of answers provided in the survey – showed the following results. Most of the companies in Pszczyna operated in the domestic market (33.0%) and the local market (31%). Further, in the regional market (19.0%) and international (17.0%). Summing up, the enterprises operating on supralocal markets on the day of the survey constituted 34.2% of the total number of the surveyed enterprises (Table 2).

The above analysis significantly extends the factor of organizational dependence of the surveyed enterprises, among which 77% were independent enterprises. Branches or subsidiaries of enterprises accounted for 16.0%. This testifies to the favorable environment in which the companies of Pszczyna conduct their business activities and proves their stability and security in meeting personnel needs (Table 3).

Considering the ownership sector, the distribution of the sample clearly confirmed the predominance of the private and public sector, in which 95.0% of the surveyed enterprises were operating on the day of the survey (Table 4).

Activities, the distribution of the survey sample was: industry 26.0%, construction 1.5%, trade and services 18.0%, hotels and restaurants 2.0%, transport, storage and communications 2.0%, banking, finance, financial intermediation 1.0%, real estate and business services 1.0% and education 29.2%. The analysis of this cognitive area indicates the dominance of four economic activities in the research sample i.e. industry, trade and services, education and construction. In these sections of economic activity were concentrated 76.0% of the surveyed enterprises (Table 5).

Another criterion characterizing the enterprises entering the research sample is their legal form. The structure of these enterprises is presented in Table 6.

According to this criterion, the sample was dominated by enterprises operating on the day of the survey on the basis of an entry in the business register (52.0%) and being limited liability companies 36.0%.

The last criterion characterizing the enterprises included in the research sample is their type of activity. The structure of these enterprises is presented in Table 7. According to this criterion, the sample was dominated by enterprises engaged in services (45.0%) and mixed economic activity (Rozporządzenie Rady Ministrów...) (38.0%) on the day of the survey, compared to 17.0% of enterprises operating in manufacturing and trade.

3. Discussion

In the first cognitive area respondents were asked a total of five questions. These were questions aimed at – as it has already been noted – diagnosing the directions of economic development of the Pszczyna powiat in the perspective of green economy. The first was the opening question, which was general in nature and referred strictly to the business conducted by the company from the perspective of the green economy. In the following questions, the respondents were asked to indicate the primary business activity, strategic objective, factors and activities determining the development of green economy in the Pszczyna powiat.

In light of the question regarding the business conducted by the company in the perspective of green economy, i.e. manufacturing environmentally friendly (green) products, offering environmentally friendly (green) services and using environmentally friendly (green) process management (Kalinowski, 2017, pp. 161-174), it should be noted that the answers confirmed the following regularity. The largest share in the surveyed business entities have the offering of environmentally friendly services (green) and using environmentally friendly process management. The percentage of indications in these two areas of business activity was 61.0% and 57.0% respectively. The lowest share was characterized by manufacturing environmentally friendly (green) products with 49% of indications.

The next question referred to the indication of the primary economic activity corresponding to the economic sectors defined as green (Kozar, 2016). For this question, the area of economic activity of the surveyed entrepreneurs in the percentage of 75.0% corresponds to the sectors closest to the green economy, which are manufacturing, construction and education.

The question of the strategic goal of the enterprises operating in the Pszczyna powiat is another cognitive area included in the survey question. In this question a progressive tendency was outlined and confirmed at the same time. The development of their company is predicted by more than 54% of the entrepreneurs in the powiat of Pszczyna – at the same time the need to maintain the current economic condition by the percentage of 43.0% of business entities from the area of the powiat of Pszczyna.

In the context of the development of Pszczyna's enterprises in the area of green economy, the question of factors determining this development is interesting. In order to organize the obtained results, the following steps were made. The first was to order the factors by summing up the answers according to the importance: high and very high. In the second phase, the evaluated factors were categorized according to the level of their importance for the development of the studied company in the area of green economy, in the district of Pszczyna. For this purpose, the factors were arranged in order from the highest to the lowest level of importance (Table 18).

According to the analytical approach adopted, the factors having the highest importance for the development of the company in the area of green economy in the district of Pszczyna can be separated. These factors are as follows:

- labour costs,
- availability of financial services,
- qualifications of the staff,
- government fiscal policy.

Table 8.

Factors of importance for the development of an enterprise in the field of green economy in the Pszczyna powiat

Lp.	Factor	Level of importance in %						
		1	2	3	4	5	6	7
1	labour costs	6,0	0,0	1,0	14,0	17,0	16,0	33,0
2	availability of financial services	8,0	0,0	0,0	15,0	23,0	8,0	31,0
3	qualifications of the staff	6,0	0,0	0,0	18,8	14,4	16,6	30,0
4	government fiscal policy	8,8	0,0	0,0	18,0	22,0	6,0	28,0
5	employee turnover	10,0	0,0	0,0	22,0	17,0	5,0	22,0
6	procedures for starting and running a business	10,0	0,0	2,0	20,0	15,0	7,0	22,0
7	price of bank loans	8,0	0,0	2,0	23,0	16,0	5,0	18,0
8	access to economic information	10,0	0,0	3,0	20,0	19,0	2,0	21,0

Legend: 1. Hard to say, 2. None, 3. Low, 4. Medium, 5. High, 6. Very high, 7. Level of significance.

Source: own study, GIG.

It should be emphasized – as it has already been noted in the description of the research method – that the results of all the remaining answers, which were evaluated using the Likert scale, were ordered identically to the areas of activities that are important for the development of the company in the area of green economy in Pszczyna powiat.

When assessing the importance of the statements related to the development of green economy in Pszczyna powiat, the respondents' answers clearly indicated that they were the most conducive to the development of green economy in Pszczyna powiat (Table 9):

- economic activity of companies related to the creation of a green economy, as this is important in improving their image in the market,
- if our company prepares itself properly for challenges resulting from if our company prepares itself properly for the challenges resulting from the development of green economy in the Pszczyna powiat, it will increase competitiveness and advantage over companies that are not prepared for this challenge.

Table 9.

Theorems having significance for the development of the enterprise in the area of green economy in the Pszczyna district

Lp.	Factor	Level of importance in %						
		1	2	3	4	5	6	7
1	The economic activity of our company related to the creation of green economy improves its image	12,0	5,0	4,0	11,0	15,0	7,0	23,0
2	If our company is properly prepared for the challenges resulting from the development of green economy in the Pszczyna district, it will increase its competitiveness and advantage over companies that are not prepared for this challenge	12,0	5,0	4,0	11	15,0	7,0	23,0
3	Expenses borne by our company for training in the field of green economy should be privileged in relation to other training, due to tax relief for their participants	14,0	6,0	5,0	10	14,0	5,0	19,0
4	Our company should get support from EU and national funds to improve skills and competencies of its employees in the area of green economy	14,0	6,0	5,0	10	14,0	5,0	19,0
5	The impact of green economy on our company will not determine the need to develop new, specific qualifications and competencies of employees	11,0	5,0	7,0	13	12,0	6,0	18,0

Cont. table 9

6	If our company is not prepared for the challenges of green economy development, it will face negative consequences in the coming years	13,0	5,0	4,0	14	14,0	4,0	18,0
7	Green economy has no prospects for rapid development in the coming years in the County of Pszczyna	12,0	7,0	6,0	12	12,0	5,0	17,0
8	Creating green jobs in our company is associated with higher costs than creating new jobs not related to the green economy	12,0	5,0	5,0	17	9,0	6,0	15,0

Legend: 1. Hard to say, 2. None, 3. Low, 4. Medium, 5. High, 6. Very high, 7. Level of significance.

Source: own study, GIG.

The issue of increase or decrease in the number of employees in Pszczyna enterprises corresponding to the green sectors is another cognitive area among the questions of personnel policy in the perspective of green economy. Based on the results obtained, it should be stated that, to a dominant extent, Pszczyna entrepreneurs in 2021 kept the number of employees unchanged and in few cases made staff reductions. Such an assessment was expressed by 54.0% and 7.0% of respondents, with more than twice the percentage of employers who reported an increase in employment (15.0%). It should be noted that nearly 24% of respondents did not give or refused to answer the question. An important regularity is the lack of influence of COVID 19 pandemic on changes in the level of employment in enterprises in Pszczyna – more than 64% of responses.

The demonstrated trends in employment of 2021 in the opinion of respondents will not significantly change in 2023, in which the surveyed entrepreneurs unequivocally declare – over 43% - no change in the size of employment. In this perspective, an increase in employment was declared by only 5% of the surveyed entrepreneurs, who represented five times the percentage of respondents anticipating a decrease in employment (1%).

In the next question, the attention of the respondents was focused on the issue of job vacancies in Pszczyna enterprises. When asked if there were any job vacancies in the surveyed company on the day of the interview, a percentage of 5% of the entrepreneurs in Pszczyna said yes. The vast majority of the surveyed companies stated that there were no vacancies on the day of the survey (95%).

In the cognitive area "Human Resources" the next questions are connected with the issues.

The next questions in the cognitive area "Human Resources" are related to the problems of finding by the entrepreneurs in Pszczyna employees with the expected and appropriate qualifications in the area of green economy and the sources of this state.

In response to the first question, 95% of the respondents answered that they do not meet the problem of finding employees with the expected and appropriate qualifications. If this phenomenon occurs at all, it is related to the lack of candidates with specific professional qualifications and the lack among candidates of basic skills related to the new workplace.

The percentage of people classified as green employees and occupations considered by the entrepreneurs in Pszczyna as key from the point of view of manufacturing products, offering environmentally friendly (green) services, using environmentally friendly (green) process management are the cognitive areas resulting from the next two questions.

The entrepreneurs surveyed on the day of the interview included in the population of green employees the percentage of people employed in their companies in the range of 40% to close to 100%. The size of the indicated percentage of employees increases in direct proportion to the size of the surveyed company due to the number of employees.

On the other hand, the analysis of key professions in the area of green economy indicated the analysis of the key professions in the area of green economy has shown that in the poviata of Pszczyna they are connected with the following economic sectors: construction, water supply; sewage and waste management and activities related to restoration, education, communication and information, health care and social assistance, industrial processing, agriculture, forestry and production and supply of electricity, gas, steam, hot water and air for air conditioning systems.

Possession of specific licenses, certificates or trainings by the employees of the surveyed companies included in the area of green economy is the scope of the next survey question. The Pszczyna entrepreneurs, while expressing their opinions, decided in the percentage of 13% that their employees must meet this need. The rest of the surveyed entrepreneurs, in the percentage of 83.59%, stated that they do not require from their employees belonging to the area of green economy specific authorizations, certificates or trainings, or it is difficult for them to give such an answer to the question.

In the next question, the entrepreneurs from Pszczyna were presented with 17 professions that are considered most important for the development of green economy (Fazlagić, 2019). Each research participant was asked to evaluate on a five-point scale the importance of the indicated professions for the development of the green economy in the Pszczyna district. The results of the evaluation are presented in Table 10.

Table 10.

Professions of the greatest significance for the development of the green economy in the Pszczyna poviata

Lp.	Occupations	Importance level in %						
		1	2	3	4	5	6	7
1	Farmer/grower	1,0	3,0	5,0	27,0	57,0	7,0	84,0
2	Waste recovery workers	1,0	3,0	7,0	26,0	53,00	10,0	79,0
3	Environmental scientists	1,0	3,0	8,0	19,0	58,0	11,0	77,0
4	Water quality technologists	1,0	4,0	9,0	21,0	53,0	12,0	74,0
5	Conservation biologists	1,0	3,0	12,0	20,0	51,0	13,0	71,0
6	Green technology construction workers	1,0	6,0	9,0	24,0	47,0	13,0	71,0
7	Wind power plant workers	2,0	3,0	11,0	21,0	44,0	19,0	65,0
8	Workers involved in the production and distribution of biofuels	1,0	4,0	12,0	24,0	42,0	17,0	66,0
9	Solar cell technicians	2,0	3,0	15,0	20,0	42,0	18,0	62,0

Cont. table 10

10	Designers of environmentally-friendly clean cars	1,0	4,0	19,0	21,0	41,0	14,0	62,0
11	Architects, engineers and designers who can take the LEED* exam and become LEED certified	1,0	5,0	12,0	20,0	40,0	22,0	60,0
12	Hydrologists	1,0	4,0	11,0	26,0	40,0	18,0	66,0
13	Synthetic meat producers*	1,0	5,0	15,0	18,0	39,0	22,0	57,0
14	Green technology educators	1,0	4,0	16,0	32,0	35,0	12,0	67,0
15	Green design professionals	1,0	4,0	20,0	25,0	32,0	18,0	57,0
16	Sustainability professionals	1,0	5,0	16,0	25,0	32,0	21,0	57,0
17	Green jobs in the local government sector	2,0	7,0	16,0	32,0	22,0	21,0	54,0

Legend: 1. Hard to say, 2. None, 3. Low, 4. Medium, 5. High, 6. Very high, 7. Level of significance.

* meat production, especially beef, is a very heavy burden on the environment. As a result, advanced research is being conducted around the world to develop industrial technology to produce animal protein synthetically using laboratory methods.

* LEED (Leadership in Energy and Environmental Design) is an international building standard.

Source: own study, GIG.

The obtained results show unequivocally that the professions in the area of green economy, which are of strategic importance for the economy, which are of strategic importance for the Pszczyna district, are:

- farmer/breeders,
- waste recovery workers,
- environmental scientists,
- water quality technologists,
- biologists involved in the preservation of the environment,
- construction workers specializing in green technologies.

The remaining professions should be considered less important for shaping the green economy economy in the Pszczyna powiat.

The type of activities with the most significant importance for the development of the Pszczyna powiat in the perspective of the current decade – in the area of green economy is a key cognitive issue, which is the focus of another expert assessment (Płatkowska-Prokopczyk, 2012, pp. 195-206). In order to perform the assessment – as in the previous question – each research participant was asked to rate the importance of the nine activities presented – on a five-point scale (Table 11).

Table 11.

The most important activities for the development of green economy in Pszczyna County in the perspective of the current decade

Lp.	Activity	Importance level in %						
		1	2	3	4	5	6	7
1	Small-scale processing of agricultural or edible forestry products	2,0	7,0	21,0	38,0	29,0	3,0	67,0
2	Services to agriculture and forestry	1,0	7,00	23,0	31,0	36,0	2,0	67,0
3	Direct sale of products mostly from own holding	2,0	8,0	24,0	32,0	32,0	2,0	64,0
4	Agritourism	2,0	7,0	31,0	37,0	23,0	0,00	60,0
5	Crafts and handicrafts	3,0	11,0	23,0	33,0	24,0	6,0	57,0

Cont. table 11

6	Small services for the rural population	2,0	7,0	30,0	34,0	21,0	6,0	55,0
7	Production of energy materials from biomass and establishment of plantations of perennial crops for energy purposes	2,0	8,0	28,0	27,0	30,0	5,0	57,0
8	E-commerce (electronic commerce)	2,0	10,0	31,0	27,0	23,0	7,0	50,0
9	Selling or promoting agricultural products via the Internet	2,0	11,0	31,0	23,0	26,0	7,0	49,0

Legend: 1. Hard to say, 2. None, 3. Low, 4. Medium, 5. High, 6. Very high, 7. Level of significance.

Source: own study, GIG.

Based on the results obtained from the research, it should be stated that in the opinion of the surveyed entrepreneurs, the most important for the development in the perspective of the current decade – in the area of green economy in the Pszczyna powiat are the following three economic activities:

- processing of agricultural products or edible forest products conducted on a small scale,
- services to agriculture and forestry,
- direct sale of products mostly from own farm.

Another expert assessment focused on seven directions of activities that could be important for green economy – in the perspective of this decade – in the Pszczyna powiat. The expert assessment of the directions for action is presented in Table 12.

Table 12.

Kierunki działań o najistotniejszym znaczeniu dla rozwoju zielonej gospodarki w powiecie pszczyńskim, w perspektywie obecnej dekady

Lp.	Action lines	Level of significance in %						
		1	2	3	4	5	6	7
1	Financial and administrative support for entrepreneurs in the green economy area	0,0	5,0	18,0	40,0	21,0	16,0	61,0
2	Identification of key competences for "green economy" in the Pszczyna district	2,0	3,0	21,0	35,0	23,0	16	58,0
3	Maintaining the diversity of rural areas as a European asset	2,0	6,0	22,0	29,0	26,0	15,0	55,0
4	Supporting rural economy and communities in building meaningful connections and exchanges with the outside world	1,0	5,0	27,0	32,0	22,0	13,0	54,0
5	Scientific and research support for projects in the field of green economy	2,0	5,0	25,0	26,0	27,0	15,0	53,0
6	Promoting the development of human and social capital in the green economy	0,0	5,0	29,0	24,0	26,0	16,0	50,0
7	Identification of potential projects in the area of green economy, particularly useful in rural areas (e.g. biomass processing, organic farming)	2,0	5,0	30,0	29,0	19,0	15,0	48,0

Legend: 1. Hard to say, 2. None, 3. Low, 4. Medium, 5. High, 6. Very high, 7. Level of significance.

Source: own study, GIG.

The results obtained from the analysis make it possible to formulate the following conclusions. The directions of actions that the surveyed Pszczyna entrepreneurs considered most important for the development of the green economy in the Pszczyna powiat in the perspective of the current decade are:

- financial and administrative support for entrepreneurs in the area of green economy,
- identification of key competencies for the green economy in the poviát of Pszczyna,
- maintaining the diversity of rural areas as a European asset.

Another problem area undertaken in the research is the directions of development of the Pszczyna poviát in the perspective of green economy in the current decade. Diagnosing this area, the experts decided that the Pszczyna poviát in the perspective of this decade building the strategic direction of development should strive to achieve the status of the district whose key features are (Table 13):

- science,
- tourism
- culture and art,
- new technologies.

Table 13.

Directions of development of the most significant meaning for the Pszczyna district in the perspective of the present decade and green economy

Lp.	Directions of development	Level of significance in %						
		1	2	3	4	5	6	7
1	learning	3,0	8,0	18,0	25,0	41,0	5,0	66,0
2	tourism	1,0	3,0	26,0	29,0	36,0	5,0	65,0
3	culture and arts	4,0	8,0	19,0	33,0	28,0	8,0	61,0
4	new technologies	3,0	8,0	20,0	25,0	36,0	7,0	61,0
5	business	3,0	8,0	23,0	25,0	33,0	8,0	58,0
6	conference center	5,0	12,0	27,0	15,0	26,0	15,0	41,0
7	religious center	10,0	15,0	21,0	13,0	18,0	23,0	31,0

Legend: 1. Hard to say, 2. None, 3. Low, 4. Medium, 5. High, 6. Very high, 7. Level of significance.

Source: own study, GIG.

The final question of the survey addressed the issue related to the 15 terms that most accurately describe Pszczyna poviát in the perspective of the current decade and the green economy. The experts participating in the survey were asked to evaluate them while identifying the desired profile of the county (Table 14).

On the basis of the experts' evaluations and their analyses we can assume that in the perspective of the green economy and the current decade the desired profile of the Pszczyna poviát should focus on activities that create its image as a well-kept, hospitable, developing, safe and family Poviát.

Table 14.

Features identifying the desired profile of the county of Pszczyna in the perspective of the current decade and green economy

Lp.	Directions of development	Level of significance in %						
		1	2	3	4	5	6	7
1	hospitable	0,0	0,0	21,0	53,0	25,0	1,0	78,0
2	thriving	0,0	0,0	34,0	44,0	21,0	1,0	65,0
3	neat	0,0	3,0	30,0	49,0	15,0	3,0	64,0
4	everywhere is close	0,0	3,0	36,0	42,0	17,0	2,0	59,0
5	safe	0,0	4,0	34,0	45,0	13,0	4,0	58,0
6	family	0,0	1,0	36,0	42,0	15,0	6,0	57,0
7	attractive	0,0	2,0	41,0	32,0	22,0	3,0	54,0
8	connects people	1,0	6,0	37,0	39,0	13,0	4,0	52,0
9	educated people	0,0	3,0	41,0	34,0	17,0	5,0	51,0
10	sporty	0,0	4,0	42,0	34,0	17,0	3,0	51,0
11	social	0,0	3,0	44,0	38,0	12,0	3,0	50,0
12	elderly	0,0	5,0	41,0	30,0	19,0	5,0	49,0
13	entertaining	0,0	9,0	40,0	34,0	14,0	3,0	48,0
14	historical	0,0	2,0	46,0	29,0	15,0	8,0	44,0
15	modern	0,0	7,0	49,0	25,0	13,0	6,0	38,0

Legend: 1. Hard to say, 2. None, 3. Low, 4. Medium, 5. High, 6. Very high, 7. Level of significance.

Source: own study, GIG.

4. Conclusions

The green economy vision is linked to several key strategic objectives. Their content and importance can be found in the European Union's policy document – Horizon Europe (Rozporządzenie Rady Europy...) – in the mission section of which, entitled "Adapting to climate change including social transformation", we read that addressing the rapid warming of the Earth's climate is one of the most pressing challenges for humanity. The climate is changing faster than ever, causing heat waves, droughts and floods to become more frequent and severe. We can turn this growing threat into an opportunity to improve our resilience and change our lives for the better and healthier. Climate change adaptation is the process of adjusting to the current or expected climate and its impacts. The mission area will support this process by connecting citizens with science and public policy. The mission area will help maximise the impact of EU support to research and innovation and demonstrate its relevance to society and citizens. The initiative will focus on solutions and preparedness to the impacts of climate change in order to protect lives and property. It will cover behavioral changes and social aspects by reaching out to new communities beyond the usual stakeholders to help bring about social transformation.

It clearly exposes the importance of human beings and their future with the overarching goal of changing lives for the better and healthier. Fully in line with this goal the results of the research presented in this chapter fully correspond with this goal, where the needs related to the perspective of green economy – i.e. better and healthier life for the citizens of Pszczyna – are unambiguously revealed.

To conclude, it is worth quoting Saint John Paul II, who in 1990 said that the greenhouse effect has reached critical proportions as a result of continuous industrial development, large urban agglomerations and increased energy consumption. He later made it clear that this phenomenon was caused by human activity. Industrial waste, gases produced by burning minerals, uncontrolled cutting down of forests – all this, as we know, has a harmful effect on the atmosphere and the whole environment. The ecological crisis, I repeat, is a moral problem", the Pope stressed.

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**PERCEPTION OF SUSTAINABLE SPORT SPONSORSHIP
IN TERMS OF SUSTAINABLE DEVELOPMENT
AND CORPORATE SOCIAL RESPONSIBILITY
IN THE ERA OF THE COVID-19 PANDEMIC**

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Purpose: The purpose of the research presented in this paper was to identify the factors that determine the perception of sport sponsorship in terms of sustainability development and CSR activities in the era of Covid-19.

Design/methodology/approach: The goal was achieved by literature review and presentation of the results of relevant pilot research. The research sample (random) consisted of questionnaires returned by 203 respondents via the Internet. In the empirical analysis workshops, binomial models in the form of logit models were used, due to which the estimation of 8 logit models (4 full and 4 reduced) was carried out, while considering their determinants in 5 categories.

Findings: The results show that despite the Covid-19 pandemic, participants in sports events pay attention to the sponsor's activities in terms of sustainable development and CSR. This is evidenced by various perceptions of his activity. These results confirm that combining sponsorship with sustainable development and CSR help to create a positive image of the company, especially in the times of crisis.

Research limitations/implications: In the period of many restrictions related to the Covid-19 pandemic, sports sponsors have limited opportunities to display their brand, thus creating their image. Additionally, the lack of sports gatherings limited the interactions occurring on the plane of the sports event – sponsor-beneficiaries of the event. Covid-19, in a way, forced brands to act in a sustainable manner and CSR. The commercialization of sport introduced sustainable development and CSR as means to achieve organizational goals and the Covid-19 pandemic has become a period of adjusting activities in the area of sustainable development and CSR to new conditions and social expectations. The obtained test results confirm this.

Social implications: The coronavirus pandemic and government-imposed social distancing measures have had a strong impact on the sports sponsorship rights market, thereby impacting sustainability and CSR activities. Therefore, the article answered the question whether the Covid-19 era is a place to combine sports sponsorship with sustainable development and CSR?

Originality/value: The discussed issue is in line with the current concept of sustainable development and CSR. Sustainable sports sponsorship allows you to build a positive image of the company and maintain a long-term competitive advantage, even in such difficult times related to the Covid-19 pandemic. The article is intended for both managers and researchers dealing with the subject of sustainable development and CSR.

Keywords: sport sponsorship, sustainable development, CSR, Covid-19 pandemic.

Category of the paper: Research paper.

1. Introduction

The Covid-19 pandemic had and still has a profound impact on the world, the economy, including sport, and government-imposed social distancing rules had a fundamental impact on the sports sponsorship rights market (Mastromartino et al., 2020). As a result of a series of Covid-19 restrictions, sports events have been restricted by postponing the event date or even canceling them. It has influenced and will continue to affect any sponsor rights related to these events. In addition, depending on the long-term economic impact of Covid-19, sponsors may face serious financial liquidity problems, which can make very difficult or impossible to meet current obligations. In such a scenario, sponsorship companies have significantly reduced their sponsorship budgets to increase their cash flow (Muñoz, Meyer, 2020; Dašić et al., 2020). As a result, the typical "partnership" between rights holders and sponsoring corporations changes. The crisis has highlighted the problems that arise in applying the current agreements. While one side struggles with the suspension of matches and sporting events, the other is hit by a lack of brand exposure (Hammerschmidt et al., 2021). According to Dastisheh and Raju (2020) many sponsorship activities have been suspended in the current situation. This is because Covid-19 changes the market dynamics and this activity would help sponsors gain greater awareness, image and customer loyalty (Khuong, Chau, 2017). These presumptions lead sponsors to become more involved in sustainable development and socially responsible activities. This is because the long-term nature of sponsorship makes it possible to build a brand permanently. And what is equally important, through sponsorship, sponsors shape a positive image of the brand in the minds of consumers (Chien et al., 2011; Pope, Voges, 2002). Thus, the purpose of the research presented in this paper was to identify the factors that determine the perception of sport sponsorship in terms of sustainability development and CSR activities in the era of Covid-19.

2. Literature review

In the contemporary conditions of market saturation and fragmentation, combined with accelerated technology and innovation progress, abundance of competitive information, consumers may feel disoriented and advertising may be ineffective (Melovic et al., 2019). Thus, contemporary enterprises look for new methods of promotion, including communication with their neighborhoods. According to Knecht (2002), one of the most refined advertising techniques, elaborately linked with other elements of promotion mix, is sponsorship. This is confirmed by Black (2003), who claims that sponsorship enables companies to communicate with their target groups that are hard to contact through standard marketing methods. From the commercial point of view, sponsorship constitutes strategic relationship between the sponsor and a sport entity for mutual, usually financial benefit (Farrelly, Quester, 2005; Pons et al., 2016; Næss, 2020). Parkes (2015) notes that sponsorship may also be used to support social initiatives and projects benefiting the society in general. In this context, sponsorship, because of its pro-social character, is naturally embedded in the sustainable development and corporate social responsibility activity of enterprises. Therefore, the research so far, among others, has focused on socially responsible activities in sport (Walker, Parent, 2010; Kang, Hur, 2012), reasons for getting involved in CSR practices by professional sports teams (Babiak, Wolfe, 2009), social commitment as an element of CSR in sport management, impact of sponsorship activities on stakeholders (Inoue, Kent, 2012; Lacey, Kennett-Hensel, 2016; Hu et al., 2016; Kolk, 2004).

Recently sustainable development and CSR have gained companies' attention due to their strategic importance. The sustainability and CSR activities are based on the understanding of interrelationships between organizations, the society and the environment, as it has been already recognized that they interrelate rather than operate as discrete entities (Sudolska, Łapińska, 2020; Hu et al., 2016; Pinelli, Maiolini, 2017). Sustainability and social responsibility are also definitely one of the top priorities that brands have when thinking about a new sponsorship activation or activating an existing one (Melovic et al., 2019; Mamo et al., 2019). Whereas the World Business Council for Sustainable Development gives an explanation of CSR pointing out the commitment of business to contribute to sustainable economic development, working with employees, their families, the local community and society at large to improve their quality of life (World..., 1999). On the other hand, Andersen and Høvring (Andersen, Høvring, 2020) claim that there is a lot of hypocrisy in sustainable development and CSR activities, which is why the dialogue of a company with a broad group of its stakeholders is so important. In many companies, sustainable development and social responsibility is communicated to stakeholders partly as the sponsoring of athletes, social events and entertainment (Scheinbaum, Lace, 2015). What is important, the UN's include sport in the sustainable development goals, through Article 37 of the SDGs, the UN identified sport as an "important enabler of sustainable development"

(UN, 2015, para. 37). As claimed by Flöter et al. (2016) and other scientists (Babiak, Wolfe, 2009; Bason, Anagnostopoulos, 2015), linking sports sponsorship with sustainability and CSR activities allows sponsors to demonstrate the value of the company and to strengthen its reflection through image transfer from the positive image of a sports facility to its own. The positive effect is that an event is transferred to the consumer's sustainable development and CSR scheme, resulting in a better perception of the sponsoring brand as a socially responsible brand (Uhrich et al., 2014; Christensen, 2006; Kim et al., 2020). As claimed by Djaballah et al. (2017), sports sponsorship covers the strategic relationship between the sponsor and the sports facility for mutual benefit, and one of its main objectives is to achieve a positive image. Smitha and Westerbeek (2007) reckon that this is related to the characteristic features of sport, e.g., attractiveness for young people, positive effects on health, social interactions, which can be effectively used in sustainable and CSR activities. This connection, as claimed by Lacey and Kennett-Hensel (2016), activates the association triangle between the brand, the sponsored event (person) and sustainable and CSR activities. This has also become the basis for a range of studies in this area (Plewa et al., 2016; Rahman et al., 2017; Scheinbaum et al., 2017; Sung, Lee, 2016).

As stated by Flöter et al. (2016), most of the research relates to CSR activities in sports organizations, such as teams, leagues or management bodies. This creates a gap and results in looking at sports sponsorship from the point of view of the beneficiaries of sports events. The study makes a contribution to the literature in the following manner. First of all, the perception of sponsorship activities in terms of sustainable development and CSR in the era of coronavirus by the participants of sports events has been indicated in the study. The research reveals the groups of viewers for whom sponsorship activities, combined with sustainable development and CSR, are the most significant. The study also confirms the importance of sustainable development and CSR activities in creating the responsible image of the sponsor. This fills the research gap in terms of the perception of sustainable development and CSR activities in sponsorship by viewers in the era of coronavirus. Secondly, the need for further research into the perception of sponsorship among the group under research is indicated. This will allow for better development of the sustainable development issues and CSR strategy in sponsorship activities, raising the sponsor's awareness in this respect. This is reflected in sponsorship objectives which are vague and thus difficult to measure.

In many companies, sustainable development and social responsibility is communicated to stakeholders partly as the sponsoring of athletes, social events and entertainment. The research conducted by Preuss (2015) revealed that significant sustainable development effects can be achieved through organizing mega sport events by investing obtained funds in buildings and adapting the infrastructure for the event using renewable resources. Nowadays, companies focus on persuading consumers of their sustainability efforts through new CSR tactics (Vollero et al., 2016; Millington et al., 2021; Szaruga, Załoga, 2022). It is also essential that The UN's call to consider the fundamental societal changes required to stem the tide of climate change,

and the importance of the environment in matters of development should resonate with critical scholars of sport. Indeed, in recent years, sport has already been cast as an engine of sustainable development (Millington et al., 2021).

Uhrich et al. (2014) believe that enterprises, by implementing sponsoring projects, combine the CSR with sponsorship. In their opinion, sponsors who opt for sponsorship linked with the CSR must decide on the main goal of sponsorship communication associated with social responsibility. In this context, sponsors make a two-level decision, i.e. they focus either on CSR information (activities involving the economic, social and environmental aspect) or on information about sponsors (e.g. events, athletes) within the framework of a combines strategy. This translates into whether or not an enterprise – sponsor does the right things to satisfy the needs of a society (Ellen et al., 2006; de Castro Sobrosa Neto et al., 2020). As claimed by Weeks et al. (2008), linking socially responsible activities with sponsorship and vice versa can be classified as leveraging, i.e., applying such tools or marketing strategies that make it possible to generate profits. This is somehow related to the value of the sports industry itself. According to The Business Research Company, the global value of the sports market is over USD 488.5 billion, and more than PLN 10 million in Poland. As a whole, it covers activities based on financial, human and social capital. In practice, these operations are performed, as claimed by Walker and Parent (2010), at three levels. The first level includes activities related to the creation of a sports product providing entertainment for viewers by sports teams or a single sportsperson. At the second level, there are activities by municipalities or local authorities that are involved in the construction of sports facilities. This, in turn, translates into building social ties. The third level is the so-called media level. At this level, “the power of the sports stars” influences the purchase of exclusive rights to broadcast sports events. All of this makes that many corporations use sponsorship to increase their profits as well as for positive associations with the sponsor’s brand. In the opinion of Babiak and Wolfe (2006), this contributes to greater identification with the sponsor’s brand. It should be noted, however, that the principle of sponsorship is “I give to get back”, so it should be a pro-active effort to achieve a certain goal, and to yield measurable and positive effects by supporting important initiatives (Breczko, 2011). On the other hand, sport triggers emotions and at the same time it is an effective tool to educate and promote healthy lifestyle, attractive for young people, and as such, it may be successfully used in the sustainability and CSR strategy (Smith, Westerbeek, 2007). Also, the engagement of an enterprise in sporting competition is supposed to communicate to a broad group of stakeholders that the enterprise is sensitive to social and economic needs, especially in the local community (Scheinbaum, Lace, 2015). According to the research conducted by Djaballah et al. (2017) combining sponsorship with the sustainable development and CSR may yield both positive and negative results. First of all enterprises – sponsors manage to transfer the positive image of a sport facility brand to its own image. According to this opinion, the goal of sponsorship activities combined with sustainable and CSR activities is that the sponsor is associated with the beneficiary and the image of the sponsor is one of a company

that cares for people and solves their problems (Breczko, 2011). According to Waller and Conaway (Waller, Conaway, 2011), sponsors use the sustainable and CSR to prevent their negative image and to make them look good. On the other hand, sport disciplines that are not very reputable, are associated with a high level of corruption or involved in doping scandals also affect the image and perception of the sponsor (Pawlak, 2015).

Stakeholders are usually positive about all kinds of sponsorship, if there is an association between a sponsor and the beneficiary. Thus, sponsoring may be helpful to achieve many different goals, such as good relationships between clients and employees, positive interest from the media, higher recognition and better brand image, more awareness of a given brand and even support from the community (Gregory, 2005). This is confirmed by Grohs and Reisinger (2014), who claim that the image of a sponsor is a function of the image of the sponsored activity and of how much an event fits the sponsor.

3. Research method

The following factors affecting image building were identified and served as the basis to interpret the research results:

- Hypotheses 1: the use of sustainable development and socially responsible activities in sponsorship opens in the pandemic Covid-19 up a wide range of opportunities for sponsors, in particular, supports their business objectives (H 1).
- Hypotheses 2: sponsorship activities, combined with sustainable development and CSR, increases the perception of sustainable development and CSR in the pandemic Covid-19 (H 2).
- Hypotheses 3: there is an increase in the significance of sponsorship communication in the field of sustainable development and CSR in the Covid-19 pandemic (H 3).
- Hypotheses 4: using sport potential in the sustainable development and CSR strategy in the pandemic Covid-19 helps create a responsible image internationally (H 4).

On this basis, the following main hypothesis (H) was formulated: sport helps create the image of a company as a sustainable and socially responsible organisation. The first step towards the goal of the research, defined above, was to develop the research model (Figure 1).

In this research, the instruments of econometric modeling were used, in the form of binomial models, which are the basis for the analysis of the relationships between one (or more) independent (explanatory) variable and a binomial (binary, dichotomous) dependent variable. Binomial modeling is mainly used for (Gruszczyński, 2010):

- verification of the adopted hypothesis (hypotheses) regarding the mechanism generating the variable Y , i.e. determining the set of variables X that are important for determining the probability value P in a given community,

- prediction $P(y_i = 1)$ of the probability of an event or state that the Y variable takes the $y_i = 1$ value, or a prediction of a change in probability P caused by a change in the value of one of the exogenous variables X .

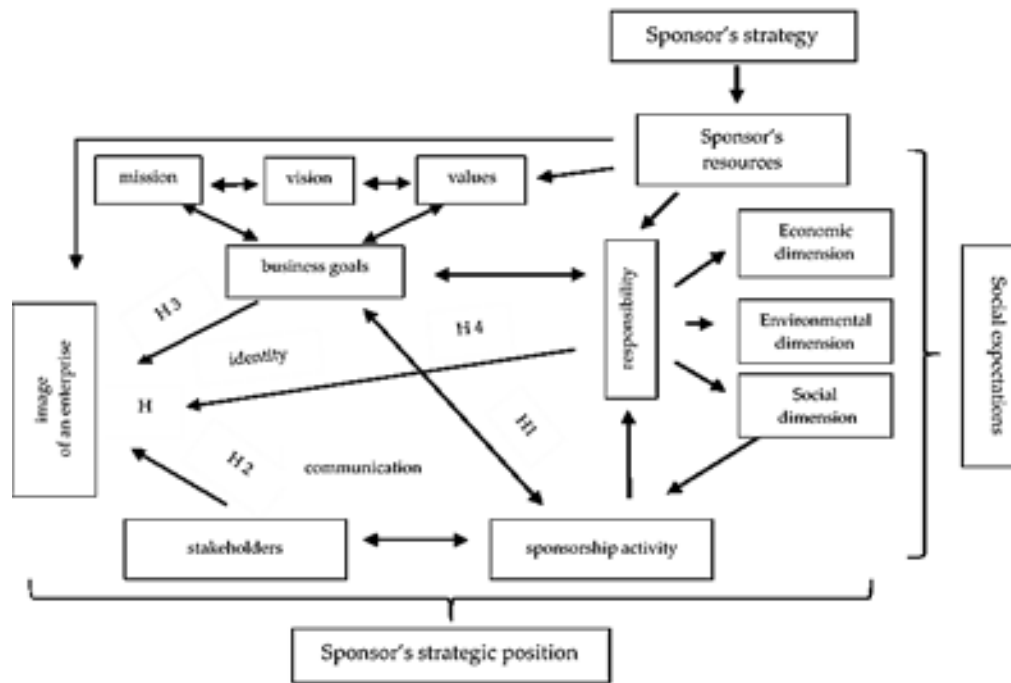


Figure 1. Research model. Source: own elaboration.

In practice, two types of binomial models are used, i.e., logit models and probit models. These models are used to specify probability and to analyze the relationships between one or more independent (explanatory) variables and a dichotomous dependent variable (taking the value of 1, when the desired event occurs, and the value of 0, when such an event does not occur), namely (Trendafilova et al., 2013):

$$y_i^* = \beta_0 + \sum_{j=1}^k \beta_j x_{ij} + u_i \tag{1}$$

where:

y_i^* - hidden variable, taking:

$$y_i = \begin{cases} 1 & \text{for } y_i^* > 0 \\ 0 & \text{for } y_i^* \leq 0 \end{cases}$$

The purposes of the perception of sports sponsoring in Poland and its impact on the company's image as a socially responsible organization from the point of view of the participants of sports events, the logit model was used, taking the form of:

$$y_i^* = \ln \frac{P_i}{1-P_i} = \beta_0 + \sum_{j=1}^k \beta_j x_{ij} + u_i \tag{2}$$

where:

y_i^* - is called logit,

P_i - is referred to as the probability of the dependent variable y_t , determined on the basis of the logistic distribution from the following equation:

$$P_i = \frac{P_i}{1-P_i} = e^{y_i^*} = e^{\beta_0 + \sum_{j=1}^k \beta_j x_{ij} + u_i} \quad (3)$$

$$P_i = \frac{P_i}{1-P_i} = \frac{P_i}{1 + e^{-(\beta_0 + \sum_{j=1}^k \beta_j x_{ij})}} \quad (4)$$

If:

$$y_i^* \rightarrow \infty, \text{ then } P_i \rightarrow 1$$

$$y_i^* \rightarrow -\infty, \text{ then } P_i \rightarrow 0$$

$$y_i^* = 0, \text{ then } P_i = 0,5$$

To determine the goodness of the fit of the data to the estimated models, the basic statistical measures were used, such as: Likelihood Ratio Test, McFadden's R-squared, Adjusted R-squared, Number of cases of 'correct prediction'.

The data of dependent and independent variables, which are the basis for the estimated models, were obtained from the pilot studies conducted in III quarter of 2021, using the CAWI survey technique. The research used a structured questionnaire with 12 research problems, four of which (RP1-4) were later analysed statistically. Considering the substantial value and statistical criteria, 5 variables were selected to describe the respondents (Table 1), i.e. the explanatory variable (x).

Table 1.

List of explanatory variables (x)

Statistical data of the respondents		Independent variable	Value %
Gender	Female	<i>F</i>	38.9
	Male	<i>M</i>	61.1
Age	up to 24 years	A24	23.2
	25-34 years	A25-34	28.1
	35-44 years	A35-44	13.3
	45-54 years	A45-54	19.7
	Above 55 years	A55	15.8
Education	Graduate	G	50.2
	High school	H	27.6
	Professional	PR	22.2
Marital status	Single	S	29.1
	in relationship	R	45.8
	Widowed	W	25.1
Professional activity	Employed	E	49.3
	Unemployed	U	27.1
	Pensioner	P	23.6

* Reference group.

Source: own elaboration.

The data presented in table 1 show that the research sample comprises 38.9% women and 61.1% men (reference group). The biggest group of respondents are young people up to 34 years – 51.2% of the respondents, of which 28.1% are aged 25 to 34 years and 23.2% – below 24 years (reference group). Most respondents are university graduates – 50.2% of the research population (reference group), 27.6% have comprehensive or technical secondary education and 22.2% – vocational education. Most respondents have spouses or partners –

45.8%, followed by singles (bachelors/maidens – 29.1% – reference group, widowers/widows – 25.1%). In terms of the last category of variables, i.e. professional activity, pensioners constituted the least numerous group – 23.6%. The most numerous group in this category were professionally active respondents – 49.3% (reference group).

Response variables were coded on the basis of respondents' feedback on the abovementioned research problems, where: $H1 - y_1$, $H2 - y_2$, $H3 - y_3$, $H4 - y_4$.

In this paper, in the logit model, for the purpose of evaluating the above H1-4s, a dependent variable is represented by a dichotomous variable, where: 1 – is the distinguished value meaning the respondent's confirmation of a dependence, 0 means that the respondent does not agree with the phenomenon in question. With this assumption, it was possible to define the respondents' perception of the H1-4s.

The research conducted by the Author suggests that Polish enterprises engage in sponsorship for:

- publicity – 32.25% of responses,
- a positive image – 29.03% of responses,
- product and company brand promotion – 22.58% of responses,
- to support a given sport discipline – 16.14% of responses.

Moreover, 45.45% of the respondents believed that using the image of athletes for promotion is a good way to attract customers. In their opinion, this not only influences the image of the company or the athlete but also confirms the reliability and quality of a product.

Accordingly, 80% of the responds think that enterprises should engage in sponsorship. Of course, they should be aware that being a sponsor has its cons as well as pros (Table 2).

Table 2.

The pros and cons of sponsorship according to the respondents

Pros	Cons
<i>of engaging in sponsorship*</i>	
is beneficial for reputation and brand identity associates sport success with company image	the success of an advertising campaign depends on sport results
the brand is more recognisable and it triggers positive associations and trust	risk of unsportsmanlike behaviour or being caught on doping
informed sponsorship activities are more visible than traditional advertising	unlike in advertising, it is not possible to inform about the features of a product
bran appears in sport and news programmes in the best airtime	it is hard to emphasise the role of the sponsor multitude of advertising information with multiple sponsors or advertisements on athletes' costumes
boosts sales	is recommended for recognisable brands

* the factors in the table are listed according in the order suggested by most respondents

Source: own elaboration.

The above list suggests that engaging in sponsorship is, in the first place, beneficial for reputation and brand identity. This is because sport success is associated with company image. This, in turn, makes the brand more recognisable, triggering positive associations and trust.

On the other hand, it should be noted that the conduct, results or unsportsmanlike behaviour of athletes has a negative impact on company reputation and its financial performance.

Looking for answers to the above RPs, eight logit models were estimated using the Gretl programme – two models per each of the examined response variables y , of which:

- 4 full models, covering all the variables (x),
- 4 reduced models covering only variables (x), with significance.

Table 3 presents the results of logit model estimations for the variable y_1 .

Table 3.

Results of logit model estimations for the variable y_1

* observations used 1-203

Variable	Coefficient	Standard deviation	z	p-value	Marginal effect	Indicators of data adjustment to model estimations
MODEL 1 full logit model for y_1						
<i>const</i>	0.1624	0.4240	0.3831	0.7016		Likelihood Ratio Test 36.9403 [0.0001]
<i>F</i>	-0.2919	0.3347	-0.872	0.3832	-0.0723	
<i>A2543</i>	0.2144	0.4027	0.532	0.5945	0.0534	
<i>A3544</i>	-0.03747	0.5214	-0.071	0.9427	-0.0093	
<i>A4555</i>	0.5343	0.4577	1.167	0.2430	0.1327	McFadden's R-squared 0.1321
<i>A55</i>	0.9050	0.4833	1.872	0.0612*	0.2207	Adjusted R-squared 0.0462
<i>H</i>	-1.109	0.4278	-2.593	0.0095***	-0.2617	
<i>PR</i>	0.1809	0.3880	0.466	0.6410	0.0451	
<i>R</i>	0.2913	0.3254	0.895	0.3707	0.0724	
<i>W</i>	0.5126	0.4017	1.276	0.2019	0.1274	Number of cases of 'correct prediction' 142 (70.3%)
<i>U</i>	-1.403	0.3799	-3.694	0.0002***	-0.3225	
<i>P</i>	-0.4045	0.3849	-1.051	0.2932	-0.0994	
MODEL 2 reduced logit model for y_1						
<i>const</i>	0.4806	0.2175	2.210	0.0271 **		Likelihood Ratio Test 31.0148 [0.0000]
<i>A55</i>	0.7028	0.4388	1.602	0.1093	0.1733	McFadden's R-squared 0.1109
<i>H</i>	-1.1668	0.3526	-3.309	0.0009 ***	-0.27418	Adjusted R-squared 0.0823
<i>U</i>	-1.4499	0.3656	-3.965	7.33e-05 ***	-0.3319	Number of cases of 'correct prediction' 139 (68.8%)

Explanation: The level of significance of the parameters: *** $\alpha = 0.01$, ** $\alpha = 0.05$, * $\alpha = 0.1$

Source: own elaboration.

An analysis of the material suggests that the respondents believe it is worth being a sponsor, but they are not quite convinced if this has a positive impact on the achievement of goals, including increased value. On the one hand, this may be connected with placing sponsorship activities in the overall operation strategy and thus defining the objective of such activities. Some sponsors take actions in the field of sustainability and CSR in order to create the "responsible" image and some – out of willingness to help. The confirmation of this is the research by Djaballah et al. (2017), which clearly pinpoints that sponsors are unwilling to communicate on S-CSR activities since they can see the risk of being accused of greenwashing.

The results (Table 3) show that neither gender nor marital status are a statistically significant determinant of the probability of the variable y_1 . Such dependence existed between respective age, education and professional activity groups, and in the latter two, there was a relationship both in the full and in the reduced models. A relationship on the $\alpha = 0.1$ level (full model) is visible for the variable *A55*. Meanwhile, the variables *H* and *U* revealed a relationship on the $\alpha = 0.01$ level (full and reduced models). Taking into account the obtained marginal effects, it should be stated that an increase in age by each year increases the probability (an increase by 0.22%) of the positive perception of activities for sustainable development and CSR in sponsorship activities, contributing to greater opportunities of the sponsor. In turn, among people with lower education, one may observe a decrease by 0.26% (full model) and by 0.27% (reduced model) of the positive perception of the selected activities. It is similar in the case of the unemployed. In this group, one may observe a decrease by 0.32% of the positive perception of sustainable and CSR activities in sponsorship activities. It should be noted here that both Model 1 and Model 2 have correct adjustment, proven by the value of the likelihood ratio test (36.9 and 31.01, respectively).

Taking into account H2, it should be stated that, in the opinion of the respondents, sponsorship activities, combined with sustainable development and CSR, increases the perception of sustainability and CSR, which translates into the creation of positive relationships with a wide range of stakeholders, in particular among the local community. As rightly claimed by Trendafilova et al. (2013) and Kufel (2007), sport is the industry in which a variety of stakeholders are involved in shaping the behavior of sports organizations. This, in turn, contributes to greater adaptation and implementation of practices related to sustainable development and CSR. This leads to the so-called strategic-corporate partnership. The use of sustainable and CSR initiatives contributes to the generation of the desired brand, fans' loyalty, sport development and ticket sales.

Considering RP 2, in the opinion of the respondents, sponsorship activity helps build positive relationships with a broad group of stakeholders, especially the local community. Accordingly, the logit models were evaluated and the results are presented in Table 4.

The same as in the case of y_1 gender is not a statistically significant factor determining the probability of the occurrence of a variable y_2 . The age of the respondents proved to be an equally insignificant factor. Therefore, for these two groups of respondents, sponsorship activities combined with sustainable development and CSR are insignificant. Such dependence was reported in the case of *PR* and *U*, on the significance level $\alpha = 0.05$ (full model). This dependence is somewhat different in the case of the reduced model, where the variable *PR* had stronger dependence ($\alpha = 0.01$), while the other variable *U* had the same level of dependence. Looking at the marginal effects, it can be concluded that the higher the education the lower (by 0.18%) the probability of better perception of sustainable development and CSR in sponsorship activities in the case of the full model. It is slightly different in the case of the

reduced model in which people with higher education perceive sponsorship activities combined with sustainability and CSR better (a likely increase of the factor by 0.24%).

Table 4.
Results of logit model estimations for y_2

* observations used 1-203

Variable	Coefficient	Standard deviation	z	p-value	Marginal effect	Indicators of data adjustment to model estimations
MODEL 3 full logit model for y_2						
<i>const</i>	0.2653	0.4175	0.635	0.5252		Likelihood Ratio Test 23.8248 [0.0135]
<i>F</i>	-0.2544	0.3402	-0.747	0.4546	-0.0581	
<i>A2543</i>	-0.0835	0.3973	-0.210	0.8334	-0.0190	
<i>A3544</i>	0.0682	0.5373	0.127	0.8989	0.0153	McFadden's R-squared 0.0897
<i>A4555</i>	-0.2617	0.4546	-0.575	0.5648	-0.0607	
<i>A55</i>	-0.2981	0.4560	-0.653	0.5134	-0.0695	Adjusted R-squared -0.0006
<i>H</i>	-0.3489	0.4179	-0.834	0.4038	-0.0808	
<i>PR</i>	-0.7842	0.3866	-2.028	0.0425**	-0.1860	
<i>R</i>	1.1659	0.3336	3.494	0.0005***	0.2559	Number of cases of 'correct prediction' 135 (66.8%)
<i>W</i>	0.254192	0.3860	0.658	0.5103	0.0565	
<i>U</i>	0.877623	0.3929	2.233	0.0255**	0.1843	
<i>P</i>	0.0191729	0.3783	0.050	0.9596	0.0043	
MODEL 4 reduced logit model for y_2						
<i>const</i>	-0.1397	0.2366	-0.590	0.5548		Likelihood Ratio Test 18.3156 [0.0004]
<i>PR</i>	1.0889	0.3157	3.449	0.0006 ***	0.2409	McFadden's R-squared 0.0690
<i>R</i>	0.0849	0.3522	0.241	0.8095	0.0192	Adjusted R-squared 0.0388
<i>U</i>	0.8362	0.3690	2.266	0.0235 **	0.1773	Number of cases of 'correct prediction' 135 (66.8%)

Explanation: The level of significance of the parameters: *** $\alpha = 0.01$, ** $\alpha = 0.05$, * $\alpha = 0.1$.

Source: own elaboration.

Taking into account the U variable, it should be noted that an increase in professional activity (finding employment) causes an increase in the probability of better perception of sustainable development and CSR in sponsorship activities (respectively by 0.18% and 0.17%). Statistically significant was also one more variable, i.e. R , on the level $\alpha = 0.01$ (full model). Therefore, people in relationships perceive the activities discussed better since the probability of their perception is by 0.25% higher than in the case of single people. In terms of the data adjustment indicators, it should be noted that both model 3 and model 4 have a good quality of estimation, which is proven both by the likelihood ratio test and the R-square coefficient.

Somewhat different are the results of the estimation of models 5 and 6 (Table 5), where statistical significance was only reported for one variable, i.e. W , from the group of marital status variables. Both in the full and in the reduced models, the variable had a medium-level statistical significance. Thus, it can be stated that the communication of sustainable development and CSR activities is very important in this group of respondents. This fact is indicated by the obtained values of marginal effects. Obviously, it should be remembered that the estimated models indicate the probability of the occurrence of the specific factor.

An analysis of the responses suggests that the respondents believe that sport sponsorship translates to a positive image, which is related to increasing communication in this area, and also the communication of sustainable development and CSR activities. As indicated by the previous studies (Campbell, Kirmani, 2008; Flöter et al., 2016), in sponsorship linked to sustainable development and CSR, a potential – relevant source of transmission should be taken into account. This is related to the limitation of persuasive communication. It happens since the activation of persuasive knowledge arouses suspicion in the minds of customers – sports beneficiaries, which leads to negative effects. Importantly, in the opinion of the respondents however, it should be treated as the promotional activity of a company – the sponsor, rather than its socially responsible activity. Nonetheless, supporting the sport or other areas makes a company more visible on the market, which results in value increase.

Table 5.
Results of logit model estimations for y_3

* observations used 1-203

Variable	Coefficient	Standard deviation	z	p-value	Marginal effect	Indicators of data adjustment to model estimations
MODEL 5 full logit model for y_3						
<i>const</i>	-0.2187	0.4123	-0.530	0.5958		Likelihood Ratio Test 12.1982 [0.3489]
<i>F</i>	0.2130	0.3263	0.652	0.5139	0.0505	
<i>A2543</i>	0.5334	0.3926	1.359	0.1743	0.1231	
<i>A3544</i>	0.2444	0.4881	0.500	0.6166	0.0570	McFadden's R-squared 0.0448
<i>A4555</i>	0.2590	0.4366	0.593	0.5530	0.0606	
<i>A55</i>	0.6661	0.4645	1.434	0.1515	0.1486	Adjusted R-squared -0.0433
<i>H</i>	0.3147	0.4104	0.766	0.4432	0.0737	
<i>PR</i>	-0.1846	0.3713	-0.497	0.6190	-0.044	
<i>R</i>	0.1070	0.3088	0.346	0.7288	0.0255	Number of cases of 'correct prediction' 128 (63.4%)
<i>W</i>	0.8423	0.3991	2.110	0.0348**	0.1882	
<i>U</i>	-0.2197	0.3494	-0.628	0.5294	-0.0529	
<i>P</i>	-0.0803	0.3701	-0.217	0.8282	-0.0192	
MODEL 6 reduced logit model for y_3						
<i>const</i>	0.1993	0.1635	1.219	0.2230		Likelihood Ratio Test 6.3191 [0.0119]
						McFadden's R-squared 0.0232
<i>W</i>	0.8733	0.3605	2.422	0.0154 **	0.1954	Adjusted R-squared 0.0085
						Number of cases of 'correct prediction' 121 (59.9%)

Explanation: The level of significance of the parameters: *** $\alpha = 0.01$, ** $\alpha = 0.05$, * $\alpha = 0.1$.

Source: own elaboration.

In the next modelling (models 7 and 8), statistical significance was reported in two groups of variables: gender and age, and in the gender group (Table 6):

- the variable *F* had low dependence, both in the full and in the reduced models,
- the age variable *A55* had average significance only in the full model.

In the reduced model, this variable was not significant.

Table 6.
Results of logit model estimations for y_4

* observations used 1-203

Variable	Coefficient	Standard deviation	z	p-value	Marginal effect	Indicators of data adjustment to model estimations
MODEL 7 full logit model for y_4						
<i>const</i>	0.9226	0.4262	2.165	0.0304**		
<i>F</i>	0.5963	0.3373	1.768	0.0771*	0.1336	
<i>A2543</i>	-0.6366	0.3927	-1.621	0.1050	-0.1503	
<i>A3544</i>	-0.6735	0.5125	-1.314	0.1888	-0.1621	
<i>A4555</i>	-0.5572	0.4561	-1.222	0.2218	-0.1326	
<i>A55</i>	-1.007	0.4469	-2.254	0.0242**	-0.2433	
<i>H</i>	-0.5056	0.4109	-1.230	0.2185	-0.1190	
<i>PR</i>	0.1151	0.3844	0.299	0.7647	0.0261	
<i>R</i>	-0.0523	0.3151	-0.166	0.8680	-0.0120	
<i>W</i>	-0.1715	0.3845	-0.446	0.6555	-0.0398	
<i>U</i>	0.2349	0.3666	0.640	0.5216	0.0530	
<i>P</i>	0.3750	0.3781	0.991	0.3214	0.0833	
MODEL 8 reduced logit model for y_4						
<i>const</i>	0.4568	0.1969	2.319	0.0204 **		Likelihood Ratio Test 5.8410 [0.0539]
<i>F</i>	0.5309	0.3099	1.713	0.0867*	0.1202	McFadden's R-squared 0.0220
<i>A55</i>	-0.6384	0.3918	-1.629	0.1033	-0.1537	Adjusted R-squared -0.0005
						Number of cases of 'correct prediction' 133 (65.8%)

Explanation: The level of significance of the parameters: *** $\alpha = 0.01$, ** $\alpha = 0.05$, * $\alpha = 0.1$.

Source: own elaboration.

Moreover, it can be concluded that female supporters show the probability of the perception of “the sustainable development and CSR-sponsorship relationship” by 0.13% higher than male ones. Also, the younger the viewers of sports events the lower the perception of the responsible image of the sponsor (by about 0.24%). The feedback from respondents proves that contemporary companies should include sport sponsorship in their sustainable and CSR strategies.

4. Discussion

Research indicates that in the times of the Covid-19 pandemic, the sponsor's activities in the area of sustainable development and CSR are gaining importance. The results of the conducted analysis indicate that there is a close link between sponsoring and creating the image in terms of socially responsible activities. Various other studies have also revealed the same fact (Babiak, Wolfe, 2006; Pope et al., 2009; Walters, Tacon, 2011; Djaballah et al., 2017). The research conducted by the author extends the previous analyses with the identification of factors determining the perception of sports sponsoring in the era Covid-19. It is particularly

important towards consumers considering a sports organization as an opportunistic one (Walker et al., 2017), and also, in relation to those beneficiaries of sport who perceive sponsoring negatively, especially when using club social media channels to share content related to sponsors (Weimar et al., 2020).

As noted by Habitzreuter & Koenigstorfer (2021) and others (Rowe et al., 2019), sports sponsoring related to sustainability and CSR is oriented to the promotion and prevention of positive effects associated with creating the image. As claimed by Djaballah et al. (2017) and Karamichas (2020), sport, as a whole, is seen as an interesting vector of sustainability and CSR, generally evoking positive perception. However, considering it in the categories of individual sports disciplines, there are many both negative and positive links with sustainability and CSR. A similar opinion is expressed by Trendafilova et al. (2013), according to whom some sports, such as hockey, motor sports, have a negative impact on the environment. Therefore, sponsorship activities in terms of sustainable development and CSR ought to primarily relate to the environmental aspect and operations in this field. Such negative perception also arises when social responsibility programs are not well suited to the core business objectives of the organization (Hills, Walker, Barry, 2019). Moreover, it seems essential to define the motives of socially responsible activities (philanthropic and not profit-oriented). This is particularly important in the perception of CSR activities that may reduce (or even eliminate) the negative impact of adverse effects (e.g., corruption activities) on the attitude towards sponsoring events (Kulczycki, Koenigstorfe, 2016a) and thus the sponsor's image (as indicated in this study). In addition, the philanthropic motivation of the sponsor translates into the perception of socially responsible activities among sportspeople, thus affecting their social attitudes (Kulczycki, Koenigstorfe, 2016b). This research indicates the need for further studies in the field of the problem related and in particular the determination of the specific relationships at the level of sports sponsoring-image – a sustainable and socially responsible company. This is also the result of the previous studies, e.g. by Inoue & Kent (2012), which indicate the growing involvement of the sports industry in sustainable and CSR operations, or the one by Huang, Ye & Kao (2015), according to which the activities of enterprises in the sports market are less frequently examined compared to other organizations. Also, the research by Flöter et al. (2016) indicates the need for further studies in the field of CSR activities and sponsoring, taking into account the need for communication of these activities. It should be remembered that CSR communication constitutes a strategic element of the market game. Moreover, it has a significant impact on the sports beneficiaries. This is due to the assumption that CSR is primarily based on transparent activities and building their trust, convincing them that responsible decisions are made, and they are responsible for their actions. The analysis of the factors influencing the perception of CSR in the sports sponsoring confirmed the study by Djaballah et al. (2017) that CSR practices in sport are a strategic approach to designing a better image, maximizing corporate financial performance or mitigating the negative perception of stakeholders.

5. Constraints and prospects

In the conducted research, logit modeling was used, which enabled the estimation of 8 models, demonstrating the perception of the analyzed aspects of sports sponsoring in combination with sustainable development and CSR activities. Unfortunately, the weakness of such a solution is the inability to perform calculations for continuous data, and they are only limited to the statement: YES (1) or NO (0). In view of the above, the estimated models relate to the subjective evaluation of participants of sporting events, relating to the activities of sponsors in the field of sustainability and CSR.

It should be remembered that the estimated models determine the probability of the occurrence of the relevant factor (PB1-4). This means that the estimated models present the significance of the factors identified in the study, shaping the sponsor's image in terms of sustainable development and CSR activities among participants of sporting events. Therefore, it can be concluded that these models and the identified characteristics constitute the basis for further research into the perception of sponsoring among the group under consideration.

In practice, it is convenient to use the odds ratio, which determines the possibility of comparing the odds of the analyzed phenomenon in another comparable group. In the analyzed cases, the odds ratio informs on how many times the odds of the occurrence of the analyzed phenomenon changes compared to the reference group (Table 1).

It is worth pinpointing that despite the obvious and unquestionable positive significance of sponsoring, sponsors' ambition is to create a real relationship with consumers, including (or perhaps most of all) sports fans. However, this does not mean that the sponsor's activities are not aimed at creating value from the undertaken investment. It is, therefore, a matter of dispute whether sports sponsorship is a philanthropic activity, or an activity aimed at profit maximization. In view of the above, according to the model estimation in relation to those determined in RQ, it can be noted that:

- RP 1, it is difficult to say whether or not sponsorship activity supports business goals. Sponsorship requires major financial contribution, so, without analysing specific data, it is hard to determine the relationship.
- RP 2, contemporary companies should take an active part in the life of the local community by supporting not only famous sport teams, events or persons, but also local clubs, which is in line with the CSR concept.
- RP 3, supporting the sport or other areas makes a company more visible on the market, which results in value increase.
- RP 4, enterprises that use the sport potential in their sustainable and CSR strategies are more able to create a positive – responsible image. Also, their activity in this area translates into value increase or (despite some uncertainties) achievement of business goals.

As a result of the conducted analyses, it can be concluded that the support for sport is to bring tangible benefits to the company (sponsor). At this point, the combination of sponsorship activities with sustainable and CSR activities can be questioned. Although sports sponsorship is a constituent of CSR programs, it has been adapted to them rather than developed by them. This is reflected precisely in sponsorship objectives, which are generally defined, and thus difficult to measure. Regardless of the emerging dilemmas and constraints in the analyzed area, it is undeniable that the objective of using sports sponsorship is a positive impact on a wide range of stakeholders.

Therefore, it should be considered whether the possibility of participating in sports events, which today cannot be held without the support of sponsors, also brings benefits to the entity and the society.

6. Conclusion

In the period of many restrictions related to the Covid-19 pandemic, sports sponsors have limited opportunities to display their brand, thus creating their image, which in turn translated into a decrease in the income generated on this account. Additionally, the lack of sports gatherings limited the interactions occurring on the plane of the sports event – sponsor-beneficiaries of the event. However, it did not change the perception of the sponsor as an implementer of activities related to sustainable development and social responsibility. Moreover, Covid-19, in a way, forced them to act in a sustainable manner and CSR. The commercialization of sport introduced sustainable development and CSR as means to achieve organizational goals. The Covid-19 pandemic has become a period of adjusting activities in the area of sustainable development and CSR to new conditions and social expectations. The obtained test results confirm this.

The estimated logit models (full and reduced) revealed different perceptions of the examined phenomena. Using the sport potential serves the business purposes of contemporary enterprises recognized from the point of view of settled, well-educated people with a stable professional position. Taking into account PB 2, the perception of sponsorship activities, combined with sustainable development and CSR, is of the greatest importance for people with well-established both professional and family position. This aspect is also significant among well-educated people. The perception of sponsorship communication in terms of sustainability and CSR is slightly different. This manifestation of the discussed subject matter is noticeable only in one group, i.e., in the group distinguished by marital status. In the case of the last PB, it can be observed that the perception of sports potential in the sustainable and CSR strategy, which translates into the creation of a responsible image, is of great importance, both for women and men, in different age groups.

It should be noted that a relatively higher quality of the estimated models is presented by model 1. In this model, the number of “correct prediction” cases reaches 70.3%. This means that in the case of variable y_1 , there is the most convergence between predictions and the actual state of affairs. The other models represent as follows: model 2 – 68.8%, model 3 – 68.8%, model 4 – 68.8%, model 5 – 63.4%, model 6 – 59.9%, model 7 – 66.3% and model 8 – 65.8%. To sum up, the overall classification of cases proved to be positive, which is a satisfactory result.

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ANALYSIS OF DEVELOPMENT PROCESSES EFFECTIVENESS USING KPI

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Purpose: The purpose of the study was to show the importance of measuring the effects of the execution of personnel processes within the framework of personnel function management in manufacturing enterprises.

Design/methodology/approach: The development of the article required a critical analysis of the literature on the subject. A literature study of scientific publications, a survey, and face-to-face interviews were performed.

Findings: Thanks to the realization of the survey it was found that, despite such high awareness of the importance and effectiveness of the use of KPIs, only less than 28% of the respondents declared the use of HR function measurements in a systematic way, and only 53% use only a few indicators, in an active way and not fully coordinated.

Research limitations/implications: Future directions of activities will concern the realization of research in another research group (increased number of analyzed production and service enterprises) from the area of the southern part of Poland and the comparative analysis of obtained results. The limitation of the research may be the unwillingness of enterprises to cooperate.

Practical implications: The results of the study indicate the possibility and at the same time recommend the implementation of KPIs for monitoring the effectiveness of development processes in enterprises. The obtained results will contribute to the implication of more KPIs and thus increase the level of effective management.

Originality/value: Filling the research gap in the field of measuring the effects of personnel function with the use of selected KPIs. The study is addressed to the management staff of enterprises.

Keywords: key performance indicators, development processes, management and quality, process management.

Category of the paper: research paper.

1. Introduction

Currently, the increasing intensity of competition and threats related to crisis phenomena, as well as dynamically changing environment and progressing globalization require the creation and implementation of innovative management systems. To gain and then maintain a stable competitive advantage means for manufacturing companies to focus their management system on increasing efficiency and innovation. The literature on the subject widely describes the types of management strategies and activities implemented in this field (Fredriksson and Larsson, 2012; Wilczarska, 2012; Downarowicz, 2000; Antosz and Ciecńska, 2011; Kaźmierczak, 2000; Legutko, 2009; Antosz et al., 2013).

In the current phase of the development of management science and economic development, the issue of corporate efficiency, its complexity and multidimensionality is becoming increasingly important. Increased interest and consideration of this topic resulted in the formulation of the concepts of a balanced scorecard (Pacana and Czerwinska, 2021) and high-performance organization (HPO) (Pyszka, 2015). In the process aspect, the topic of performance measurement becomes crucial, which is captured not so much as financial efficiency but also process efficiency in the context of cost, time and quality. Key performance indicators (KPIs) are the answer to the arising demand. These indicators make it possible to control the processes occurring in a company without time delay.

Given the above, the aim of the study was to show the importance of measuring the effects of the execution of personnel processes within the framework of personnel function management in manufacturing companies. The empirical part of the study presents the results of the research in which secondary sources and partial results of the primary research were used. The research was carried out on a group of 50 manufacturing enterprises located in the south-eastern part of Poland, using a questionnaire survey and face-to-face interviews.

2. Employee and HR process effectiveness vs. key performance indicators

Corporate efficiency is a complex and multidimensional construct that must be considered and measured with its complexity, which is influenced by non-financial forward-looking factors as well as subjective assessment (Zbierowski, 2011). A significant number of studies indicate that modern systems on performance measurement and supervision consider tangible and intangible factors as well as profitability and growth (McGree et al., 2005; Pearce and Robinson 2005).

Work efficiency is the ratio of the value of intangible and tangible effects, which are obtained thanks to human work, to the amount of intangible and tangible expenses, which were incurred because of this work (Jasiński et al., 2002). When considering the issue of the effectiveness of work teams, it is often understood as efficiency – "effective teams or teams with high efficiency" (Jedrych, 2007). In the literature, we can find a definition of effectiveness as the ability to achieve certain (usually complex) goals while focusing on the maximum reduction of activity costs, i.e. the ability to work productively and generate the lowest costs (Padzik, 2002). Moreover, the formulation of the effect of work is of paramount importance here, which is understood as a direct result - in non-material terms (intangible benefit or service) and material terms (value and/or quantity of work) – of activities performed by employees. Considerations of the terms efficiency, effectiveness, and productivity of work show that a narrower approach prevails, which identifies effects with the results of work (Listwan, 2005). There are also studies that indicate that work results can also be understood as directly achieved work effects, as well as behaviors. In this view, the work effect is behavior leading to a certain result, but also the direct result of this work. Behaviors represent the results of both physical and mental efforts put into the realization of tasks, so they can be assessed independently of the results, but it should be remembered that without certain activities there will be no results. Therefore, work is a physical and mental effort that results in the completion of tasks and the achievement of desired outcomes (Amstrong, 2005).

The assumption of a broader approach to work effects draws attention to the subjective dimension of work effects – it is created as a result of the efforts of individual workers or their teams. As a result, the concept of performance management was formed, originally strongly oriented on continuous growth of work results of individuals and teams. Currently, there are many terms "performance management" or "highly effective work systems", which refer to the above mentioned broader concept of work effect (Lewicka, 2010; Borkowska, 2007; Milmore et al., 2007), which means:

- a coherent and integrated set of human resource management processes that support each other and contribute to increasing company performance; the idea is to implement a high-performance culture in which individual units and teams take responsibility for the systematic development of employees and their level of commitment and for improving business processes, provided that such activities are linked to corporate strategy
- an organisation of work which creates opportunities for obtaining the best possible results;
- a strategy that relates to each activity within the company in terms of its established culture, personnel policy, style and communication system;
- a specific combination of work organisation and HR processes and practices that maximise employees' skills, knowledge, flexibility and commitment.

From the above assumptions, it becomes important to place emphasis on inputs and thus on maintaining results and improving the efficiency of input rationalization activities.

From a pragmatic point of view, the concept of using key performance indicators (KPIs) seems to be useful and at the same time scientifically valuable in terms of analyzing the effectiveness of employees and processes. This is also indicated by the fact that more effective are those companies that pay attention to the measurement of activities carried out in them. Performance measurement can have various forms. It can be manifested as an annual analysis of financial results or the implementation of a set of KPIs used for ongoing supervision.

KPIs are used to measure, fundamental in economic, technical and organizational terms, the parameters that characterize the functioning of the enterprise, allow not only to determine the values of the KPIs used, but also to identify selected factors that affect their values (Bartecki et al., 2018; Hollender, 2016). KPIs are defined as a set of measurable and strategic parameters depicting the operational achievements of an enterprise, playing a key role in the creation of a measurement (achievement) system (Kang et al., 2015). Achievement measures identify (system) events reflected in the KPI formula and prove that something happened, such as a failure or success in a specific (network) procedure (Czerwinska and Pacana, 2020). In the broadest sense, a key performance measure provides the most important information about performance that allows organizations or their stakeholders to know whether the organization is on the right track. Key achievement measures are used to simplify organizational characteristics to a small number of key metrics to increase organizational effectiveness (Marr, 2010).

KPIs are one of the tools of Business Performance Management, i.e. a group of concepts in the field of operations management, promoting the improvement of the efficiency of the organization's functioning using metrics, processes, monitoring systems, and managing the organization's performance (Grycuk, 2010; Piasecka-Głuszak, 2017; Parmenter, 2016).

3. Research Methodology

The research methodology adopted in the study consists of a survey questionnaire. The first stage of work consisted of the analysis of the literature in the field under study and the isolation of an appropriate group of key performance indicators. The pilot stage of research was aimed at a group of 50 manufacturing enterprises. The study was aimed at checking the knowledge of selected KPIs – a set of current and forecasting indicators established on the basis of two perspectives: finance and development. The target group of respondents was people employed in HR departments and departments cooperating with them.

The next stage of the research was connected with the analysis of the knowledge of KPIs within the specified groups among manufacturing entrepreneurs. The respondents who answered were selected purposively – just as it was done in the first stage of the research. Figure 1 presents a diagram of the research presented in the study.

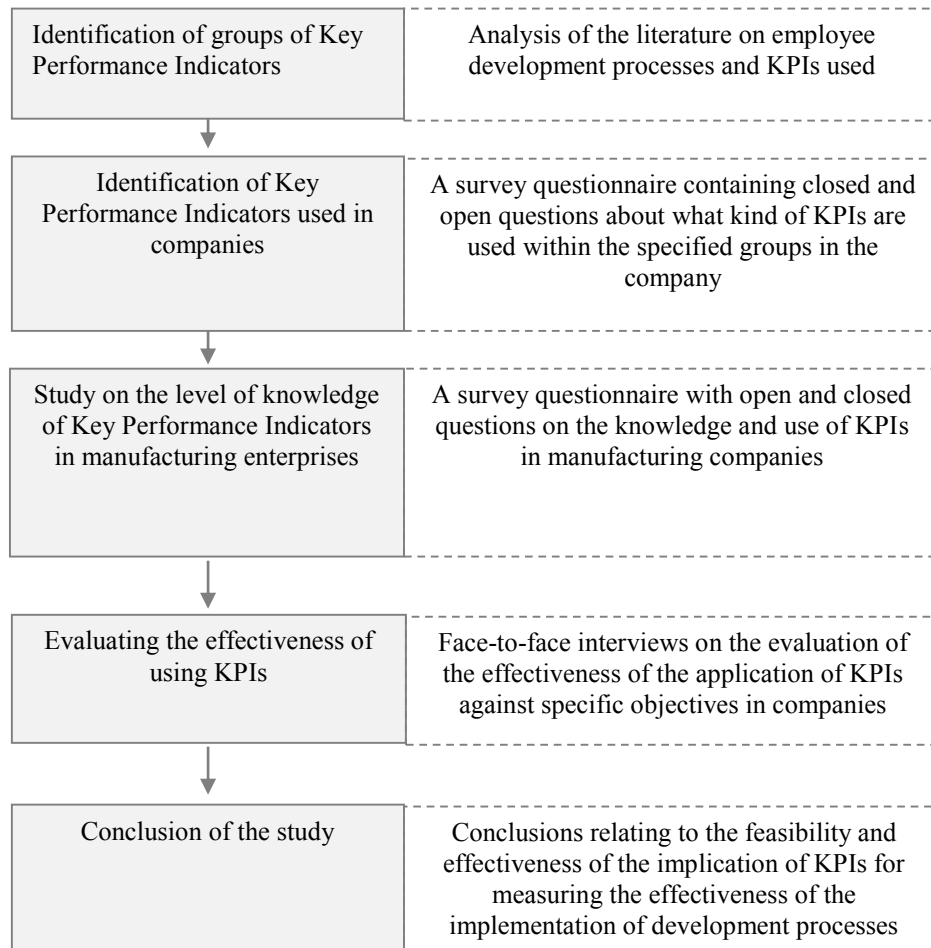


Figure 1. Research methodology

In the study, through face-to-face interviews with respondents, respondents were asked to express their opinion on the effectiveness of using KPIs against the goals established in their companies.

4. Research findings and analysis

Through various forms of stimulating development and further training, employees achieve a certain level of performance and competence, which is required for a given or higher position. This opens the way for further professional promotions. Therefore, the study analyzed the indicators that manufacturing companies use to monitor and evaluate the effectiveness of development processes.

The study began by examining the level of awareness of the need to measure the results of the HR function (Figure 2).

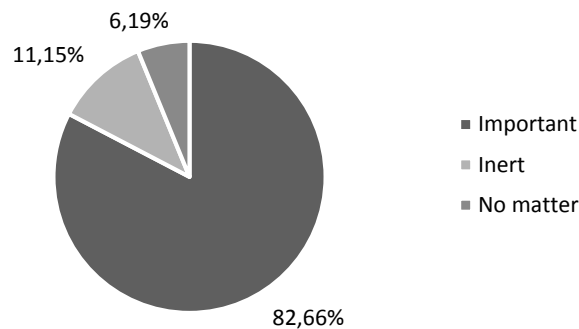


Figure 2. The importance of monitoring HR processes as part of business management

An important fact observed is the high level of respondents' awareness of the importance of measuring the personnel function as part of the business management process. The vast majority (82.66%) of respondents believe that the use of these indicators is an important and even key task from the perspective of the organization.

The study identified nine most commonly used indicators. A common feature of the listed metrics is their numerical nature. Basically, only two - ROI and BCR, answer the question about the business effects of investments in employee training and development, according to the model of J.J. Phillips (Phillips, 2010). The author of the model was based on D. Kirkpatrick's four-level model of training effectiveness evaluation (Kirkpatrick, 2001) extending it, however, by the level of indicator calculation. Two measures that are usually calculated in the model are ROI (return on investment) and BCR (benefits/ costs ratio). The calculation of ROI and BCR is presented in formulas (1) and (2).

$$BCR = \frac{\text{Sum of benefits from investments}}{\text{Sum of investment benefits}} \quad (1)$$

$$ROI = \frac{\text{Net benefits from investments}}{\text{um of investment benefits}} \cdot 100\% \quad (2)$$

Indicators (1) and (2) provide an answer to how much money the company will gain in relation to those that have been allocated to finance a specific training or other personnel management project.

The results of the research on the application of indicators of effectiveness of development processes are presented in Table 1.

Table 1.
The result of research in manufacturing companies

Indicator	Description	Responses [%]	
Cost of training as a total wage cost	$\frac{\text{Total cost of training}}{\text{Sum of total costs}} \cdot 100\%$	I use	22.59
		I intend to use	41.23
		I don't use	36.18
Cost of training per FTE	$\frac{\text{Total cost of training}}{\text{FTE total and broken down by internal and external training}}$	I use	28.04
		I intend to use	36.57
		I don't use	35.39
Cost of training as OPEX (expenses to maintain a full-time position)	$\frac{\text{Total cost of training related to product maintenance}}{\text{FTE}}$	I use	18.92
		I intend to use	51.71
		I don't use	29.37
Cost of training as CAPEX (capital expenditures per FTE)	$\frac{\text{Total cost of training related to product development}}{\text{FTE}}$	I use	16.13
		I intend to use	45.98
		I don't use	37.89
Total number of days, training hours for the entire organization	$\frac{\text{Total number of days, hours of training}}{\text{month, quarter, year}}$	I use	52.31
		I intend to use	17.44
		I don't use	30.25
Average number of days, training hours per FTE	$\frac{\text{Number of days, hours of training}}{\text{FTE (in terms of organization, divisions, cells)}}$	I use	42.01
		I intend to use	23.57
		I don't use	34.42
Share of costs of e-learning courses in total training costs	$\frac{\text{Sum of e-learning training costs}}{\text{Total training costs}}$	I use	49.91
		I intend to use	11.16
		I don't use	38.93
Return on investment (ROI) of employee training and development	$\frac{\text{Sum of benefits from investments}}{\text{Total costs from investments}}$	I use	13.54
		I intend to use	54.23
		I don't use	32.23
Benefit cost ratio for employee training and development (BRC)	$\frac{\text{Net benefits from investments}}{\text{Total costs from investments}} \cdot 100\%$	I use	19.47
		I intend to use	36.15
		I don't use	44.38

Source: own study.

The largest number of respondents indicated the use of the indicator of the total number of days, hours of training for the entire organization and, in turn, the indicators: "the share of e-learning training costs in the total training costs" and "the average number of days, training hours per FTE". In addition, a significant number of respondents indicate the willingness to introduce an indicator for the return on investment in training and development of employees (ROI) and the indicator for the cost of training as OPEX.

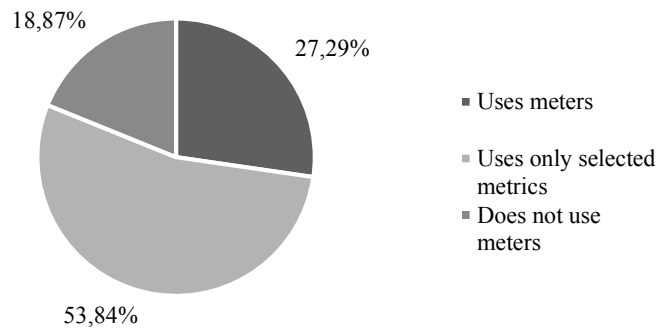


Figure 3. Using KPIs to monitor HR processes within business management

It has been observed that despite declaring a high level of awareness of the importance of KPIs in HR process management, the majority of respondents (just under 54%) replied that they only intend to introduce KPIs of this type in their enterprise. About 27% of the respondents use the surveyed indicators in a systematic way, while only (18.87%) of representatives of the surveyed companies answered that they do not use KPIs as part of the HR function.

In addition, the respondents indicated that the information value of the KPIs functioning in their enterprises, often analysed together with the results of internal quality audits, provides the management with a foundation for the current personnel management, as well as for planning future activities within the framework of strategic enterprise management.

It should be remembered that an effective indicator management system cannot function without a system of meticulously designed and interrelated databases. Without the accumulation of necessary data and without formalized procedures for carrying out measurements, the presentation of any information would lose its features of reliability. The way to efficiently manage indicators is to implement solutions linked to databases and then based on them define a strict research methodology and finally present and interpret the results.

Conclusions

In the prevailing market competition conditions and commonly occurring pro-client orientation, the success of companies mainly depends on the employees, their commitment and individual and group achievements. The basic determinant of the approach to the effective implementation of processes related to the company's personnel is the human capital management strategy, which is often based on KPIs.

The study observed the fact that despite the awareness of the importance of implementing KPIs to monitor the effectiveness of development processes in the vast majority of respondents (about 83%), only less than 27% declared their use. The vast majority of respondents use only selected KPIs. Among the surveyed metrics, the most popular was the indicator of the total number of days and hours of training for the entire organization, followed by the indicator of

the share of e-learning training costs in the total training costs and the average number of days and hours of training per employee. The survey showed that only (18.87%) representatives of the surveyed companies answered that they do not use KPIs in the implementation of human resources function.

When implementing systems of indicators in manufacturing enterprises, it is necessary to remember and relevance and function of the people who implement it. The personnel should have knowledge of the system and should be aware of the fact that it will be their task to achieve the goals set on the basis of the metrics.

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CUSTOMER ENGAGEMENT PROJECTS WITHIN THE ORGANIZATIONAL CONTEXT: A CASE OF B2B E-COMMERCE

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Purpose: The article investigates organizational customers response to the marketing stimulation in order to understand the moderating role of economy and emotional motives in business-to-business relationship.

Design/methodology/approach: The research was conducted in the form of case studies of experimental marketing projects facilitated in context of wholesale e-commerce B2B platform. Surveys and free text content has been analysed for statistics and conclusions formulation.

Findings: The study identifies the influence of different forms of emotional motivation on the engagement of B2B customers and points out the success factors for engagement in B2B. Customers, when stimulated, demonstrate willingness to value creation for themselves in form of emotional satisfaction and inside for company. They benchmark sales platform delivering inside from market. Finally, customers share their experience as the boosting factor for others. The study analyses customer engagement from the organizational and individual perspective.

Research limitations/implications: The limitations are typical for the experimental projects which entail the uncertainty of the exact results replication. However, the obtained results indicate extension to academic literature as well as the practical suggestion for business.

Originality/value: The research contributes to academia in the field of B2B customers behaviour when they are stimulated to creative activity on the e-commerce platform. Paper investigates reactions of individual responders to engagement projects while they are in strong organisational context.

Keywords: customer engagement; customer experience; experiential marketing; B2B.

Category of the paper: research paper.

1. Introduction

Relations exist between companies in its business environment. They are based on generating value, i.e., a certation certain advantages which should be reflected in offerings available on the market. The essence of modern management lies in value management, value exchange between companies and its delivery to the environment they are operating (Mazurek, 2014). Business-to-business cooperation model (B2B) creates a natural opportunity for business partners to strengthen their competitiveness by aligning their resources to act more efficiently for certain goals (Kohler, 2015; Howe, 2009). They can benefit from collaboration not only as profit capturers, as buyers and sellers do, but also as the organizations which are learning from each other and utilize their specific competences jointly (Goyal et al., 2020). This could create unique environment of sustainable development of their market position. Many organizational relationships such as strategic alliances and buyer–supplier transactions involve the simultaneous pursuit of competition and cooperation (Chen, 2008). Thus, the paradox occurs when firms engage their partners in collaboration with a close rival (Gnyawali et al., 2016), but when they cooperate in B2B wholesale relationship the effect of common environment of collaboration comes prominent (Eser, 2012). Most often, a wholesaler as a stronger and dominant player in the relationship to a large number of small partners is caring for a collaboration quality and realism (Lejeune and Yakova, 2005). Therefore, firms are usually aligning with supply chain functionalities in order to make it one of the main advantages of a business network of collaboration (Lambert and Cooper, 2000).

Recently, we can observe digitalisation development which moves the B2B cooperation paradigm from a relational approach to the digitization of all business processes into the platforms of transactional cooperation. Despite the fact that firms still narrate the importance of relations, personal interactions, partnership, and trust they are rapidly exchanging people-to-people business to e-business (Remane et al., 2017). This is clearly visible in numbers of publications in business and academic resources. Usually, authors are dealing with the transformation of the business model into digital one with a significant component of e-commerce trade (Morakanyane et al., 2017) or discuss the conversion of a product-centric strategy into a client-centric orientation with a large people-based engagement process (Pansari & Kumar, 2017; Gil-Gomez et al., 2020). Thus, it is worth consideration objects of engagement in technology-aided trade. Pöyry et al. (2020) are wondering how to create engagement to service, brand, and company in digital-centric configuration? Are customers engaged to the brand or just committed to the technology? Are digitalization and e-commerce reserve place for the interactions on humanistic way or interaction is only information exchange? Perhaps, we should respectfully utilize people's relational sentiments and emotional motivations, if they still exist, also in digital trade in parallel with technology development as a contemporary way of doing business. The goal of our study is to test engagement projects as antecedent of customer experience in e-commerce cooperation environment.

According to the Gallup report concerning B2B market (Galup, 2019), the only 29% of customers are fully engaged. It creates a risk of unexpected migration. Gallup analysts suggest that the key driver of engagement lies in understanding the impact of partnership on the company in certain aspects. They report example of companies that obtained the 72% increase in fully engaged customers through customer feedback acquisition and adoption to the company practices. Based on that we formulate research questions for this investigation:

1. What makes customers achieve meaningful brand engagement?
2. Can we tie the CE level to organizational effort, or do we need to involve people working together on both sides to build the most unforgettable satisfaction for all parties?
3. How can an organization relate the state of customer engagement to the level of willingness to share CX with others?

Building on this, the main objective of the study is to understand how B2B customers will respond to the engagement projects facilitated on the e-commerce platform supplemented with motivations based on economy and emotional benefits. We are going to extend our knowledge in B2B marketing, especially concerning customer behaviour, motivation, and engagement aspects, as well as sharing experience for business processes organizing for value creation and value sharing in engagement projects.

The paper is arranged as follows. The next section presents an overview of the literature consideration of CE, CX, and its interplay in organizational context. Then we present empirical study and the results. Finally, we present conclusion a limitation analyse. We also formulate some implication for business practitioners.

2. Customer Engagement

Vivek et al., (2012) define the concept of customer engagement as a “partner's voluntary contribution to the company's marketing activities, going beyond financial patronage”. Jaakkola and Alexander (2014) emphasize the aspect of the use of the customer's resources jointly to facilitate value creation. They draw attention to the role of emotions that accompanies business purchases and their influence on the decisions taken throughout all of the stages of the process. Despite, currently ongoing digital disruption, which is changing organizations and influence on business communication (Liu et al., 2019) people are still interacting with emotions originating from their human nature and independent thoughts (Chiu et al., 2014). Organizations are changing the way they operate what is modifying the decision-making patterns. It allows to win a new, digitally native consumers (Vassileva, 2017; Holmlund et al., 2020). Mazurek (2014) is emphasising that virtual environment, including Internet and cloud computing or semantic web liquidate all barriers of treating the client as a partner. It creates the opportunity for

organizations to include their customers as a part of the organization, as co-creator of value streams of great importance for the client, the company, and its stakeholders. This in turn appreciates the role of marketing as a concept that focuses the attention of the organization on the client from acquiring to involving fully in diverse of internal processes.

Customer engagement can also be analysed from the several other theoretical perspectives. One of them focuses on the engagement as a behavioural phenomenon based on the client's ability to value co-creation beyond direct economic benefits. Customer can manifest its engagement in the activity, such as providing feedback from the market, writing reviews, participating company's marketing projects, and influence other customers (Van Doorn et al., 2010). The other approach describes CE as the mental state or disposition to the company that occurs in the form of enthusiasm for interaction, co-creation, and willingness to promote the brand based on the engagement demonstrated in form of certain behaviour (Brodie et al., 2011). This approach utilises emotional interactions which are specific to cognitive benefits. The third approach covers the current state of digitization and the e-commerce dominant logic, where CE is considered to be the ability of the customer and company to interact as value co-creators in the network ecosystem (Mitrega et al., 2012). All these approaches situate CE in the area of client-company interaction, where the client can also be a person representing the company as it takes place in B2B relationship. The root of commitment is understood here as the main motive of the actions taken. If we consider CE as a phenomenon that occurs when individuals are interacting with each other in the context of organizational collaboration, then individual motives may positively or negatively affect to the business results of cooperating parties. Adapted from Gaubinger et al. (2015), we can categorize the themes that drive people into ten categories: curiosity, fun activities, skill development, information-seeking, appreciation, community support, friendships, personal satisfaction, self-efficacy, and reward. Based on management decisions, the company may exacerbate or suppress some of these behaviours. It can therefore be generalized that collaborating parties can be defined as a) reward-oriented, b) interested in the content of the project, c) curiosity-oriented, or d) satisfaction-oriented (Fuller, 2010). Then we can differentiate the business relationship actors into profiled groups: a) economy-oriented, who are looking for business skills and problem-solving skills, b) education and innovation oriented, motivated by curiosity, information seeking and emotions, and c) artists and creators who they fight for recognition and the opportunity to present their skills and originality to a wider audience. Therefore, if wholesaler company is able to streamline these topics, the company will benefit from CE, but it is going to happen only when firms are able to collaborate, co-design, and adopt their strategies and actions to meet common expectations in both the emotional and business areas (O'Hern & Rindfleischa, 2017). A graphic illustration of this division is presented in Figure 1.

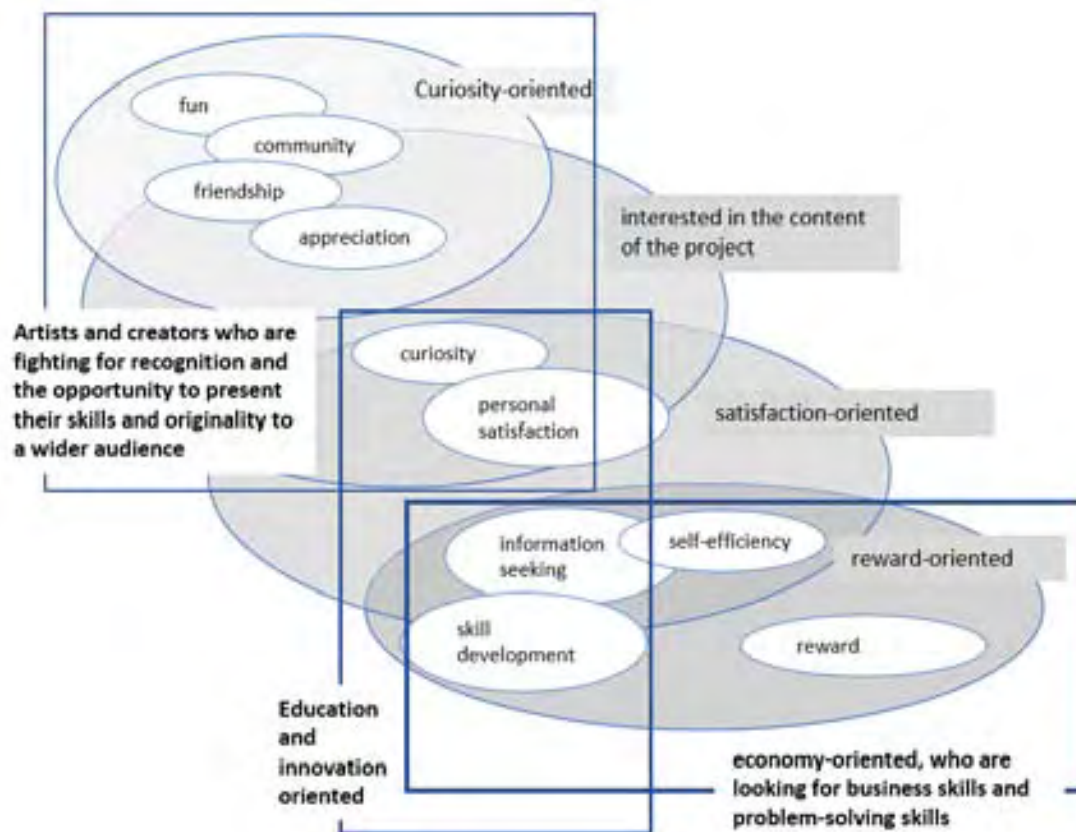


Figure 1. Customer groups according to themes that drive people for engagement.

3. Customer Experience

The customer experience (CX) term refers to the sensory, emotional, cognitive, social, and behavioural dimensions of people's activity that connect customer's satisfaction to the brand reputation over time (Berry et al., 2002; Lemon and Verhoef, 2016). This definition covers the mental results of customer activities related to the business as shopping satisfaction, commitment to the brand style, convenience, and other even non-purchasing value perception. In a B2B market, CX attributes should be applied to cooperating companies' representatives who are interacting as the sellers and buyers even if the e-commerce system is the interface. CX arises primarily as a result of satisfactory purchase in direct form. Direct CX includes contractual and functional conditions (B2B financial contract and the effort of use). CX is a natural extension of customer relationship management, but with a strong emphasis on its contextual nature and dynamics that need to be analysed over time. Hence, CX management emphasizes the role of situational factors that moderate the perception of value, ultimately affecting the overall CX (Becker & Jaakkola, 2020). There are aspects of CX that the company controls (e.g., price levels, service quality) and others that the company cannot control (e.g., the behaviour of competitors or other customers that it has an influence on). If a company

can control customer responses, it can adopt market standards and develop them for its own profit or use customer feedback to improve relationship benefits. The company may also expose customer activity in the store or on the website to indirectly influence CX in an active or passive way. This finally allows you to improve control of the most important CX drivers. Therefore, if a company provides excellent customer experiences, it can expect increased long-term business success (Bolton et al., 2021).

4. CE as the antecedent of CX

Clients can directly demonstrate their satisfaction by leveraging, recommending, or actively encouraging others to take action. This can be considered a direct effect on the CX of others. Customers can also be influenced indirectly by observing how others demonstrate the products they have purchased, the services they have ordered, and display the content on the websites they use, participate in events, webinars or trainings organized by the company. Clients can participate physically or online. Customers can take advantage of a range of self-service that are the native ways of doing business on the Internet and that is the nature of e-commerce. All this activity is a form of CE that actively or passively influences other customers and engages them in the value created by the brand (Hollebeek et al., 2014).

The relationship between CE and CX has been analysed by a number of authors including Lemon and Verhoef (2016) and Khan et al. (2019). It is still widely regarded, especially as an idea for collecting customer feedback useful for improving products or services (Pee, 2016; Zaborek and Mazur, 2019). Still the most innovative companies create an opportunity for continuous dialogue with stakeholders on the forum of advisory boards, focus groups or expert forums. This suggests that the products inspired by customer feedback may have a significant influence over the market performance of a company (Nishikawa et al., 2013). Companies encourage people to provide valuable feedback, which in turn improves the perception of brand-created value and ultimately strongly supports the overall CX (Babiak & Kihl, 2018). Engaged customers not only comment on satisfaction with the purchased products and services, but also recommend the overall brand value based on generalizations (Patrício et al., 2011). CE projects in B2B e-commerce creates the opportunity for people to interact for business purpose while having also a significant individual satisfaction. An example of this type of project are tailor-made IT solutions that are facilitated in order to provide software components tailored to the specific needs of the client. The value generated in this way can be called value-in-use, because it contains a number of subjectively determined functionalities, but strictly ensuring the implementation of the project's goals (Eggert et al., 2018). This kind collaboration significantly engages all partners increasing professional competence of co-working individuals and rump up competitive advantage all companies. Finally overall CX perceived for the brands is improved (Macdonald et al., 2016).

We can distinguish between a static and dynamic approach to CE as the predecessor of the CX. The static approach assumes that the firm uses a set of stimuli that are perceived in a similar way, while the dynamic approach identifies the influence of the network and subjective interactions with submissive (Zolkiewski et al., 2017; Kranzbühler et al., 2018). The static approach emphasizes the interactions with a focus on organizational relationships while dynamic approach refers to the networking capabilities (Mitrega et al., 2012). Networking capabilities enable engagement processes to occur if the company is able to initiate and persist with collective value co-creation (Kumar et al., 2010; Porter & Kramer, 2019). The dynamic approach is also applied when company link together a customer groups for short term projects, e.g.: for testing the application or utilize their feedback ideas in practice. This approach can result in significant increase of brand image and overall CX (Jarvis et al., 2017; Amit & Han, 2017; Zhang et al., 2018). Based on that, we can conclude that companies should engage customers because they can engage others not only for utilizing digital platforms for purchase but also indicating with their psychological state and disposal to act collectively for a certain set of benefits for all parties what makes CE antecedent to CX (Harmeling et al., 2017).

While CE can represent rational attachment with respect to the satisfaction that arises during interactions between the parties, the emotional (cognitive, hedonic, personal, and social) themes are paramount. The intensity of CE for individual clients may be due to their emotional and behavioural ability to accept a collective effort to create benefits for all parties. The utilitarian aspects of placing CE processes in a digital collaborative environment should also be viewed as the setting for the emotional game. Therefore, we can consider the e-commerce platform as an effective environment for observation an emotional interaction (Hein et al., 2019; Chen et al., 2020). The dynamics of CE in B2B relations is more significant than in the consumer market because business partners have closer access to each other and a real perspective of long-term cooperation. It leads them to consider their subjective goals and understand the value they can create for them all together (Merrilees et al., 2017), especially when they can take advantage of the knowledge gained from compound databases of clients. We can call this phenomenon as a "just-in-time-learning" or "learning by cases" (Lilien, 2016).

5. Empirical study design

The design of empirical study is demonstrated on Figure 2. The company offering is analysed as the strongest, native, and direct influencer on CX. It comes from the offer content and the way how company organizes customer journey. Direct CX covers customer satisfaction based on product's features and the convenience of the service use. Visibility of the sales process efficiency, expressed by customers in form of customer content, can actively but

indirectly engage others to (re)purchase through recommendations. By organizing forums for customers, where they are discussing the effectiveness of purchases, the shortcomings of the program and possible improvements, but despite that they are still buying as a loyal customer builds CX in an indirect and passive way. Individual satisfaction or customer's activity in projects running on the platform which influence others in both, active and passive way can be presented on the platform. In order to test customer's reaction on mentioned groups of motivations we have facilitated engagement projects and propose some actions to be taken by customers. We have observed willingness to participate and its dynamics as well as the influence on other customers and overall brand value perception.

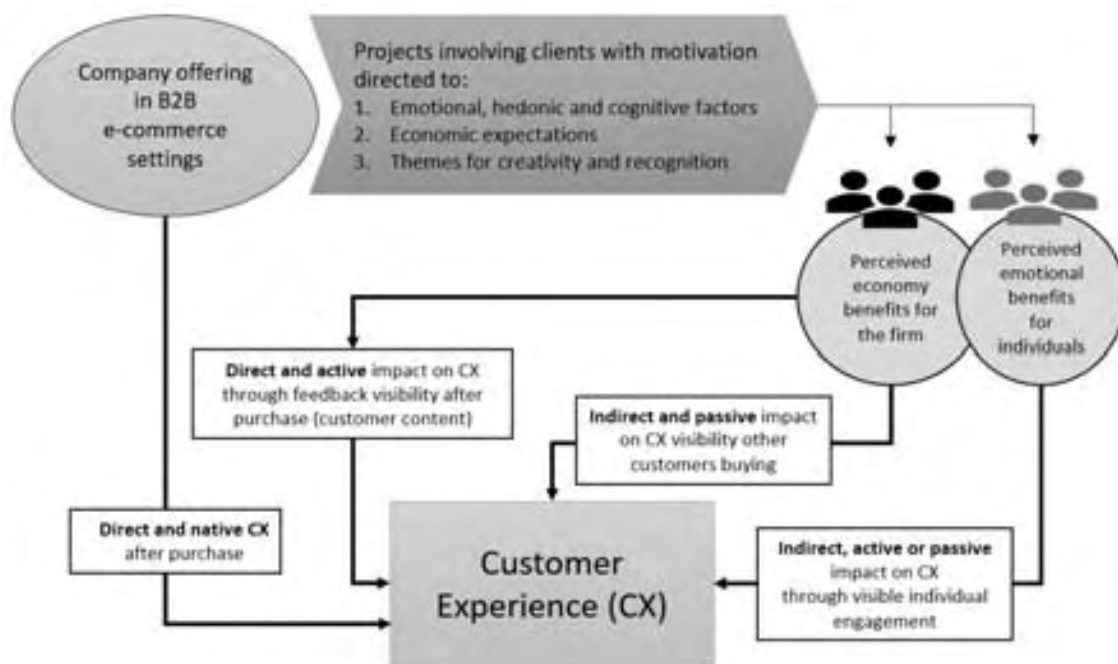


Figure 2. Research model.

The study has been facilitated in cooperation with the material supply wholesaler who run business on B2B e-commerce platform. The number of clients participating in engagement projects with division to dominant motivation is presented in Table 1.

Table 1.
Customer probe in CE projects

Project type	year of experiment	number of participants
Economic projects	2018	461
Emotional, creative	2018-2019	300
Social benefits project	2019	435

6. Results

Engagement projects with an economic motivation

The first group of engagement projects were linked with perspective of obtaining economy benefits. Customers have been invited to participate in the design of e-commerce platform (projects P1 and P2). They were also asked to evaluate platform features as the first-time users (project P3). And finally, they were asked to create advertisement in form of user content (project P4). Customers presented user's point of view and delivered valuable market inside. The number of customers participating in projects is presented in Table 2.

Table 2.

Participation in the platform project

No	sub-project	participants
P1	Assessment of the usefulness of platform functionalities	241
P2	Evaluation of the platform features answering open questions	121
P3	Judgment of the first-time impression when start using the platform	74
P4	The creation of advertisement stories related to the platform	25
	Total	461

In P1 and P2, customers played the role of creative experts, advisors, or designers while in projects P3 and P4, they just share their own CX to others. When playing the role of experts, customers attempted to consider not only their own needs, but also the broad context of the entire community of clients (Yi and Gong, 2013). In P1 we have collected 241 fulfilled questionnaires, which represents 15% of regular users, and 68 free text comments, consisting of 433 words in total. When customers judged the most relevant platform's features to be developed, we have noted a significant polarization in their opinions. While some features were judged as highly recommended or necessary by most users the other were scored as harmful. There was only small friction (14%) of neutral user's opinions. This shows that customers are engaged, and they have a clear opinion about what they do insist to develop and what could negatively influence effectiveness and need to be not developed or personalised according to individual characteristics. They try to prevent the harmful feature programming in the sales system which they use. Based on the probe review, we have detected two groups of customers which behave differently in the experiment. The first one includes contractor companies specialized in assembling technical installations for industry while the second was group of small retailers doing trade business for consumers. A certain feature could be assessed as harmful for the way of purchasing for contractors while retailers deem the functionality useful or even necessary because it makes the way they are buying effortless, e.g.: adding to the basket single product based on search versus adding a list of products from file as an import.

Customers, participating in projects also delivered some comments in the form of free text. They described functionalities not only as useful or harmful but also as required redesign or equip with missing elements. It was clearly visible that some features were preferred by users (e.g.: “downloading product carts in pdf”, 56%), while other were just signalled (e.g.: “exporting and importing product lists”, 14%). There were also functionalities which users clearly prioritized as unnecessary, sometimes surprisingly (e.g., “integration with external software” – 44%). It was also visible that customers spent time formulating their detailed opinions and cases. This suggest that projects P1 and P2 were engaging for customers and perceived as valuable.

In project P3, we asked customers to assess the first-time impression with platform. Most customers participating in this project was just recently acquired and they should remember their first impression. We obtained 74 answers in questionnaire divided to several parts according to system functionalities. We were also asked about free form opinions and advice for development. While customers answered for close questions rather schematic then the open question they use to deliver specific suggestions and solution proposals, such as: “It would be useful to be able to do this and that ...”, “If it could be possible to choose this type of delivery ... or scheduling date”, “It should be possible to collect goods from this and that locations together”, “The program should have this and that feature ... something like the competitor’s solution already has”, “The search engine should work this way ...“, “The platform has an error in this area... or unexpected behaviour or ineffectiveness”, “The search engine should be more intuitive in this or that area...”. They delivered not only their own expectation, but also provided information concerning the market context and benchmarking to competitors. This could be interpreted as strong contextuality of CE and CX where the value perceived depends on the ability to get the solution anywhere on the market. It provokes to expect the same or better solution from the supplier the customer is loyal to. This also shows an example of CE in the initial phase of cooperation where customer in engagement process is able to deliver market inside even not be fully engaged. Hence, B2B customers could be valuable source of knowledge for the company in any phase of cooperation but the only in situation when the company is able to utilize it as a just-in-time-learning. New knowledge could leverage the companies position on the market and adjusted sales system to customers’ needs. We have noticed that customers refer to the competitor’s systems, saying e.g.: “I also buy from company A, B, C ... they have a search engine works better in the case ...”. It shows how easily customers exchange benchmarking in the market, which can be a strength, but also a threat and erosion of value. When customer is engaged to wholesaler who is sensitive to that kind of inside, that the emergency development could be prioritized in order to catch up competitors. It could wark for wholesaler in appreciation expressed by customer what make the essence of building the society of engaged brand promoters. A summary of free-text feedback from projects P2 and P3 is presented as the cloud of words in Figure 3.

following favourite picture score by clicking them in several rounds of voting (for month pages, for season pages, etc.). The project created psychological satisfaction and built the client's commitment based on emotions. This kind of CE can indirectly influence CX. Indirect impact can be analysed not only as a positive impression that prompts people to think positively about the brand, but it is also a process of capturing negative emotions into outstanding action.

As we had been motivated by the results of the project, we have proposed similar activity next year. We asked customers about the preferred themes for the annual “common” calendar. Surprisingly, we have received only 47 answers. This might indicate that customers may not only required to be directed but also expected emotional novelty, more attractive to them. Despite that, the wholesaler decided to print the calendar which included the life mottos. After delivery to major group of customers purchasing on the platform, we issued a questionnaire concerning the project. We received 45 answers, of which, 35% was positive (“Good idea”, “Nice”, etc.), 18% negative (“Didn’t know about the project”, etc.), and 42% customers were complaining, that they have not received any shipment. This may indicate that customers are signalling the project was not attractive, but they still appreciate that activity in general. This may also indicate a low quality of project communication and not enough effort for engagement because customers fail to get know about the project when it is finished. They may also contest a lack of material reward. Finally, we may summarize that CE in the second edition of the project was low. The survey results also suggest a regret of lost chance for satisfaction. It could signal those customers were ready to participate in the project, but emotional satisfaction was insufficient. In similar way customers may signal a problem with the offer or attractiveness of the loyalty programs, or something else. They would ignore and contest. The phenomena accruing in this kind of customer behaviour remain relevant to future studies.

Cognitive benefits in CE educational project

Nine educational articles on management, negotiation and e-business topics were posted on the platform with visibility blocked, excluding students who registered for the sales academy project. In the middle and the end of the project, we conducted a survey to check the new knowledge acquired by clients and gather feedback on the project quality. The survey was combined with a scoring question and free-text answer. There is an obvious subjectivity in text content analysis, but it is a good tool for engaging customers when they are writing with openness, describe their ideas, doubts and complaints, which was the main goal of the project. We assumed that if a project participant is looking for knowledge and skills, he or she can add a comment in text form. Ultimately, we received 434 free text answers in the mid-test and 229 in the post-test. First, the project participants gave their opinion on the initiative: “the sales academy is a good idea that I appreciate”, “I am interested in participating next edition”, “This was expected project”. They commented content: “I appreciate the issues selection – they were relevant and explained well”. Customers show some innovativeness and applicability in the project’s content: “I have found an application for the presented knowledge in my

company”, “The sales academy converted my thoughts about sales process”, “It would be useful to discuss some more subjects in the academy”. Customers signalled that the project should be continued in regular editions. They used terms such as “great”, “cool”, “practical”, “new”, “new experience” and “hitting the bull's-eye”. It could indicate that participants reached some hedonic pleasure and mental point of CE detached from their current purchasing process. Customers responded not only playing passively the role of the student-listener, but also active role of constructive reviewer for the business idea (Tran et al., 2021).

The comments related to the project and its role in customer community are presented in the form of a word cloud in Figure 4. In order to keep words in phrases together we have applied an NLP filter (Honnibal et al., 2020).



Figure 4. Customer opinions about the summer sales academy.

We observed that customers activity was based on an emotional motivation to share their own CX with other customers on the platform. We noticed their readiness to participate in discussions and openness in forming opinions for the public. They also referred to their CX as being obvious to all. Therefore, based on these observations, we conclude that clients are willing to participate in CE projects even beyond their immediate business issues, when they are organized in relation to the business process and with the intention to achieve individual emotional satisfaction. In such circumstances, customers demonstrate a commitment to society associated with brand and providing inside information and sharing CX beyond direct business issues.

7. Conclusion and implications

Customers, especially B2B parties, can share their organizational solutions and individual ideas based on motivation obtained from leading partner (Markovic et al., 2021). They can recommend each other product and services based on combine B2B offering. They can also improve mutual benefit strategies as subcontractors (Kozinets et al., 2010). Through openness and dialogue, they can integrate partner's specific needs, ideas, and insights into common market strategy. Finally, all partners can work together for the success of all (Youssef et al., 2018). In this study, we presented customer engagement projects that were implemented on the B2B e-commerce platform in order to study how customers react to motivation to deeper engagement, to play the role of expert and advisor, to impact on other's experience and organizational ecosystem for cooperation. We studied organizational relationships between companies and relationships between people, as they play different roles apart from the obligation to purchase.

Customer experience belongs to the group of key factors for customer retention, but it does not occur itself and does not sell to others itself. The only company create the ecosystem of business interactions that is conducive to customer engagement for building society attached to the brand promoting retention. The environment of collaboration where particular groups of customers can build and test their engagement induce the willingness to share their positive or negative experience which in consequence is the propellant fuel of the whole business ecosystem development. CX is a subjective, dynamic, and contextual in nature, what makes sustainable development and strong attachment to the brand if managed correctly (Carù & Cova, 2003). The ability of a company to create a relationship network (NC-network capability) of partners is currently a very important factor that significantly affects economical results of all players. It also creates the position in the marketplace for all actors (Parida et al., 2017). The networking capacity concept refers to the complex of dynamic capabilities of the enterprise to optimize the entire portfolio of business relationships among net relations. As a result, the resources of all business partner, e.g., time, investment, technical expertise, talents, and knowledge are used jointly and most productively (Ngasri & Freeman, 2018).

The concept of CE changes a company's approach to the way how customer loyalty is built. If partners have access to each other resources and can use them jointly, then this creates the ecosystem that engage all actors for rapid development (Maslowska et al., 2016). Intrinsic value starts with sharing know-how for improvement purchase processes and evolve to collective agreements and joint negotiation for corporate contracts. Likewise, market improvements can start from common projects in selected areas then developed jointly to cost optimization, to joint offering, combine logistic operations, and utilize resource sharing on a large scale. The CE and CX concepts are important to consumers, but in B2B relationships, it become a factor of incredible development and hyper-optimization (Zolkiewski et al., 2017).

We also observed negative emotions and disappointment when clients missed an opportunity to participate in a project and then did not receive project results. This was complained as a lack of recognition, as a doubt to customer's loyalty in all other business aspects. CX encapsulate customer's opinion about entire purchasing journey, including pre-, inter-, and post-purchase stages. Despite the fact that CE is limited to the period when customer is actively interacting with the brand (Hollebeek et al., 2014), CX inherits a lot from CE (Khan et al., 2019). Especially, if company is able to convert all repeated interactions (passive or active) to CE and then to the sustainable CX and to the brand reputation (Islam et al., 2019). In digital world, company innovativeness regarding new technologies is positively associated with personal creativity of their representatives (Korzynski, et al., 2019) what can influence CE on e-commerce platforms and following CX.

Presented research broadens our understanding of CE on B2B e-commerce platform. Digitization and e-commerce are constantly pushing people to mechanical information exchange, causing interactions between people. The study of CE points ambitious companies to manage their organization with human venue for each party. In addition, their managers should consider the utilitarian aspects of this study as describing the opportunities to build a strong CX on the brand with the support of customer's resources (Loureiro et al., 2012), which makes the business concept more sustainable.

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CAPITAL STRUCTURE OF ENTERPRISES IN THE PROCESS OF INTERNATIONALIZATION

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Purpose: The aim of the article is to define the capital structure in Polish enterprises – in the group of enterprises exporting their products and in the group of enterprises that do not conduct export activities.

Design/methodology/approach: 30 companies representing various sectors of the economy were taken into account for the preliminary research. In the first group of 15 companies that exported their products (the first stage of internationalization), the capital structure was examined, determining the level of financing with equity and foreign capital. The research scheme from the first group was also used in the second examined group – enterprises that do not export their products. Each surveyed group included a company that represented one selected sector. A case study for three Polish listed companies was also used.

Findings: Thus, the view of foreign authors based on the results of their study that, in emerging markets countries, companies that have internationalised their activities have higher levels of indebtedness than companies operating only domestically, should not be considered as confirmed (for the time being on the example of pilot studies).

Originality/value: The results of the preliminary research made it possible to identify the most important differences in the capital structure for companies that exported their products and companies that did not export.

Keywords: capital structure, internationalization, sources of financing.

Category of the paper: Research paper.

1. Introduction

The liberalisation of the world economy is increasing the incentives for companies to internationalise their operations, which is conducive to extending product life cycles, acquiring new technologies and diversifying their sales sphere. In most cases the internationalisation of company is a step-by-step process (following the Upsala model) although there are companies that have found a way to internationalise right from their inception (born global).

Internationalisation of company should be a component of its overall strategy. In turn, capital structure policy is an important element of a company's financial strategy.

The capital structure, its formation and changes occurring in it, have a great impact on the possibilities of financing the enterprises's development, but also directly affects its effectiveness (different capital costs of different sources of financing, the possibility of using tax shield, the limits of acquiring foreign capital, determining the effectiveness of its use). Not only in the scientific literature in Poland, but also in other countries (for example in the English literature), the issue of the relationship between the internationalization of the company and capital structure is quit rarely addressed. Therefore, the aim of this paper is to examine the relationship between capital structure and the internationalisation or non-internationalisation of firms in Poland. The research into the interrelationship between the internationalisation of enterprises and their capital structure commenced in 2021 with pilot studies, the results of which will be presented in this paper. The results of this research should form the basis for the preparation of empirical research, which will be, on a large sample, conducted in 2022. The results of the preliminary research, whose targets were enterprises producing for export, were confronted with the results of the research into the capital structure of enterprises producing for the domestic market. In this way, it is possible to assess whether the internationalisation process influences changes in the capital structure of enterprises under the conditions of the Polish economy. In addition to the survey, three case studies – of companies that have advanced in the internationalisation process - have been prepared on a group of 30 companies.

2. Analysis of existing studies on the internationalisation of enterprises

In reviewing the world literature on internationalisation, it is important to note that studies of the internationalisation processes of companies have largely focused on determining the relationship between internationalisation and the financial performance of the company (Barłozewski, 2017) There have also been studies indicating that profitability declines when the internationalisation process of a company begins – but as foreign direct investment increases and scales, so does the profitability of the company as a whole. The same studies have also shown that exports weaken the relationship between FDI and corporate financial performance, as pursuing a strategy of high exports at the same time as a significant commitment to foreign direct investment (FDI) is less profitable than a strategy of lower exports when the level of FDI is high. Multinational firms often make multiple investments (by forming strategic alliances beforehand) accumulating knowledge and skills – not only in connection with the internationalization of their operations, but also as a result of the cooperation established. A statistical analysis of the overseas expansion decisions made by Japanese manufacturing

firms over a period of 35 years showed that the tendency of firms to reinvest in the same host countries was weaker for horizontal investment (i.e. market search), but stronger for vertical investment (i.e. investment to increase efficiency). Research has also been conducted on the links between internationalisation and host country taxes – companies consider the location of their foreign subsidiaries depending on the taxes paid in the host country. The desire for tax savings is related to the relationship between taxes and profitability – the greater the tax savings, the greater the profitability. MNEs can also reduce their tax burden by transferring profits between subsidiaries in different tax jurisdictions/countries through transfer pricing. Research on internationalisation and financial aspects has also raised issues related to defining the stages of corporate internationalisation, namely Johanson and Vahlne's (1977 and 2009) Uppsala model - which assumes a gradual entry of companies into the internationalisation process inspired in part by Aharoni (1966) along with the later concept of Dunning and Lundan (2008). It is noteworthy that other concepts have talked about the possibility of a reversal of this process, i.e. deinternationalization (Welch, Luoristarinen, 1998), as well as the possibility of and Vahlne (2009), Continen, Ojala (2011, 2012). It was also pointed out that there is a need to carry out research to determine the relationship of internationalisation processes with the overall strategy of the company (Frymas, Mellahi, 2011). Some scholars have focused on studying the specifics of this process in emerging markets – which also include Poland, and here it has been pointed out that companies in these countries are trying to reach particular stages of internationalisation more quickly and are mainly aiming to acquire strategic resources and competitive advantages outside the home country (Mathews, 2006; Luo, and Thung, 2007; Hennert, 2012; Kothari, 2013). Research on the relationship between internationalisation and finance also includes studies of the relationship between the foreign investor and the host country, taking into account the motives for internationalisation and incentives used by the host country in relation to the foreign investor, including the theory of special economic zones (Karaszewski, Rymarczyk, Gorynia, Dorożyński), calculating the effectiveness of foreign investment (Różański, Jaworek), the relationship between the progress of internationalisation and the financial performance of enterprises (Barłożewski). There is also a theme of strategies related to international expansion. Some studies explicitly referred to the relationship between capital structure and internationalisation, through:

- examining the debt ratio of multinational firms according to agency theory (Chiung-Jung Chen, Chwo-Ming Joseph, 2011) – multinational corporations in emerging economies, defined as firms with at least one foreign subsidiary or some FDI, have higher debt levels than non-multinational corporations, which contrasts with findings for multinational corporations from developed countries;
- studying the impact of foreign investment and export sophistication on capital structure (Chiung-Jung Chen, Chwo-Ming Joseph, 2011);
- determining the degree of internationalisation of a company in the context of agency costs and capital structure (Hitt, 1997);

- study of capital structure among multinational firms (Hughes, 1975; Shapiro, 1978; Michel, and Shaked, 1986; Fatemi, 1988; Lee, and Kwok, 1988);
- a study of the increase in leverage among firms that internationalise their operations (Chen, 1997; Chkir, and Cosset, 2001)

The research also sought to determine the impact of foreign investment and export sophistication on capital structure – the impact is negative, meaning that costs (e.g. agency costs) increase when firms' international operations become overly complex – the firm reaches successive levels of internationalisation of its business. Research on capital structure among multinationals used multiple regression analysis using measures of international activity for firms that internationalise their operations, while comparing them with results for domestic firms. Based on 18,495 observations – 1) multinationals have lower debt-to-equity ratios than domestic firms, 2) in multinational companies, the debt-to-equity ratio is positively related to the degree of internationalisation. In the study of leverage growth among companies that internationalize, an event study was conducted that compared corporate leverage before and after the acquisition of foreign subsidiaries. The level of leverage increases from the first to the third year after the acquisition. It turns out that in addition to such important determinants as size and profitability, debt financing is explained by geographical and industrial diversification effects. The literature also draws attention to the increasing role of technology platforms (knowledge platforms), linking the thread of digitalization to the complementarity of capital and non-capital forms of expansion of foreign transnational corporations (Palulska, Poniatowska-Jaksch, 2021). It is also necessary to point out the appearance of a historical thread relating to the expansion of foreign capital on Polish soil, where the authors indicated that already from the 19th century, through the interwar period, until now (with a clear weakening of this trend in the period of socialist economy in Poland) foreign expansion continued, with sometimes very high amounts of foreign capital (Jaworek, Karaszewski, 2020). Another theme concerns the relationship between international expansion and the type of enterprises, thus supporting development through international expansion and the special role of internationalization of enterprises operating in the area of advanced technologies – on the example of Polish enterprises (Cieślik, 2014). Thus, the role of entrepreneurship and innovation in creating global leaders among Polish enterprises, which have strongly internationalized their activities, is relevant here. Therefore, it was considered purposeful to study the relationship between capital structure and internationalisation also in Polish enterprises.

3. Results of pilot studies conducted in 30 Polish enterprises

A pilot survey was conducted in 2021 to answer the question:

Is there any relationship between an enterprise's capital structure and its openness to foreign markets (or lack thereof) - on the example of Polish enterprises?

30 enterprises were selected, matched in pairs so that one represented a specific manufacturing sector or provided services exclusively to the country, and the other was an established exporter in that sector. The following sectors were selected: manufacture of building materials, manufacture of footwear, metalworking, manufacture of clothing, manufacture of windows and doors, manufacture of textiles, manufacture of electrical engineering products, manufacture of fabricated metal products, manufacture of wood products, manufacture of paper products, agriculture, printing services, transport services. The enterprises represented very different economic sectors. Pairs of enterprises were selected, characterised by similar parameters (size, structure of production or services, history and time of operation), but differing clearly by the feature of export/non-export. In this way the comparability of research objects was ensured. The results of the research will provide an opportunity to design basic research, which will enable confrontation with the results of research teams from outside Poland, undertaking this subject. By performing a collective assessment of the sources of financing of the 30 enterprises studied on a pilot basis, it was found that in 2015-2019, both in enterprises producing for the domestic market and in exporting enterprises, the primary source of financing with equity was retained earnings, and with foreign capital – bank credit and leasing. This is documented in the table below.

Table 1.
Sources of financing for enterprises

Companies	2015	2016	2017	2018	2019
1. Producing for the internal market					
• retained earnings	13	13	13	13	13
• credit	5	5	5	5	5
• lease	6	6	7	6	5
• other own	2	2	3	3	3
2. Exporting companies					
• retained earnings	14	14	14	14	14
• credit	6	6	6	6	6
• lease	6	6	6	5	5
• other own	1	1	1	1	1

Source: survey conducted on behalf of the authors by Biostat.

Thus, we are dealing with a fairly traditional capital structure (retained earnings, bank credit, leasing) that occurs regardless of whether the company exports or produces (services) exclusively for the domestic market.

There were, of course, some differences in funding sources from year to year, for example:

- a company producing and exporting footwear financed itself in 2015-2016 by leasing and in subsequent years by bank credit,
- a company producing windows and doors for export was supported by third-party financing in the form of working capital credit and leasing between 2015 and 2016, and only by leasing from 2017 onwards,
- a company producing metal products for export financed itself through leasing in 2015-2016, in subsequent years it abandoned foreign capital,
- a company exporting food products financed itself with working capital credit and leasing in 2015-2016 and abandoned credit in subsequent years,
- a company operating in the agricultural sector, producing, among others, for export, in 2015 benefited from EU funds, in subsequent years additionally supported by a bank loan.

The existing changes in the financing system of these enterprises, as can easily be seen, were undertaken by exporting enterprises, while enterprises producing or providing services for the domestic market presented virtually unchanged policies for financing their activities. Very mixed responses were given to the question, "What are the plans for the capital structure over the next 5 years?" Of the 30 companies surveyed, the vast majority declared that they did not want to make any changes to the company's financing system, motivating this most often by the uncertainty of the situation, e.g. in relation to pandemics, changes in interest rates, many uncertainties related to future operations. Statistically speaking:

- 8 companies declared that they were afraid to use foreign capital and would continue to use equity,
- 7 companies intend to use credit and 8 companies leasing.

In a few cases it was planned to use:

- financing from liabilities to suppliers – 2 replies,
- EU funding – 2 replies.

As many as 9 respondents declared a complete lack of plans for the future, in terms of shaping the capital structure. It is difficult to find a significant relationship between the sector of economic activity and the company's policy related to the future formation of the capital structure – two companies from the same sector represent a completely different approach – for example, two shoe or clothing companies, the first do not want to plan anything, the second have crystallized views on future financing.

Examples of advanced internationalisation of Polish enterprises – KGHM, LPP, Agat – case studies. In addition to companies that have stopped at the first phase (export) in the internationalisation process, there are of course companies that have reached subsequent phases of the process. Three companies were selected which were characterised by varying degrees of progress in the internationalisation process. The company that achieved the most is undoubtedly

Kombinat Górniczo-Hutniczy KGHM SA, which created its own subsidiaries abroad, entered into joint-ventures with foreign entities, took over foreign companies – the scale of these activities was (and is) very large. LPP, in turn, which operates in the clothing industry, has internationalised its activity mainly through a strongly developed distribution network covering many countries of the world (through 25 foreign companies). The Agat company, on the other hand, opened one foreign subsidiary (in Berlin), which can be considered the beginning of a process of further internationalisation. By comparing the capital structures of these three enterprises, which are at different stages of the internationalisation processes, and by comparing these structures with the structures of enterprises that only exported or produced for the domestic market, it is possible to answer the question of whether, under the conditions of the Polish economy, capital structures are in any way related to the internationalisation of the enterprise.

Case: Capital expansion of KGHM Polska Miedź SA

KGHM is a mining and smelting company, which was founded in 1961. Its activities are focused on the production of copper, precious metals and other non-ferrous metals. Since 1991, KGHM has been a joint stock company, and since 1997 it has been listed on the Warsaw Stock Exchange and is included in the WIG 20 index.

It is one of the largest Polish exporters and the main employer in Lower Silesia. It holds shares in over 20 entities, including telecommunications, trade, production, construction, transport, scientific and research companies, etc.

In June 2009 the company KGHM HMS Bergban AG was established in Berlin, in which KGHM holds 75.1% of the shares. The company is engaged in the exploration and exploitation of copper ore deposits and other mines in Europe.

In May 2010, KGHM signed an investment agreement with Vancouver-based Abacus Mining and Exploration Corporation (AMEC) on the joint realisation of a copper and gold mining project in the Canadian province of British Columbia. KGHM contributed USD 37 million to the joint venture formed with Abacus, giving it a 51% stake. KGHM undertook to finance capital expenditures related to the project in the amount of USD 535m. In addition, KGHM purchased 15 million shares in Abacus for USD 4.5 million.

In 2012, KGHM acquired the Canadian company Quadra FNX. Quadra, apart from the copper and silver mines, had mines of molybdenum, platinum, palladium and gold – located in Canada, the US and Chile. The purchase price was PLN 9.5bn. KGHM financed the purchase entirely from its own funds.

Following the addition of the Canadian company, copper production at KGHM increased by 18% compared to 2011. Quadra FNX was transformed into KGHM International. The existing staff was retained, the existing operating plans and their implementation were confirmed, actions were taken to ensure the value of the acquisition (achieving synergies,

lowering the unit cost of mining, exchanging best practices) and to ensure control in key areas (cash management, procurement).

A key case in point is the Sierra Gorda mine in Chile – where lowering the unit cost of production is very difficult (high energy costs, lack of workers and lack of water).

KGHM made 40 acquisitions between 2005 and 2015 for a total value of USD 3584.8 million.

Without the purchase of Quadra and access to new deposits, particularly in Chile, it would be difficult for KGHM to achieve further growth.

KGHM is the world's third largest copper mining company in terms of revenue and return on assets (ROA), and fourth in terms of return on equity (ROE). The investment programme for 2014-2020 cost PLN 27bn.

Diversification of activities (e.g. construction of a photovoltaic factory) is to strengthen the company's already strong position on global markets.

Table 2.

The capital structure of the joint-stock company KGHM

Capital structure	2015	2016	2017	2018	2019
Equity	20 211 000	15 772 000	17 694 000	19 133 000	20 110 000
Liabilities and provisions for liabilities	16 350 000	17 531 000	16 337 000	18 012 000	19 207 000
Share of equity in total equity	55%	47%	52%	52%	51%
Share of outside capital in total equity	45%	53%	48%	48%	49%

Source: own compilation based on KGHM's financial reports for the years 2015-2019.

Between 2015 and 2019, KGHM had a fairly balanced capital structure, i.e. the proportion of equity and debt capital was close to a 1:1 ratio, with some predominance of debt capital. This relationship persisted, despite the fact that during this period KGHM pursued an ambitious investment programme (as already mentioned, PLN 27 billion was invested between 2014 and 2020). The very good economic results mean that the majority of capital expenditure is made using equity, which allows the Company to maintain a capital structure similar to the model (1:1). It should be mentioned that the latest investment intention is to participate in an investment involving the construction of small nuclear reactors in Poland, which will strengthen the already very strong position of KGHM not only on the Polish market, but also on global markets.

Case: Internationalisation of LPP

LPP is a Polish family-owned company involved in designing, manufacturing and distribution of clothing. The company was established in 1991 as a limited liability company and in 1995 it was transformed into a joint stock company. LPP SA Capital Group consists of 5 domestic companies (including the parent company) and 25 foreign companies. Foreign companies of the Group are mostly entities engaged in distribution of products of all brands outside Poland. Currently, the sales network covers the whole of Poland, countries of Central, Eastern and Western Europe, the Balkans and the Middle East. The company does not have its

own factories. As a result, individual pieces of the collection are produced in factories specialising in specific types of clothing. According to the company's report for 2019/2020, no single supplier accounted for more than 5% of total purchases. Most orders came from China 36.4%, Bangladesh 31.4%, Turkey 7.1%, Cambodia 6.1%, Myanmar 6.0%. Poland accounts for 2.5% of all orders. Products are offered to customers in stationary and online shops, in a total of 39 countries on 3 continents. The stationary sales network consists of 1,746 shops with a total area of 1,230.9 thousand m². In its online form, LPP currently operates on 30 markets. Its sales offer includes: clothing, accessories and footwear of five brands: Reserved, Cropp, House, Mohito and Sinsay. Currently LPP operates on 39 markets. The most important location of the company's activity is Gdańsk. The company also has offices in Krakow, Warsaw, Shanghai and Dhaka. The team of employees totals about 25,000 people in offices and sales and distribution structures in Poland, European and Asian countries. The research period covers the years 2015-2019. In connection with the research period of the entire study, an analogous analysis of the LPP company's activity and the most important strategic activities that occurred during that time was conducted. In 2015, the Reserved brand debuted in Egypt, the same year the first shop opened in Qatar and Kuwait. September also saw the launch of new shops in Saudi Arabia. In 2016, the company launched its 1,000th store in Poland and continued to expand in Germany. At the same time, focusing on e-commerce development. At the same time, in Poland all brands of the LPP company have online shops. In 2017, LPP opened a Reserved store in London, Belarus and Serbia. In 2018, the company's founders, in order to ensure its long-term continuity and avoid future fragmentation of LPP's capital, decided to establish a foundation and contribute the shares they hold there (footnote). In 2019, LPP strengthened its position in the Balkans and launched a showroom of its 5 brands in Bosnia and Herzegovina. In October 2019, the company also launched showrooms of its 5 brands in Finland. In 2020, due to the pandemic, LPP transformed its business into an omnichannel organisation¹.

Table 3.

The capital structure of the joint-stock company LPP

Capital structure	2015	2016	2017	2018	2019
Equity	1 889 739	2 134 731	2 443 446	2 860 553	3 247 491
Liabilities and provisions for liabilities	1 675 430	1 543 201	1 763 373	2 520 255	6 358 371
Share of equity in total equity	53%	58%	58%	53%	34%
Share of outside capital in total equity	47%	42%	42%	47%	66%

Source: own compilation based on company financial data for 2015-2019.

Analysing the capital structure of LPP, in 2015-2019 that the company in 2015-2018 recorded a certain predominance of equity over foreign capital, while in 2019 we already have a clear predominance of foreign capital, which is related to the acceleration of the process of development of the distribution network outside Poland.

¹ It is an interaction using a variety of integrated channels between the seller and the customer, guaranteeing multi-channel sales. The use of this business model helps to increase the company's reach. The most important assumption of the omnichannel strategy is the permeation of individual sales channels.

Case: Internationalisation of the Agat Joint Stock Company

The pilot study used more precise data obtained in the enterprise "Agat" S.A. based in Koluszki – to present the relationship between the early phase of internationalization of the enterprise and its capital structure.

The Agat company is a large company operating as a joint stock company specialising in:

- civil engineering works and construction of buildings,
- telecommunications and power lines,
- industrial pipelines and distribution stations,
- roads, motorways, railways and underground railways,
- steerable drilling,
- industrial automation,
- construction of a sewage treatment plant.

The company started its activities in 1990 as a limited liability company and in 2008 it was transformed into a joint stock company. The company forms a capital group with the following shareholdings:

- Achat Infrastruktur GmbH in Berlin – speciality construction services – company founded in 2015, 100% of Agat shares,
- Agat IT S.A., 74% owned by Agat – in Łódź, company active in the field of IT, telecommunication, industrial automation, logistics and low voltage installations – 74% owned by Agat, active since 2005,
- Przedsiębiorstwo Budownictwa Inżynieryjnego S.A. in Piotrków, construction of industrial buildings, roads and bridges, 55% stake in Agat, founded in 2009,
- Przedsiębiorstwo Inżynierii Środowiska i Melioracji "Piomel" S.A. in Piotrków, "Agat" purchased 100% of shares in 2010,
- KB Pomorze, sp. z o.o. Gdańsk – construction of fuel tanks and process water pipelines, established in 2003 – 40.32% of shares.

The financial situation of the company is good. Sales revenues have been growing – from over PLN 128 million in 2016 to 148 million in 2019 (only a decrease in the level was recorded in 2017). Stable profits on sales from 2016 PLN 3.6 million to approximately PLN 4.3 million in 2019 (negative result in 2017). Revenue in 2020 – approx. 270 million PLN. It should be pointed out that the structure of the Company's sources of financing is fairly stable between 2015 and 2019. The data is contained in the table below.

Table 4.
The capital structure of the joint-stock company Agat

	2015	2016	2017	2018	2019
Own sources					
retained earnings	6.535	6.557	-3.780	4.311	3.123
redemption fund	1.299	1.437	1.586	1.626	1.847
External sources					
bank loan	6.000	6.000	6.000	6.000	6.000
leasing	2,8	-	-	-	783
share of equity	0,56	0,57	0,21	0,49	0,42
share of outside capital	0,44	0,43	0,79	0,51	0,58

Source: Agat internal materials.

The other items included in the analysis were not filled in, as "Agat" did not use such sources of financing as:

- issue of shares and bonds,
- venture capital and related funds,
- other (for example, grants).

It should be noted that the foreign subsidiary of the Agat enterprise accounts for only about 2% of the total turnover, so its impact on the sources of financing is small, as can be seen by analysing the data in the table. There are two main sources of funding:

- retained earnings (supported by the depreciation fund),
- a revolving overdraft facility, with a fixed limit for its use.

Leasing has been recognised as a complementary source of third-party financing, but it is only from 2019 that this source has been confirmed as an important form of financing for the Company – making it necessary to increase the scale of leasing in future years. In addition, the Agat company does not expect to make any fundamental changes to its capital structure in the next 5 years. Thus, the low degree of internationalisation of Agat's operations – despite the fact that the company owns 100% of shares in a foreign company, so we are already dealing here with a process of internationalisation going further than the classic export of goods and services – means that internationalisation has no impact on the development of the capital structure and will probably continue to do so in the coming years, as the company has announced.

4. Conclusion

The conducted pilot study allowed us to notice the occurrence of certain regularities in the formation of the capital structure of enterprises.

- 1) Companies producing (or providing services) exclusively for the domestic market are most willing to finance themselves with own capital (retained earnings) sometimes giving up foreign capital altogether (about half of the cases). Other companies use bank

credit, or leasing, or both sources of external financing at the same time. In the case of these companies we are dealing with a very traditional capital structure (retained earnings, credit and leasing), in which, however, external capital plays an important role.

- 2) Companies producing for export more often use foreign sources of financing, however these are most often also credit and leasing. Only 2 companies in this group did not use foreign capital. Thus a balanced relationship between equity and debt can be observed here, but with a slight predominance of equity.
- 3) Companies that have moved on to further stages of the internationalisation process also pursue a rather cautious policy related to raising foreign capital, but in most cases trying to maintain a balance between financing their activities with equity and foreign capital. A clear prevalence of foreign capital could only be recorded in 2019 in LPP, and in 2017 in the Company "Agat", but here due to the net loss incurred (clear prevalence of financing with foreign capital).

Noteworthy, in all cases studied, is the high stability of the sources of financing during the period studied. Thus, the view of foreign authors based on the results of their study that, in emerging markets countries, companies that have internationalised their activities have higher levels of indebtedness than companies operating only domestically, should not be considered as confirmed (for the time being on the example of pilot studies). Undoubtedly, extending the time horizon of the research and covering a larger number of enterprises with surveys, interviews and identification of available reporting data will allow for a broader analysis of the explored topic.

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BUSINESS TARGETS AND CORPORATE GOVERNANCE MODELS

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Purpose: The purpose of the study was to compare the management practices of American, German and Polish enterprises in the cross-section of business objectives analysed.

Design/methodology/approach: The paper assumes that the differences in setting business objectives result from the differences in corporate governance models. The study used the Kruskal-Wallis One-way Analysis of Variance by Ranks and multiple comparisons of mean ranks for all samples.

Findings: The study found that some of the management practices of German, Polish and American enterprises differed across business objectives. However, differences in management practices did not always coincide with differences in corporate governance models. The research shows that corporate governance institutions do not always explain existing differences in management practices, and that the setting of business objectives also depends on other factors.

Originality/value: The conducted research enriches the literature in the area of strategic management by issues concerning the determinants of setting business goals in enterprises.

Keywords: business targets, corporate governance models, differences in management practices.

Category of the paper: Research paper.

1. Introduction

The activities of an enterprise are purposeful in nature. The company's business objectives determine the direction of its development (Stoner, and Wankel, 1994). However, there are differences in the institutional set-up of individual countries. Businesses operate in a different socio-economic environment. Their behaviour and choices are influenced by different formal rules and informal constraints (North, 1992). It is therefore legitimate to ask – are the business objectives of companies operating in different countries the same or different (Hofstede, 2004). The research was limited to three groups of companies, adopting the criterion of country of origin, i.e. American, German and Polish. Each of these countries is associated with a different model of corporate governance. The category of a company's business goal is a very broad

notion and requires specification. It includes: type of goals, their internal connections and time scope, as well as degree of difficulty and clarity of formulating goals (Bloom et al., 2021d).

The question about business objectives can be further clarified by pointing to specific questions such as:

- how are the financial and non-financial objectives of US, German and Polish enterprises set?
- what measures do US, German and Polish companies use to set their goals?
- what is the time horizon of the targets set by American, German and Polish enterprises?
- what is the degree of difficulty of the targets set by American, German and Polish companies?
- are the goals set in a clear way at American, German and Polish enterprises, and are individual employee performance against the goals compared?¹

The institutional arrangements determining the behaviour of enterprises are linked to specific models of corporate governance (North, 1992; Hofstede, 2004).

Corporate governance creates a structure through which the company's objectives are set. The structure also provides the means to achieve these objectives and the means to track the company's performance (OECD, 2004). Corporate governance refers to the distribution of power within the company (Tricker, 2019). It includes the distribution of rights and the possibility to enforce them. This includes the rights of shareholders, creditors, employees, suppliers, subcontractors and customers of the company (Schmidt, and Tyrell, 1997). These rights derive directly from the company's articles of association and the legal framework governing its operation (Schmidt, and Tyrell, 1997). It consists of rights of decision-making, intervention or control in the company (Schmidt, and Tyrell, 1997). Besides formal rules, corporate governance is also shaped by informal constraints, such as voluntary codes of conduct, norms of behaviour, social values, conventions (North, 1992). It can therefore be defined as institutional and organisational mechanisms aimed at resolving conflicts of interest between different stakeholder groups within a company (Schmidt, and Tyrell, 1997). However, corporate governance cannot be confused with management. It is something different. Management is concerned with running the affairs of the company. The role of governing bodies, on the other hand, is to ensure that the affairs of the company are managed both well and in the right direction (Tricker, 2019).

Three models of corporate governance have emerged over the years.² These are: the market-based governance model (example United States), the relationship-based governance model (example Germany) and the transitional governance model (example Poland) (Praveen Bhasa, 2004). These models have developed in countries with different legal and financial systems, different ownership structures in companies, different cultures and different social, economic and political conditions (Adungo, 2012).

¹ The questions were formulated on the basis of a survey instrument: (Bloom et al., 2021d).

² The literature on the subject also proposes other divisions.

Differences and similarities in corporate governance institutions in the United States, Germany and Poland are presented in Table 1.

Table 1.

Corporate governance institutions in the United States, Germany and Poland

	United States	Germany	Poland
the company concept	instrumental (shareholder-oriented)	institutional	institutional
the company's core business objective	shareholder value, profitability	stakeholder value, multiple objectives (profitability, market share, employment)	stakeholder value, multiple objectives (mainly profit or other economic objectives)
concentration of ownership in listed companies	low-dispersed ownership	moderate/high	high
dominant entities in the ownership structure of listed companies	portfolio investors (small shareholders)	strategic investors (large shareholders, stable shareholding)	large shareholders
shareholders of listed companies	mainly individuals, and institutional investors	families, industrial companies, financial institutions	companies, financial institutions, individuals, State Treasury (large companies)
key stakeholders in listed companies	top management, shareholders	banks, top management, employees (stakeholders represented at board level)	shareholders, top management, employees
the importance of the capital market in the economy	high - strong capital market with high liquidity	moderate/high-capital market with relatively low liquidity	moderate
external control market of the corporation of an active nature	yes	no	no
rewarding top managers in listed companies based on performance/market incentives	high	low	low
board structure in joint stock companies	one-tier board structure	two-tier board structure	two-tier board structure
the cultural aspect of decision-making	individualism	collectivism	individualism/collectivism
economic relations	short-term, focus on short-term results	long-term (complex links, interconnections, mutual agreements)	medium-term
competition strategies of enterprises	radical innovation (in new economic sectors), price competition (in established economic sectors)	non-price competition (incremental innovation)	price competition
responsibility towards society in listed companies	voluntary, defined at strategy level	mandatory	voluntary
labour market	decentralised, flexible forms of employment predominate	centralised, stable labour market	centralised

Source: (Praveen Bhasa, 2004; Weimer, and Pape, 1999; Desender et al., 2020; Meier, H.H., and Meier, N.C., 2014; Vitols, 2001; Franks, and Mayer, 2017; Jackson, and Moerke, 2005; Mintz, 2005; Casper, 2001; West, 2009; Adamska, 2013; Aluchna, and Tomczyk, 2016; Kozioł, 2008; Łudzińska, and Zdziarski, 2013).

The characteristics of the different corporate governance models have important implications for the type of business targets a company adopts. The type of business objectives within a company depends on both internal factors and institutional and economic conditions (Howe, 1986). Numerous constraints influence the shape of business objectives. These arise from limited access to capital, from legal constraints on the company's growth potential or market share, as well as from cultural constraints and the strategy adopted (Howe, 1986). However, the development strategies of individual enterprises are influenced by their ownership structure (Adamska, 2013). The ownership structure determines the financial objectives adopted. This is because small investors have different expectations of the company, while sectoral or institutional investors (e.g. investment funds, pension funds) have different ones (Howe, 1986). These expectations relate to financial objectives, their balancing with non-financial objectives, and the time horizon of return on investment. Corporate objectives and strategy are also affected by the degree of ownership concentration. When ownership is separated from control in dispersed ownership structures, shareholders have less influence over managers. It is then the managers who determine the shape of the strategy and the types of objectives pursued (Howe, 1986). This is different in the case of concentrated ownership structures, where the dominant shareholder directly controls the managers.

The choice of business objectives is influenced by the overriding interest perspective adopted within the company: shareholders or stakeholders (Maassen, 2002). Taking the shareholders' perspective, the goal of a company's action is to maximise its value. Taking a stakeholder perspective, the task of managers is to act in the interests of various entities (Jensen, 2001).

The time horizon of the objectives, in addition to the strategy already mentioned, is also influenced by the nature of the economic relationship (short-term vs. long-term), the importance of the capital market (large vs. small) and issues concerning the way top managers are remunerated. A strong capital market, linking manager remuneration to pro-market incentives, results in managers focusing on short-term performance (Praveen Bhasa, 2004; Weimer, and Pape, 1999; Howe, 1986). In such a situation, short-termism also applies to economic relations (Weimer, and Pape, 1999). Long-termism in economic relations, on the other hand, is associated with an economic model in which the capital market plays a lesser role (Weimer, and Pape, 1999). In this case, the time horizon of the objectives becomes longer.

The degree of difficulty of formulating objectives is related to the specifics of the labour market, the strategies pursued and cultural aspects. Research shows that clearly formulated goals increase employee motivation and productivity. Employees then take responsibility for team goals and it is easier to set individual work goals in the context of team goals (Mayer, Dale, and Fox, 2020). As regards comparability of objectives, the nature of the local labour market and cultural aspects play a key role.

The shape of the business objectives set is linked to specific corporate governance institutions. However, corporate governance models are not permanent. They change over time. Some researchers expect that in the near future, national differences will lose their importance and a single corporate governance model will emerge (West, 2009). They foresee the triumph of the shareholder-oriented corporate governance model (Hansmann, and Kraakman, 2000). In such a situation, one would expect a standardisation of management practices within companies. For other researchers, however, there is no reliable evidence for this (Adungo, 2012; Rossouw, 2009; West 2009). In their view, differences in the governance structure and ownership of companies are key (Adungo, 2012). They also point to factors such as the path of dependency, cultural values, economic, social and legal conditions (Testy, 2002). Undoubtedly, however, corporate governance models are intertwined. They share characteristics of other models (Thomsen, 2003). Convergence is particularly evident in economic sectors dominated by multinationals. However, this observation does not apply to small and medium-sized enterprises, which are often managed differently from multinationals. Consequently, corporate governance models not only differ from one another, but are also internally diverse (Edwards, 2004). The convergence process itself depends on many factors (Yoshikawa, and Rasheed, 2009). The degree of similarity between corporate governance models is influenced by economic integration. Harmonisation of corporate governance practices is also fostered by the process of harmonisation of legal solutions across countries (Palepu, Khanna, and Kogan, 2002). Convergence can also take different forms, namely: functional, formal and contractual convergence. It all depends on the flexibility of the institutional set-up in a given country (Gilson, 2000).

Consequently, there can be no single model of corporate governance. Although corporate governance models are intertwined as a result of progressive economic integration, each has retained basic characteristics that result from different economic, social and legal conditions. This diversity translates into differences in corporate management practices between countries. By grouping enterprises according to their country of origin, i.e. Germany, Poland, USA, it can be assumed that management practices of German, Polish and American enterprises differ.

The aim of the study is to compare management practices in American, German and Polish enterprises in terms of the business objectives analysed.

2. Method

The data used in the study comes from The World Management Survey and was obtained from the Harvard Dataverse Repository (Harvard Dataverse, [www 2022](http://www.harvarddataverse.org)). The World Management Survey (hereafter WMS) is a collection of data on management practices in enterprises that has been developed to measure their quality. The WMS is international and

cross-industry. It is an interview-based tool for assessing the quality of management practices in companies. The WMS defines 18 key management practices in companies from 35 countries. These practices are rated on a scale from 1 to 5 (“worst practice” – “best practice”). The WMS assesses the key areas in which companies operate, i.e. monitoring, objectives, people management (Bloom et al., 2021a; 2021c).

The research used data on management practices in American, German and Polish companies operating in the Manufacturing sector (2-Digit SIC, www.2digit.com 2022). A total of 430 German, 238 Polish and 953 US companies were surveyed (Bloom et al., 2021c). Data on management practices relate to business targets and include:

- Target 1. Types of objectives and balancing of financial and non-financial targets.
- Target 2. The interrelationship between goals.
- Target 3. Time range of objectives.
- Target 4. Degree of difficulty of the objectives and their rationality.
- Target 5. Clarity of the formulation of the objectives and their comparability (Bloom et al., 2021d).

A description of management practices for setting business objectives is provided in Table 2.

Table 2.

Management practices for setting business objectives (rating scale from 1 to 5)

	worst practice (assessment 1)	best practice (assessment 5)
Target 1	setting purely financial or operational targets	balance between financial and non-financial objectives
Target 2	setting targets solely on the basis of accounting data	setting targets based on shareholder value linked to individual objectives
Target 3	short-termism of goals in top management practices	linking long-term objectives to short-term objectives in such a way as to help achieve long-term goals
Target 4	setting goals that are too easy or impossible to achieve	adopting challenging targets based on sound reasons
Target 5	adopting complex and incomprehensible performance measures and not making individual results public	adopting well-defined performance measures, communicating them properly, ranking them and making individual results publicly available

Source: (Bloom et al., 2021a; 2021b; 2021c; 2021d).

Countries (Germany, Poland, USA) were used as grouping variables, ratings of management practices were used as dependent variables.

A null and an alternative hypothesis were formulated for each management practice. The null hypothesis assumed that all mean ranks of management practice ratings in the study population of enterprise groups are the same (across individual business objectives). In the alternative hypothesis, on the other hand, it was assumed that at least one pair of mean ranks of management practice ratings is different (across individual business objectives) (Holmes, Illowsky, and Dean, 2018; Sheskin, 2000; Rabiej, 2012). For three groups of enterprises (German, Polish and American) and five objectives, we have:

Null hypotheses:

$$H_{01}: \bar{R}_{11} = \bar{R}_{21} = \bar{R}_{31}$$

$$H_{02}: \bar{R}_{12} = \bar{R}_{22} = \bar{R}_{32}$$

$$H_{03}: \bar{R}_{13} = \bar{R}_{23} = \bar{R}_{33}$$

$$H_{04}: \bar{R}_{14} = \bar{R}_{24} = \bar{R}_{34}$$

$$H_{05}: \bar{R}_{15} = \bar{R}_{25} = \bar{R}_{35}$$

Alternative hypotheses:

H_{a1} : At least two group means of management practice ratings $\bar{R}_{11}, \bar{R}_{21}, \bar{R}_{31}$ are not equal to.

H_{a2} : At least two group means of management practice ratings $\bar{R}_{12}, \bar{R}_{22}, \bar{R}_{32}$ are not equal to.

H_{a3} : At least two group means of management practice ratings $\bar{R}_{13}, \bar{R}_{23}, \bar{R}_{33}$ are not equal to.

H_{a4} : At least two group means of management practice ratings $\bar{R}_{14}, \bar{R}_{24}, \bar{R}_{34}$ are not equal to.

H_{a5} : At least two group means of management practice ratings $\bar{R}_{15}, \bar{R}_{25}, \bar{R}_{35}$ are not equal to³.

The Kruskal-Wallis One-way Analysis of Variance by Ranks was used to test the significance of differences between the mean scores of management practices in companies from three groups of countries, namely Germany, Poland and the USA (Kruskal-Wallis test) (Kruskal, and Wallis, 1952; Siegel, 1956; Rabiej, 2012; Śmigielski, www 2022; Śmigielski et al., 2020). The use of Kruskal-Wallis test was dictated by the fact that the assumptions of ANOVA analysis of variance with normal distribution of the variable were not met (in order to check the normality of distribution the Shapiro-Wilk test was used) (Rabiej, 2012; Śmigielski et al., 2020). The Kruskal-Wallis test examines the null hypothesis in which all samples are assumed to come from identical populations. In practice, as in ANOVA, two hypotheses are accepted, i.e. the null hypothesis, which assumes that the population means are equal, and the alternative hypothesis, which assumes that at least one of them is different (Kruskal, and Wallis, 1952).

In order to clarify the differences detected by the Kruskal-Wallis test, multiple comparisons of mean ranks for all samples were used (post hoc analysis). This allowed the means to be grouped and homogeneous groups to be identified. In order to assess differences in management practices in German, Polish and American enterprises, descriptive statistics were used, i.e. median and quartile deviation (Rabiej, 2012; Śmigielski, www 2022; Śmigielski et al., 2020). Calculations were performed using the Statistica programme (TIBCO Software Inc., 2017). The level of significance was adopted for $p < 0.05$ (Śmigielski et al., 2020).

³ In formulating the hypotheses, the following were used: Holmes, Illowsky, and Dean, 2018; Sheskin, 2000.

3. Results

The Kruskal-Wallis One-way Analysis of Variance by Ranks shows that at least two group means of management practice ratings in the surveyed population of enterprises across the analysed objectives, i.e.:

$$\bar{R}_{1\ 1}, \bar{R}_{2\ 1}, \bar{R}_{3\ 1};$$

$$\bar{R}_{1\ 2}, \bar{R}_{2\ 2}, \bar{R}_{3\ 2};$$

$$\bar{R}_{1\ 3}, \bar{R}_{2\ 3}, \bar{R}_{3\ 3};$$

$$\bar{R}_{1\ 4}, \bar{R}_{2\ 4}, \bar{R}_{3\ 4};$$

$$\bar{R}_{1\ 5}, \bar{R}_{2\ 5}, \bar{R}_{3\ 5}$$

are not equal (Table 3). The differences between them are statistically significant.

The p-values for each objective are: $p_1 = 0.031$, $p_2 = 0.001$, $p_3 = 0.028$, $p_4 = 0.011$, $p_5 = 0.001$.

At the assumed level of statistical significance, the verified null hypotheses:

$$H_{0\ 1}: \bar{R}_{1\ 1} = \bar{R}_{2\ 1} = \bar{R}_{3\ 1};$$

$$H_{0\ 2}: \bar{R}_{1\ 2} = \bar{R}_{2\ 2} = \bar{R}_{3\ 2};$$

$$H_{0\ 3}: \bar{R}_{1\ 3} = \bar{R}_{2\ 3} = \bar{R}_{3\ 3};$$

$$H_{0\ 4}: \bar{R}_{1\ 4} = \bar{R}_{2\ 4} = \bar{R}_{3\ 4};$$

$$H_{0\ 5}: \bar{R}_{1\ 5} = \bar{R}_{2\ 5} = \bar{R}_{3\ 5}$$

about the equality of the mean ranks of management practice ratings in the population of enterprises under study should be rejected.

The use of multiple comparisons of mean ranks for all samples identified differences in the evaluation of management practices across groups as detected by the Kruskal-Wallis test.

For Target 1, the differences in management practices of US and Polish enterprises were found to be statistically significant ($p = 0.032$). The differences in management practices between US and German enterprises are not statistically significant ($p = 0.899$). This observation also applies to the differences in management practices between German and Polish companies, which also turned out to be statistically insignificant ($p = 0.363$). The median rating of management practices was at level 3 for all analysed groups of enterprises (Table 4). Differences were found in the quartile deviation and amounted to 0.5 (Germany), 1 (Poland), 0.75 (USA).

For Target 2, there were statistically significant differences in management practices between Polish and American enterprises ($p = 0.001$) and between Polish and German enterprises ($p = 0.001$). In contrast, the differences in management practices between US and German companies are not statistically significant ($p = 1.000$). The median score of management practices for Germany and the USA was at the same level – 3.33, while for Poland it was 3. The quartile deviation for Germany and the USA was 0.5 and for Poland 0.75.

Table 3.

Target 1-5 in enterprises – Kruskal-Wallis test and p-value for multiple comparisons (two-sided)

Variable dependent: target 1	p-value for multiple comparisons (two-sided); target 1 Independent (grouping) variable: country Kruskal-Wallis test: H (2, N = 1614) = 6.930 p = 0.031		
	Germany (R:799.59)	Poland (R:741.12)	United States (R:827.70)
Germany		0.363	0.899
Poland	0.363		0.032
United States	0.899	0.032	
Variable dependent: target 2	p-value for multiple comparisons (two-sided); target 2 Independent (grouping) variable: country Kruskal-Wallis test: H (2, N = 1620) = 51.808 p = 0.001		
	Germany (R:832.63)	Poland (R:613.39)	United States (R:849.78)
Germany		0.001	1
Poland	0.001		0.001
United States	1	0.001	
Variable dependent: target 3	p-value for multiple comparisons (two-sided); target 3 Independent (grouping) variable: country Kruskal-Wallis test: H (2, N = 1619) = 7.161 p = 0.028		
	Germany (R:850.29)	Poland (R:751.98)	United States (R:806.35)
Germany		0.028	0.318
Poland	0.028		0.326
United States	0.318	0.326	
Variable dependent: target 4	p-value for multiple comparisons (two-sided); target 4 Independent (grouping) variable: country Kruskal-Wallis test: H (2, N = 1614) = 8.957 p = 0.011		
	Germany (R:811.48)	Poland (R:727.05)	United States (R:825.81)
Germany		0.076	1.000
Poland	0.076		0.011
United States	1.000	0.011	
Variable dependent: target 5	p-value for multiple comparisons (two-sided); target 5 Independent (grouping) variable: country Kruskal-Wallis test: H (2, N = 1614) = 21.017 p = 0.001		
	Germany (R:771.45)	Poland (R:709.34)	United States (R:848.14)
Germany		0.301	0.014
Poland	0.301		0.001
United States	0.014	0.001	

Calculations: STATISTICA program (TIBCO Software Inc., 2017), own rounding.

Source: Data extracted from The World Management Survey dataset; (Bloom et al., 2021a; 2021b; 2021c; 2021d).

For Target 3, the differences in management practices between German and Polish enterprises are statistically significant ($p = 0.028$). In contrast, the differences in management practices between US and German enterprises ($p = 0.318$) and US and Polish enterprises are not statistically significant ($p = 0.326$). The median score of management practices for Germany was 3.5, for Poland and the USA 3. The quartile deviation for Germany and the USA was 0.5, for Poland 1.

For the fourth objective, there were statistically significant differences in management practices between Polish and American enterprises ($p = 0.011$). On the other hand, for differences in management practices between American and German enterprises ($p = 1.000$) and between German and Polish enterprises ($p = 0.076$), it can be concluded that they are not

statistically significant. The median score of management practices for all groups studied was 3. The quartile deviation for Germany and the USA was 0.5, for Poland 0.75.

For Target 5, the differences in management practices between US and German enterprises ($p = 0.014$) and between US and Polish enterprises ($p = 0.001$) proved to be statistically significant. In contrast, the differences in management practices between German and Polish companies are not statistically significant ($p = 0.301$). The median score of management practices for Germany and the USA was 3, for Poland 2.5. The quartile deviation for Germany 0.5 for Poland and the USA 0.75.

Table 4.

Assessment of management practices on a scale from 1 to 5 in the area of business targets

	Germany	Poland	United States
Types of objectives and balancing of financial and non-financial targets			
Median	3	3	3
Quartile deviation	0.5	1	0.75
The interrelationship between goals			
Median	3.33	3	3.33
Quartile deviation	0.5	0.75	0.5
Time range of objectives			
Median	3.5	3	3
Quartile deviation	0.5	1	0.5
Degree of difficulty of the objectives and their rationality			
Median	3	3	3
Quartile deviation	0.5	0.75	0.5
Clarity of the formulation of the objectives and their comparability			
Median	3	2,5	3
Quartile deviation	0.5	0.75	0.75

Calculations: STATISTICA program (TIBCO Software Inc., 2017).

Source: Data extracted from The World Management Survey dataset; (Bloom et al., 2021a; 2021b; 2021c; 2021d).

4. Discussion

The research shows that some of the management practices of German, Polish and American enterprises differ in the cross-section of individual business objectives. These differences are to be found in formal institutions and informal constraints (Yoshikawa, Zhu, and Wang, 2014). Formal institutions and informal constraints influence each other to shape the country-specific corporate governance environment. Corporate governance, by providing a structure for setting business objectives (OECD, 2004), influences the way enterprises operate and their management practices. Formal institutions, through the legal framework, define the scope of discretion and shape the corporate environment. Within this discretion and the specific shape of the institutional environment, business objectives are formulated in enterprises. Informal constraints stem directly from social norms, certain

conventions and specific values (Yoshikawa, Zhu, and Wang, 2014). Informal constraints shape individuals, their behaviour and their relationships with others. Socially formed attitudes are central to the objectives adopted in companies.

However, the differences in management practices of American, German and Polish enterprises in terms of individual objectives do not always coincide with differences in corporate governance models. Hence, it can be assumed that corporate governance institutions do not always explain the existing differences in management practices and that the setting of business goals depends on other factors as well. On this basis, additional questions may be formulated:

- what factors outside corporate governance institutions influence the setting of business objectives in companies?
- what role does flexibility of institutional arrangements and economic integration play in the convergence of management practices?
- which management practices tend to converge and which are specific to a particular community of values?
- do management practices differ according to the size of enterprises and their level of internationalisation?

Such questions may provide directions for further research in the area under consideration. The conducted research enriches the literature in the area of strategic management by adding issues concerning the determinants of setting business goals in enterprises. The research should be continued and extended to other countries.

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SHELF-LIFE LABELLING SYSTEM IN THE OPINION OF FOOD MARKET PARTICIPANTS IN POLAND

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Purpose: The aim of the study was an assessment of the European shelf-life labelling system from the perspectives of food producers and consumers in Poland in the context of its possible impact on food waste.

Design/methodology/approach: Qualitative and quantitative research methods were used to conduct the study among key food market participants. Individual in-depth interviews (IDIs) were conducted among senior managers in 18 key food producing companies, an eye-tracking study (ET) involved 30 purposefully selected consumers, and a quantitative survey using the face-to-face interview was undertaken among food consumers in Poland (n = 1145).

Findings: The existing regulations regarding date labelling do not support the policy of establishing sustainable food chains. Even though the date label is one of the most eye-catching elements on the food packaging, a great number of Polish consumers are not able to correctly interpret the information – 39% have problems with proper understanding of ‘best before’ date. Less educated consumers more often admit that the information on the date label is difficult for them to comprehend. Food business operators have adopted the date labelling system as a mandatory requirement, although they consider it to be complicated.

Research limitations/implications: The research results are partially declarative. It would be interesting to examine the interpretation of the date labels in the purchasing and consumption process.

Practical implications: Consumer misunderstanding of the ‘best before’ date contributes to food waste. Point of view of food market participants differ what should be taken into account with regard to the final iteration of the date labelling system.

Social implications: Consumer interest in shelf-life dates should be treated as an opportunity in efficient education and building food waste prevention behaviour.

Originality/value: Triangulation of quantitative and qualitative methods was applied which allowed for a comprehensive assessment the shelf-life labelling system.

Keywords: Date labelling, ‘Best before’ date, Informative value, Sustainable food chains, Food waste.

Category of the paper: Research paper.

1. Introduction

The level of food waste along the supply chain in the European Union covers one-fifth of its food production, yearly reaching 88 million tons worth and a cost of 143 billion euros (Fusions, 2016). Poland ranks fifth in Europe in terms of the amount of wasted food (European Commission, 2010). In line with the ‘2030 Agenda for Sustainable Development’, sustainable consumption and production is a challenge for the coming years. In item 12 of the Sustainable Development Goals (SDGs), halving per capita global food waste at retail and consumer levels by 2030 was postulated, as well as reducing food losses along production and supply chains (United Nations, 2015). Beside social, economics, and ethical implications of food waste, its environmental impact has been recently discussed in the context of inefficient use of natural resources. Production of food that in the end is not consumed is related to redundant land, water, labour and energy use, as well to unnecessary emission of the greenhouse gasses contributing to global warming (Chen, Chaudhary, Mathys, 2020; Padeyanda et al., 2016).

Shelf-life date is one of the mandatory elements of a food label in the EU (Regulation (EU) No. 1169/2011). Its incorporation is primarily intended to protect consumers against the consumption of unsafe outdated foods (Newsome et al., 2014). According to the European date labelling system, certain food items, from a microbiological point of view, are highly perishable and are therefore likely after a short period to constitute an immediate danger to human health. These are labelled with a ‘use by’ date. After this date, the food item should not be consumed. In other cases, food is labelled by the minimum durability date (‘best before’ date). Although food quality may not be optimal after this period, food can be safely consumed past this date.

For some time now, attention has been paid to another aspect of date labelling – how it affects consumer behavior regarding to food waste. The latest publications reveal that consumers have difficulties with distinguishing and understanding the terms on the label, by which they throw away outdated ‘best before’ foods, treating ‘best before’ dates as if they were ‘use by’ dates. Misunderstanding and misuse of date marking brings about premature disposal of edible food and increases the mass of wasted food (Amicarelli, Bux, 2021; Zielińska et al., 2020; Neff et al., 2019; Toma, Font, Thompson, 2020). With this in mind, the Commission announced a revision of EU rules of date labelling to take account consumer research. These activities were included in the implementation of the ‘Farm to Fork’ Strategy, which comprehensively addresses the challenges of sustainable food systems and recognises the inextricable links between healthy people, healthy societies and a healthy planet (European Commission, 2020b). The proposal for a revision of EU rules for food dating was included as item 27 of the draft action plan (European Commission, 2020a). The transition to sustainable food systems requires an efficient food labelling system. A clear and simple date labelling scheme is essential for conscious consumer choice and sustainable consumption in order to reduce food insecurity, ensure access to high quality and safe food and to reduce redundant

environmental impact of date labels. Understanding the perspectives of food market participants, which on the one hand – generate demand, and on the other hand – generate supply on the same market, is crucial in order to effectively manage the food labelling system. Although consumer food waste has received increasing scientific attention (Karunasena, Ananda, Pearson, 2021; Parizeau, von Massow, Martin, 2021; Aschemann-Witzel, Giménez, Ares, 2020; Ares, Giménez, Gámbaro, 2008), consumer perception of date labels, their interpretations of the meaning of ‘use by’ and ‘best before’ information, as well as point of view of the FBOs (food business operators) who act on the same market, was rather discussed separately, therefore, further work needs to be conducted in this area.

2. Literature review

In previous studies, food labelling was shown to be a tool which shapes consumer attitudes and behaviour on the food market influencing decision-making process both at the point of purchase and during food handling at home (Díaz, Fernández-Ruiz, Montaña Cámara, 2020; Latiff et al., 2016). It was noticed that food labelling might facilitate consumers to select the most healthful food options in order to maintain good overall health and reduce the risk of diet-related diseases (Crocker et al., 2020; Fagerstrøm et al., 2019; Lima, Ares, Deliza, 2018; Lundeberg, Graham, Mohr, 2018). Among the elements on the label of food, shelf-life dates, composition, dietary and nutritional value get the most attention (SielickaRóżyńska, Jerzyk, Gluza, 2021; Świda, Halagarda, Popek, 2018). The importance of particular information depends on whether a purchase or consumption decision is made (Bryła, 2020; Ares, Giménez, Gámbaro, 2008). Most consumers consider compulsory information of food labelling important. In a study by Moreira et al. (2019), most respondents revealed that shelf-life information, nutritional facts and the list of ingredients influence their buying decision and are useful. Food labelling also influences industry practices, for example the value of functional food products is constantly growing due to market opportunities that nutrition and health claims make (Díaz, Fernández-Ruiz, Cámara, 2020). From reviewing 60 intervention studies by Shangquan et al. (2019), it was found that mandatory nutrient declaration induces food producers to reformulate their products, e.g., to reduce sodium and undesirable *trans* fats contents.

Subjective norms and diet-health concern were proved to be significant predictors of intention to use food labels (Vijaykumar et al., 2013). Reading the label's content takes time due to the multitude of information contained therein (Stuart, 2010). In a study by Moreira et al. (2019), half of consumers gave ‘lack of time’ as a reason for not reading food labels. A similar number considered the information to be too excessive. Reported problems with food labels may result in a lack of consumer motivation to use the labels. Some authors argue that

the effectiveness of the food labelling system as a tool that models consumer behaviour may be decreased if consumers experience trouble finding, interpreting, and applying information on the labels (Grunert et al., 2010). Similar negative influence may be attributed to ignoring given information or not trusting it (Rupprecht et al., 2020). Sunstein (2021) drew attention to the general phenomenon of ‘information avoidance’, according to which people often prefer not to know, despite the fact that information is available. Consequently, intervention actions may be in question or insufficient (Anastasiou, Miller, Dickinson, 2019).

Although households are the sector that contributes the most to food waste (over 50% of all cases) (Fusions, 2016), discarding food because of shelf-life date is also a concern of FBO’s (Rosenlund et al., 2020; de Moraes et al., 2020; Jagtap, Rahimifard, 2019). Their point of view in the matter of shelf-life labelling is rarely discussed in literature. Producers also experience difficulties arising from lack of coherence and consistency of food labelling scheme (European Commission, 2010). It is their own responsibility to judge and decide which type of date – ‘best before’ or ‘use by’ date should be used on the particular food product in accordance with law requirements. Retailers and wholesalers invest heavily in compliance checks to ensure that expired food products are not offered for sale. The checking of date labels is time-consuming and complicated by the lack of uniformity of size, font, and location on the pack which extend the time it takes to complete checks. In the case of large retailers, 100 percent compliance is unlikely to ever be achieved. It was noticed that if there were fewer products with a ‘use by’ date then this challenge would be less (LBRO, 2011). On the other hand, the phenomenon of labelling food products with the ‘use by’ date instead of the date of minimum durability, not for safety reasons, but in order to avoid a situation that a product of reduced quality after the date of minimum durability will go to the consumer, has been already observed (LBRO, 2011). FBO’s are afraid of increased probability of complaints, brand damage, loss of consumer trust, and even loss of the market (Harcar, Karakaya, 2005). Another issue is that interpretation if food can be sold after minimum durability date varies across the European Union – some local regulations are more restrictive and treat selling the outdated ‘best before’ food as an offence (Varallo, 2013; Ustawa, 2019). There is, however, no consensus amongst key players on the impact of possible removing ‘best before’ date on food waste prevention (Raikos, Gassin, 2018). Some manufacturers believe that the period of time during which food operators are responsible for food quality would be undefined if there were no minimum durability dates (Domka-Rybka, 2014).

An efficient food labelling system is necessary to protect all the participants of the food market. A clear and simple shelf-life labelling scheme is needed for conscious consumers’ choices and sustainable consumption. Developing an efficient labelling system or modifying of an existing one requires the consideration and understanding of both consumers’ and producers’ point of view in the discussed area.

The main goal of the present study was to comprehensive assess the European date labelling system from the point of view of market participants in Poland (food producers and consumers) in the context of food waste. The specific research goals correlated with the main goal and were as follows:

- evaluating the functioning system of the shelf-life labelling system, together with an indication of the key problems related to this system from the point of view of food producers in Poland,
- identifying and assessing consumer involvement in the processing of information on the shelf-life of products (in relation to selected food products),
- ascertaining the Polish consumers' perception of the shelf-life labelling system in terms of difficulties in interpretation and understanding of the date types.

3. Material and methods

The achievement of the set goals required an advanced research process including both qualitative and quantitative research. Triangulation of quantitative and qualitative methods allowed for a comprehensive assessment of how the date labelling system is perceived by market participants in Poland. The overview of the research approach is presented in Figure 1.

The research process consisted of three stages:

- stage 1: qualitative research carried out using the individual in-depth interview (IDI) method among senior managers in 18 key producers of food from the following categories: confectionery, tea and coffee, fruit and vegetable products, milk and dairy products. Producers were selected on purpose – they were market leaders in Poland in the analyzed product categories (market shares were the criterion for selecting entities for research). The study was conducted in the period from December 2018 to April 2019, in Poland. The research tool was a semi-structured interview questionnaire;
- stage 2: a qualitative eye-tracking study (ET) conducted among 30 purposefully selected consumers. The research population consisted of consumers declaring the systematic purchase of milk. The study was conducted in July 2019, by employing SMI Eye Tracking Glasses 2 Wireless systems with built-in HD cameras, which automatically corrected errors and recorded eye movements at a speed of 60 Hz. The used ET recorded the respondents' eye directions based on a 3-point calibration. The ET study was prepared using OpenSesame. Additionally, ET was supported by a qualitative research carried out using the individual face-to-face interview method among the participants of the ET survey. The direct interview research tool was the short interview questionnaire;

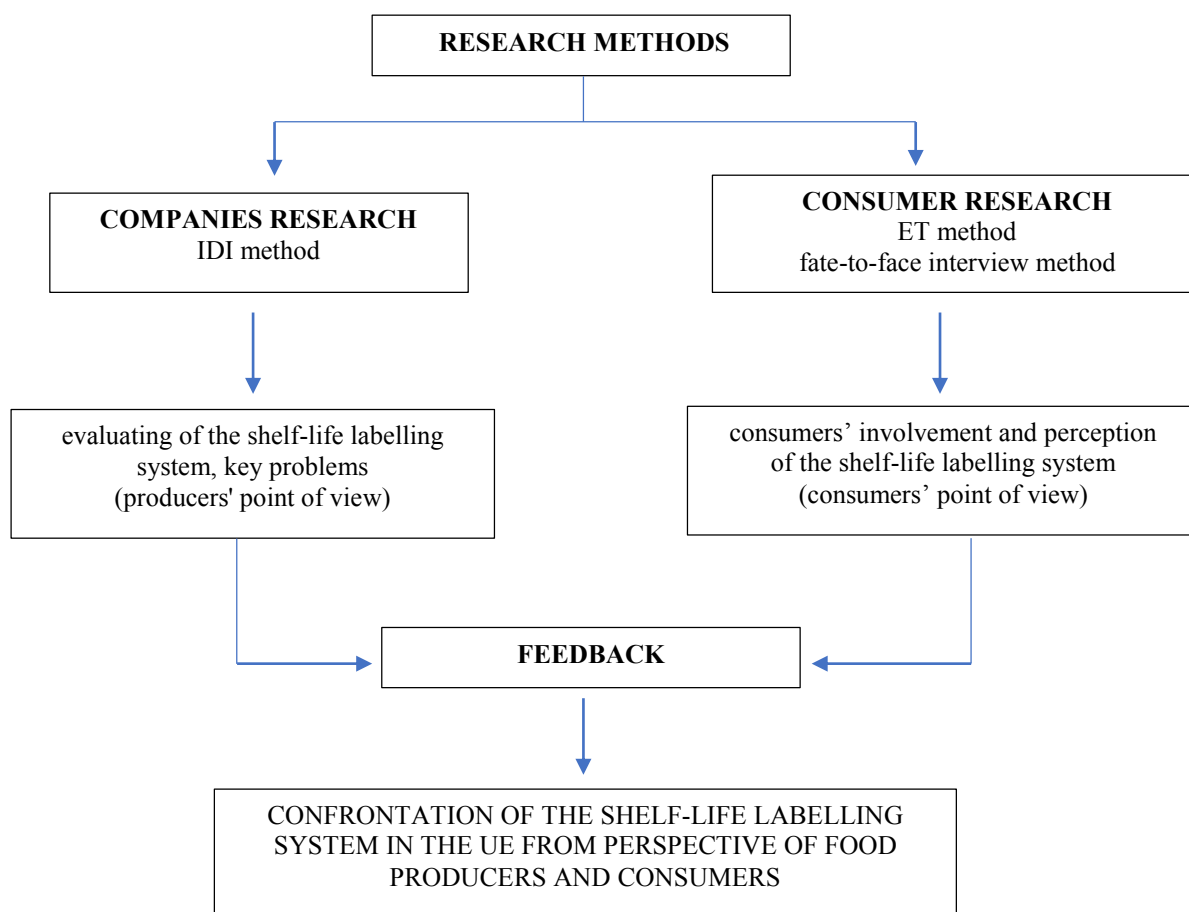


Figure 1. The overview of the research approach. Source: own study.

- stage 3: a quantitative survey conducted by means of applying the face-to-face interview method among consumers in Poland. The research population consisted of consumers declaring the systematic purchase of food products. The selection of the research sample (n = 1145) was carried out by the quota method (selection criteria: gender, age and place of residence), which met the demand for maintaining the relative representativeness of the research population. The study was conducted in the period from April to June 2019. The research tool was an interview-structured questionnaire prepared and verified in piloting (based on the pilot study (n = 100), the interview questionnaire was modified). The interviews of consumers included questions aimed at recognizing the opinions held by individual consumers on communicativeness of the date labelling system, as well as at exploring whether consumers correctly interpret the date labelling. In the process of empirical data analysis, an IBM SPSS Statistics tool was applied.

The conducted research made it possible to confront the consumers' declarations regarding the perception and evaluation of the date labelling system with the actual involvement of consumers in the analysis and processing of information on the 'use by' and 'best before' dates.

4. Results and discussion

4.1. The food date labelling system in the opinion of the surveyed companies

The main goal of the individual in-depth interview (IDI) in the food producers sector in Poland was to assess the merits and faults of the food labelling system currently functioning in Poland and the European Union (in terms of legibility, communication and ease of interpretation). The questions stated in the interviews concerned the following issues:

- assessing communicativeness and ease of interpretation of the date labelling system from the producers' point of view,
- deriving producers' opinions on the possible future simplification of the food date labelling system through:
 1. simplifying the way of minimum durability date indication,
 2. abolishing the concept of 'best before' date,
- identifying the most significant problems related to the current food labelling systems that, in the opinion of producers, may affect consumers' misinterpretation of information.

The IDI survey results are presented in Table 1.

Table 1.

Assessment of the date labelling system by the surveyed companies

Research problems	Food market sectors			
	Confectionery	Milk and dairy products	Coffee and tea	Fruit and vegetable products
Legibility and clarity of communication of date labelling system from enterprises' point of view	<ul style="list-style-type: none"> • the system is quite complicated • the system is readable by FBO's • communicative guidelines, but not very simple 			
The probability of problems in interpretation by consumers according to enterprises' point of view	<ul style="list-style-type: none"> • probably the system is not readable and complicated for consumers • consumers may tend not to differentiate between 'best before' and 'use by' dates • education of consumers with a wide social range is necessary in order to correctly interpret the labelling 			
The preferred way of minimum durability date indication				
– 'best before...' [DD-MM YYYY]		✓		
– simplification the way of date indication: 'best before end...' [MM-YYYY] (or [YYYY])	✓		✓	✓
Abolishing the concept of 'best before' date	unnecessary	unnecessary or only 'use by' date	unnecessary	unnecessary

Source: own study.

According to the results of our survey, companies assess the food date labelling system in the European Union countries as quite complex, but legible from the point of view of entities. This is conditioned by the fact that it is necessary to implement these solutions and adapt to

legal guidelines, which is a *sine qua non*-condition for introducing food products to the market. On the other hand, the surveyed companies suspect that the date labelling system can cause many interpretation difficulties for the consumers. They agreed that the current date labelling system is probably not understandable and communicative for consumers who may have problems with delineating and correctly interpreting the phrases: ‘use by’ and ‘best before’. The above can generate wasting behaviour due to misunderstanding of the information on the product packaging. It should be noted that not only the two kinds of the dates (‘use by’ and ‘best before’), but also a variety of other date formats have been discussed by several authors in the field as key factors causing confusions (Chu et al., 2020).

The surveyed companies unequivocally emphasize that the correct interpretation of information on the shelf-life of food by consumers depends on their awareness and knowledge in this regard. According to the respondents’ opinion, the level of consumer awareness is relatively low, therefore, extensive communication and educational activities in this area should be undertaken. Such actions should be implemented by government regulators, non-governmental organizations and by the economic entities (production and trade) themselves. Upon analysing in full the results of the study in the context of possible future simplification of the labelling system, it can be concluded that the vast majority of the surveyed entities (companies from the sector of confectionery, tea and coffee, fruit and vegetable products) do not see the need to unify the labelling procedure. The surveyed entities have implemented the European Union’s recommendations in this regard and do not see the need for changes. Moreover, their production portfolio includes mainly shelf stable products, so these companies use only minimum durability dates of fairly long term and have no problems with deciding about the type of the shelf-life date.

Simplification of the date labelling system to a single set of terminology has been earlier postulated as a result of interviews conducted with ten industry practitioners from Australia (Chu et al., 2020). In the present study, agreement to this notion is presented, albeit only by companies involved in dairy item production. They take the position that one should consider simplification of the system and limit it to the ‘use by’ date. The view of entities in the milk products sector is due to the fact that they offer both fresh products (e.g. fresh milk – pasteurized and microfiltered milk) and products with a long shelf-life (e.g. UHT milk – ultra high temperature sterilized milk), and the above is related to different ways of labelling products.

Referring to the possible simplification of the way of date indication, entities operating within the milk products market indicated that they prefer to specify the exact date, and entities from other sectors indicated that they prefer giving only the month and year or only a year. Changes of food labelling system consisting of introducing one of the two date types: the date of production or the ‘use by’ date were proposed by one company operating in the confectionery sector. This, in their opinion, would make the date label more readable and understandable for consumers. Moreover, it would reduce the interpretation problems, and thus limit the undesirable, irrational behaviour of consumers related to the consumption of outdated ‘use-by’-

labelled or disposal of products that are safe and edible. The advantage of this proposal would be that it does not deprive consumers of information – an issue that Polish producers had earlier feared (Domka-Rybka, 2014).

4.2. Consumers' interest in shelf-life dates on food packaging

One of the study's goals was to identify the involvement of consumers in Poland in the processing of information on shelf-life of food ('use by' date and 'best before' date) placed on food unit packaging. The test was carried out using the ET technique, which has been employed earlier to gain knowledge on consumer involvement in processing of information regarding food composition and dietary properties (Sielicka-Różyńska, Jerzyk, Gluza, 2021; Bialkova, Grunert, van Trijp, 2020; Zuschke et al., 2020). The subject of the study was the packaging of fresh (pasteurized and microfiltered milk labelled with 'use by' date) and packaging of UHT (ultra high temperature sterilised milk labelled with 'best before' date). The participants' answers to the question: "Do you know the difference between the 'best before' date and the 'use by' date?" showed that not one participant could tell the differences between 'use by' and 'best before' dates. The participants of ET study claimed that these terms are synonyms.

The results of the ET study were presented in the form of heat maps and area of interest analysis (AOI). AOI was distinguished by grouping information elements on the presented milk packages. One of the identified areas of packaging interest was information on the shelf-life of fresh milk (which is communicated by the 'use by' date) and UHT milk (which is communicated by the 'best before' date).

The following ET parameters were used in the analysis of consumer interest in information on the shelf-life of milk placed on the packaging:

- entry time – the time after which the respondent looked at a particular AOI,
- sequence – the order of looking at the selected areas of AOI,
- dwell time – the time of looking at the separated area of the AOI.

Heat maps for fresh milk packaging are presented in Figure 2.



Figure 2. Heat maps of fresh milk packaging. Source: own study.

The basic ET parameters for fresh milk are presented in Table 2.

Table 2.

Basic parameters for ET – fresh milk packaging

Area of interest analysis (AOI)	Entry time in ms (average)	Sequence	Dwell time in ms (average)
A nutrition declaration, 'pasteurised, microfiltered, fresh milk', conditions of storage	2790.3	1	6828.6
'Fresh milk' and fat content (front)	3212.1	2	720.3
Product name (front)	3883.3	3	922.2
Logo (front)	4945.4	4	1006.8
White space	7209.7	5	837.0
'Use by' date	7279.3	6	1571.1
Net quantity (volume) (front)	9915.1	7	130.6
Additional information	10783.1	8	4058.8
Bar code	11074.7	9	111.2
Logo (back)	13147.6	10	442.5
Product name (back)	16719.9	11	262.2
'Fresh milk' and fat content (back)	20193.2	12	276.1
Net quantity (volume) (back)	21401.8	13	95.1

Source: own study.

As shown by the results in Figure 2 and Table 2, in fresh milk packaging, the elements that attract the most attention are nutrition declaration (on the front of the packaging) and information about the product (on the back of the packaging). The respondents devoted relatively much attention to exploring the product's 'use by' date – indeed, it is the third most eye-catching element of the packaging. The subjects looked at it for an average of 1571 ms. After the packaging elements are normalized (that is, taking into account their size), the 'use-by' date becomes the area that attracts the most attention. Heat maps for UHT milk packaging are shown in Figure 3.



Figure 3. Heat maps of UHT milk packaging. Source: own study.

The basic ET parameters for fresh milk are presented in Table 3.

Table 3.

Basic parameters for ET – UHT milk packaging

Area of interest analysis (AOI)	Entry time in ms (average)	Sequence	Dwell time in ms (average)
Product name (front)	2873.6	1	1507.4
A nutrition declaration, 'UHT milk', conditions of storage	4662.7	2	7279.7
Fat content (front)	5532.1	3	416.1
White space	5580.7	4	885.4
Logo (front)	5789.9	5	259.8
Product name (back)	6970.0	6	1455.9
Additional information	7556.0	7	2418.9
'Best before' date	8826.2	8	1918.7
'Source of calcium' nutrition claim	9264.8	9	552.3
Logo (back)	9743.8	10	186.0
Fat content (back)	9880.0	11	232.4
Bar code	10345.3	12	106.4
Net quantity (volume)	13057.0	13	159.6

Source: own study.

In the case of UHT milk, the packaging elements that attract the most attention are the nutrition declaration and detailed information about the product. The surveyed individuals devoted relatively much attention to the exploration of the date of minimum durability – it was the third most eye-catching element of the packaging. The surveyed looked at it for an average of 1919 ms. Detailed product information remains the area that attracts the most attention after standardization of packaging components (taking into account their size).

Summarizing the results of ET in terms of consumer involvement in the processing of information on shelf-life placed on milk packaging, it can be stated that regardless of the product category (fresh milk/UHT milk), the information about the 'use-by' or 'best before' date attracted relatively much respondent attention. The results obtained in this study are in agreement with a study of Świda, Halagarda, Popek (2018), where the most sought information was the 'use by' or 'best before' date, followed by the product composition and the name of the producer. Świda, Halagarda, Popek (2018) demonstrated that ease of finding the shelf-life date depended on the age of consumers and the place where the information was printed on the packaging.

4.3. Consumer perception and interpretation of the food date labelling system

In this study, we also sought to identify the opinions of individual consumers on the communicativeness of the date labelling system and to assess whether consumers correctly interpret the assigned date labelling. The following question was asked: "How do you rate the date labelling system in terms of ease of interpretation?". As shown in Table 4, most consumers in Poland (66.4%) declare that the date labelling system is not difficult to interpret (it is very easy/easy/rather easy). In turn, 19.0% of the respondents cannot assess it, and 14.6% claim that

the system is difficult to interpret (very difficult/difficult/rather difficult). Therefore, it can be assumed that 2/3 of consumers in Poland evaluate the date labelling system positively in terms of ease of interpretation, while the remaining 1/3 of consumers have difficulties with the correct interpretation of the information proffered by the ‘use by’ and ‘best before’ dates.

It should be noted that incorrect interpretation may lead to irrational behaviour of consumers with regard to food handling after expiration, i.e. tasting, consuming or processing outdated food labelled with the ‘use by’ date, which is associated with a high health risk. On the other hand, consumers may irrationally throw away expired food labelled with a minimum durability date, which would contribute to increasing food waste. In this context, an interesting research issue was also to discern consumer opinions about interpretation difficulties with regard to the date labelling system, taking into account the variables of consumer gender and education.

Table 4.

Assessment of the food labeling system in terms of ease of interpretation (%)

Variants of answers	Total		Women		Men	
Very difficult to interpret	0.9	14.6	1.1	14.0	0.6	13.3
Difficult to interpret	4.8		4.5		5.3	
Rather difficult to interpret	8.0		8.4		7.4	
I have no opinion	19.0		16.9		21.4	
Rather easy to interpret	35.9	66.4	36.4	69.1	35.6	65.3
Easy to interpret	22.9		24.8		20.6	
Very easy to interpret	8.5		7.9		9.1	

Source: own study.

The analysis of the assessment of the difficulty in interpreting information on the ‘use by’ and ‘best before’ dates in relation to the gender of consumers using the independent samples t-test showed no statistically significant differences in the case of gender (two-sided significance 0.577). Therefore, it can be assumed that gender is not a variable differentiating consumer opinions in the analyzed scope, which is reflected in Table 5.

Table 5.

Independent samples t-test

-	Levene's test of equality of variances		Test t for Equality of Means				
	S	Sig.	t	df	Sig.	Means Difference	Std Error Difference
Equal variances assumed	0.080	0.777	-0.558	1133.0	0.577	-0.043	0.076
Equal variances no assumed			-0.559	1095.710	0.577	-0.043	0.000

Source: own study.

In the case of consumer education, the starting point for the analysis was the assessment of the significance index between the variables (‘assessment of the current food labelling system for ease of interpretation’ and ‘consumer education’) in terms of the education of the respondents based on the one-way analysis of variance and the Spearman correlation index. The results of the one-way ANOVA presented in Table 6 show a significance level of 0.000,

which means that the differences in answers due to the level of consumer education are statistically significant.

Table 6.

The results of one-way Anova

Source of variation	Sum of Squares	df	Mean Square	S	Sig.
Between groups	49.131	3	16.377	10.327	0.000
Within groups	1761.789	1111	1.586		
Total	1810.920	1114			

Source: own study.

The assessment of the food date labelling system in terms of ease of interpretation depending on the education of consumers is presented in Figure 4.

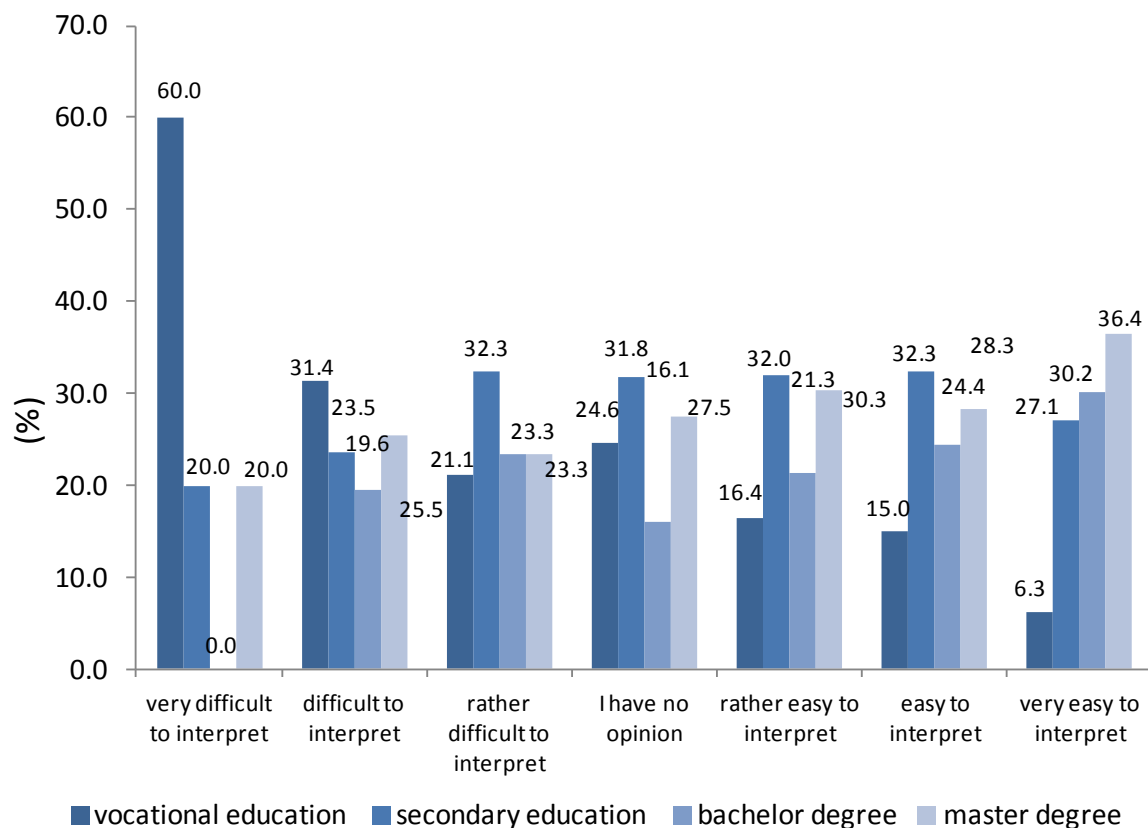


Figure 4. The assessment of the food date labelling system in terms of ease of interpretation depending on the education of consumers. Source: own study.

Our survey results indicate that the degree of difficulty in interpreting information on the ‘use by’ or ‘best before’ dates of a food depends on the education level. In general, it can be stated that, in the opinion of more educated consumers, the food date labelling system is easy to interpret. In contrast, in the segment of consumers who declare that the information on the ‘use by’ or ‘best before’ dates is difficult to interpret, the highest percentage are consumers with the lowest level of education. For example: in the segment of consumers who rate the food date labelling system as ‘very difficult to interpret’ as many as 60.0% are people with vocational education. In the segments assessing this system as ‘difficult’ and ‘rather difficult’, 31.4% and

21.1% of consumers have vocational education. On the other hand, in the group of consumers who evaluate the date labelling system as easy to understand, a higher percentage of consumers have a bachelor's / master's degree. For example: the answer 'very easy' is declared by only 6.3% of consumers with a vocational training, but as many as 36.5% with a master degree. Therefore, it can be concluded that most consumers with a higher level of education declare that the current date labelling system is 'very easy / easy / rather easy' to interpret; in turn, in the opinion of consumers with the lowest education level, this system is difficult to interpret.

In the literature, no consistency exists over the role of gender and level of education on household food waste (Falasconi et al., 2019; Fanelli, 2019; Schanes, Dobernig, Gözet, 2018; Filipová et al., 2017). There are data, however, showing positive correlation between level of education with food provisioning in households (Fami et al., 2021; Karunasena, Ananda, Pearson, 2021).

Ease of understanding of food labelling system is important for proper food handling, therefore, our study points the role of out-of-school consumer education, especially for less educated individuals. Uncertainty about how to proceed with food after passing shelf-life date and doubts regarding its safety is the driver of food waste (Ankiel, Samotyja, 2020). Consumers who find the date labelling system difficult to understand may represent less motivated preventive behaviour (van Geffen et al., 2020).

Another research objective was to assess whether consumers correctly interpret the information on the 'use by' and 'best before' dates on product packaging. Consumers were shown two dates (one minimum durability date and one 'use by' date) and asked a question if food can be consumed after passing of the dates. The results (Table 7) show that in the case of the date of minimum durability, only 61.0% of consumers were able to correctly interpret it, more than 1/3 of the respondents interpreted it incorrectly (indicating, for example, that after this date food should not be consumed, but disposed of), and 5.0% did not know how to interpret this information. More optimistic results were obtained in the case of the 'use by' date – a much larger percentage of consumers – 79.0% were able to correctly interpret this information, while 21.0% of all respondents misinterpreted it or admitted that they could not do so.

Table 7.

Interpretation of the 'use by' and 'best before' dates by consumers (%)

Variants of answers	Correct interpretation	Incorrect interpretation	'I don't know'
Best before 05.06.2020	61.0	33.9	5.1
Use by 05.06.2020	79.0	16.1	4.9

Source: own study.

The percentage of consumers who do not understand shelf-life dates, as well as consumers who rate the labelling system as difficult is not optimistic. Our results are in agreement with studies conducted in other European countries in which consumers' confusion about the date label was indicated (Toma, Font, Thompson, 2020; Van Boxtael et al., 2014). In the study of Wikström et al. (2014), consumers express the need for clear shelf-life information. The above

underlines the notions that the date labelling system in force in the European Union countries is ineffective from the consumers' point of view, and that consumers in the EU (including Poland) are not properly educated. The potential effects of poor communicativeness and readability of the shelf-life labelling system are presented in Figure 5.

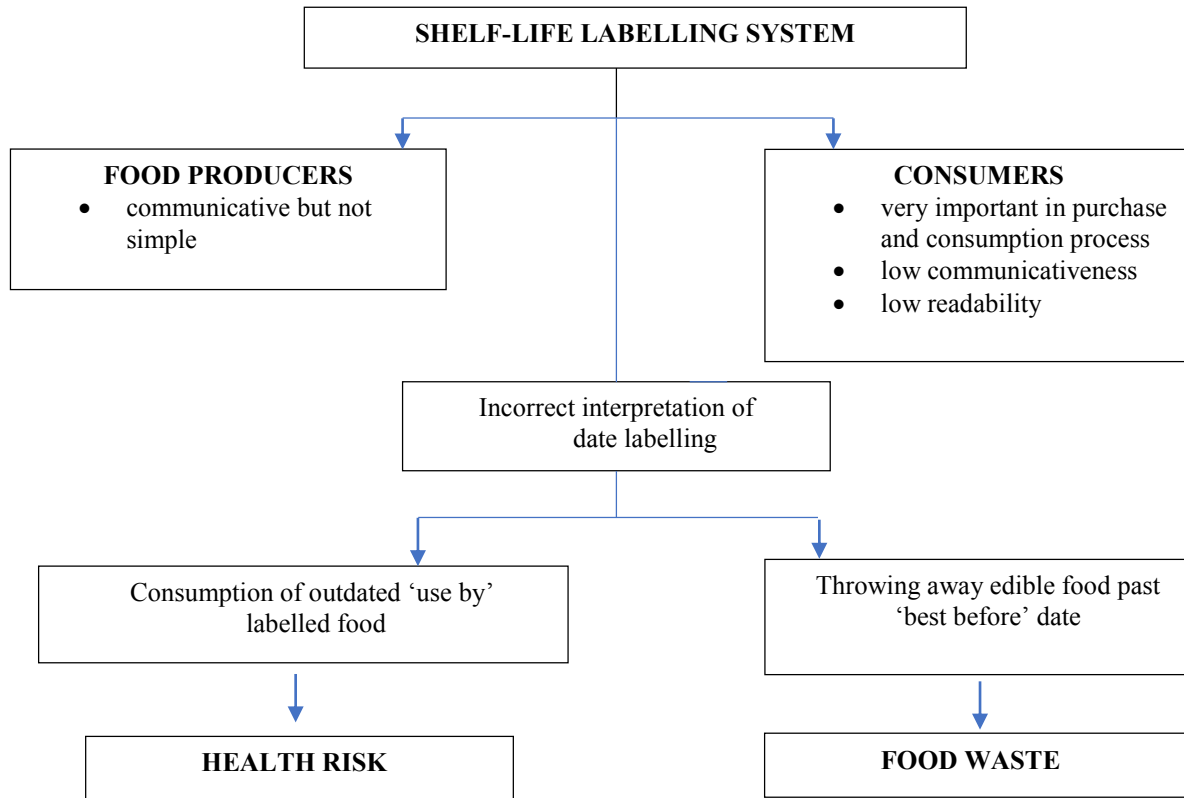


Figure 5. Potential effects of poor communicativeness and readability of the date labeling system
Source: own study.

Misinterpretation of the 'best before' date labels contributes to global food waste problem because edible and safe food is being thrown away. Schanes, Dobernig, Gözet (2018) state that a big potential for reducing food waste lies in optimising labels, e.g. redesigning them or adding additional guidance. During the Covid-19 virus outbreak lockdown, the problem of food wastage due to expiration dates in households was maintained (Jribi et al., 2020).

5. Conclusions and recommendations

The advanced research process, involving the food market in Poland, provides interesting conclusions and allowed for numerous recommendations. Firstly, the date labelling system functioning in the EU countries was assessed by the survey participants as not very communicative and legible. Still, companies have adopted this system (which was a mandatory requirement on the food market), and it is understandable to them. According to the majority

of enterprises operating in the field of food supply, possible unification of the system to only one type of the date is not necessary; the only exception are companies working within the milk sector, which would benefit from this solution. In the opinion of food producers, however, consumers may have a problem with distinguishing and thus correctly interpreting 'use by' and 'best before' dates. This assumption has been confirmed in research conducted among food consumers in Poland.

Information on the 'use by' or 'best before' date is one of the most important pieces of information engaging consumers' interest. Consumer involvement in processing information on the shelf-life dates should, therefore, be associated with the correct interpretation of this information, otherwise the information will not play its intended role.

What actions should be taken to increase consumer awareness of the date labelling system and to avoid mishandling out-dated food? The surveyed companies indicate that consumer education is of key importance in this respect. Consumers' interest in shelf-life dates, as indicated in the ET study, is optimistic and should be treated, along with consumer education, as an opportunity to advance communication. Educational activities should be carried out not only for mature consumers, but also for young market participants (primary school students) using various channels and forms of communication, such as traditional media, social media, lectures and projects. Communication at points of sale in the form of banners and posters explaining how to interpret shelf-life information is also important.

That less educated consumers admit that the information on the date labels is difficult for them indicates that there is a need to initiate campaigns especially dedicated for this segment of the food market. Companies should consider the possibility of placing additional educational information on the packaging, both in the form of linguistic and graphic signs (pictograms), which have a high communication value. Intelligent food packaging is a relatively new and quite popular solution used in some markets. Such packaging allows traders and consumers to continuously assess the quality condition of the packaged food as it very communicatively and simply indicates when the food should be thrown away because it is not suitable for consumption. Unfortunately, such solutions have not been implemented on the Polish food market yet, mainly due to the high commercialization costs. Therefore, the most important actions that should be taken are educational activities that will increase consumer awareness of the date labelling system and of food waste.

Beyond the aforementioned, special care should be paid during revisiting the existing law regulation and during prospective changing of the rules or improvement of expression and presentation of food dating. Our study showed how much market position and point of view of producers and consumers differs and how great the challenge is in designing a system that would be suitable for all FBOs.

6. Limitations and future research directions

The study and its conclusions have limitations related to the adopted research procedure and the research method and technique. It is worth emphasizing that the respondents' answers, and thus the research results, are partially declarative. Consumers' declarations may differ from their actual behaviour in the process of purchasing and consuming food products. However, the used ET test allows recognition of the consumers' actual behaviour, in this case concerning their interest in the information on the 'use by' and 'best before' dates placed on the packaging.

One of the significant research limitations in the ET study came about with regard to the information on the shelf-life of fresh and UHT milk. This is due to the fact that in Poland, producers market fresh and UHT milk in different packaging, both in terms of graphics, colours and often – construction forms). Nevertheless, it would be interesting to recognize the role and importance of information on food durability in the food purchasing process, and to examine the interpretation of this information in the purchasing and consumption process (e.g. in the course of ethnographic research).

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POLITICAL INSTABILITY AS A RISK FACTOR FOR PPP PROJECT SUCCESS – A CASE STUDY OF THE HUNGARIAN M1/M15 MOTORWAY PROJECT

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Purpose: The main aim of this paper is to analyze political instability as a risk factor for public-private partnership (hereinafter: PPP) project success on the case of the 1992 Hungarian M1/M15 motorway project. Furthermore, it also examines the project success framework and critical success factors in PPPs, as well as project risk division and proper risk allocation.

Design/methodology/approach: The text includes a review of relevant literature in the field of political instability and risk management pertaining to PPPs, in combination with a case study illustrating the impact of political instability on a PPP project.

Findings: The findings of the case study suggest that Hungary's institutions at the time of the project did not offer the necessary safeguards against governmental abuse of bargaining power. Independent courts are essential for the success of public-private partnerships, in combination with an emphasis on the protection of property rights and the rule of law. A well-functioning institutional and legal framework offer protection against the failure of public-private partnership projects and constitute a critical success factor for PPPs.

Practical implications: Despite growing social infrastructure investment needs, PPP is not developing in accordance with expectations in the majority of developing and emerging economies. Political stability is an essential factor in any development process and happens to be one of the most distinguishing factors between developed and developing countries, in which PPP schemes are underutilized despite an enormous potential for more private sector involvement. Countries lacking independent courts may strongly benefit from alternative dispute resolution procedures. The retention of a larger amount of project risk by the public party may additionally prove to be helpful for the development of PPP markets in nations lacking institutional and political stability.

Originality/value: The research problem identified in this paper concerns the implications of political instability – a global phenomenon of growing significance, on the success of PPP projects. The obtained results may be of interest to representatives of science and practice, especially with regards to developing countries, as well as emerging economies.

Keywords: public-private partnership, risk allocation, political instability, PPP barriers, critical success factors.

Category of the paper: Research paper.

1. Introduction

Public-private partnership is increasingly becoming the method of choice for social infrastructure investments by combining the retention of governmental control with the harnessing of private sector efficiencies (Luqmani and Quraeshi, 2011). Said mode of social infrastructure financing may be particularly beneficial to nations with developing and emerging economies, due to lacking funds and know-how for the self-realization of necessary social infrastructure investments (Otairu et al., 2014). The applicability of PPP to developing nations however leads to the question of the impact and risk of political instability on PPP project success, which this article aims to address with an analysis of existing literature on critical success factors and risks of PPPs, in combination with a case study of the Hungarian M1/M15 motorway project.

2. Project success framework

Before addressing critical factors and risks influencing the PPP project success, it is important to set a framework for what project success entails. The body of research in the field of project success definition and measurement is extensive, and a brief overview thereof is provided in this paragraph.

PPP project success can be defined as a timely and satisfactorily completed project which meets the stakeholders' expectations (Hai et al., 2022). In their research, Ika (2009) defined project success to constitute a compliance with cost, time and quality constraints. Baccarini (1999) claimed that a PPP project's success was achieved when it met the expectations of clients, end users and stakeholders.

De Wit (1988) extensively researched the measures and criteria of project success. He made an interesting case for the distinction between the project management success, and the overall success of a project, claiming that especially at lower managerial levels the two may be at odds with each other. A similar observation has been made by Baker et al. (2008), who argued that a satisfactory final result outweighs successes in upholding the project schedule or performance, stating that "[i]n the long run, what really matters is whether the parties associated with, and affected by, a project are satisfied. Good schedule and cost performance means very little in the face of a poor performing end product" (Baker et al., 2008, p. 685).

De Wit (1988) argues that measures are the most effective way of determining whether or not a project can be classified as successful. "[I]t appears unlikely that any project can be a complete success for all stakeholders during the entire life of the project. Therefore, referring

to a project as being a success or a failure without qualification is a nonsense” (de Wit, 1988, p. 168). De Wit (1988) outlined the following three measures for the success of a project:

1. The project’s functionality:
 - The financial functionality.
 - The technical functionality.
 - Functionality derived otherwise.
2. The project management:
 - The budget.
 - The schedule.
 - Technical specifications.
3. The contractors’ commercial performances:
 - Short term.
 - Long term.

He also claimed that different measures may apply for governmental projects. De Wit (1988) argued that the success of governmental projects can primarily be defined in terms of satisfaction by those affected – i.e. the citizens. He outlined the following factors for the performance assessment of public sector projects:

- A favorable environment.
- Winning skill in bureaucratic politics through four strategies:
 1. Differentiation.
 2. Co-optation.
 3. Moderation.
 4. Managerial innovation.
- An ability to manage technological development.

De Wit (1988) claimed that with public sector projects, perceived success is more important than real success due to politics playing a dominant role. With the satisfaction of the citizens constituting a key measure of success, the absence of criticism can hence be considered a marker of success. The above mentioned measures offer a foundational framework for the further elaboration of critical success factors of PPP projects.

2.1. Critical success factors for PPPs

The term critical success factors (hereinafter: CSFs) has been used in management science since the second half of the 20th century, defined by Rockart (1982) as “those few key areas of activity in which favorable results are absolutely necessary for a manager to reach his/her goals” (Rockart, 1982, p. 4). CSFs have also been extensively studied in application to public-private partnership projects, offering important variables influencing the successful achievement of the PPP project objectives.

In their review of studies on CSFs for PPP projects from 1990 to 2013, Osei-Kyei and Chan (2015) outlined the top five CSFs in PPPs, which are:

1. Appropriate risk allocation and sharing.
2. A strong private consortium.
3. Political support.
4. Community/public support.
5. Transparent procurement.

Aerts et al. (2014) organized PPP CSFs into eight categories, a structural overview of which is visible in Figure 1.

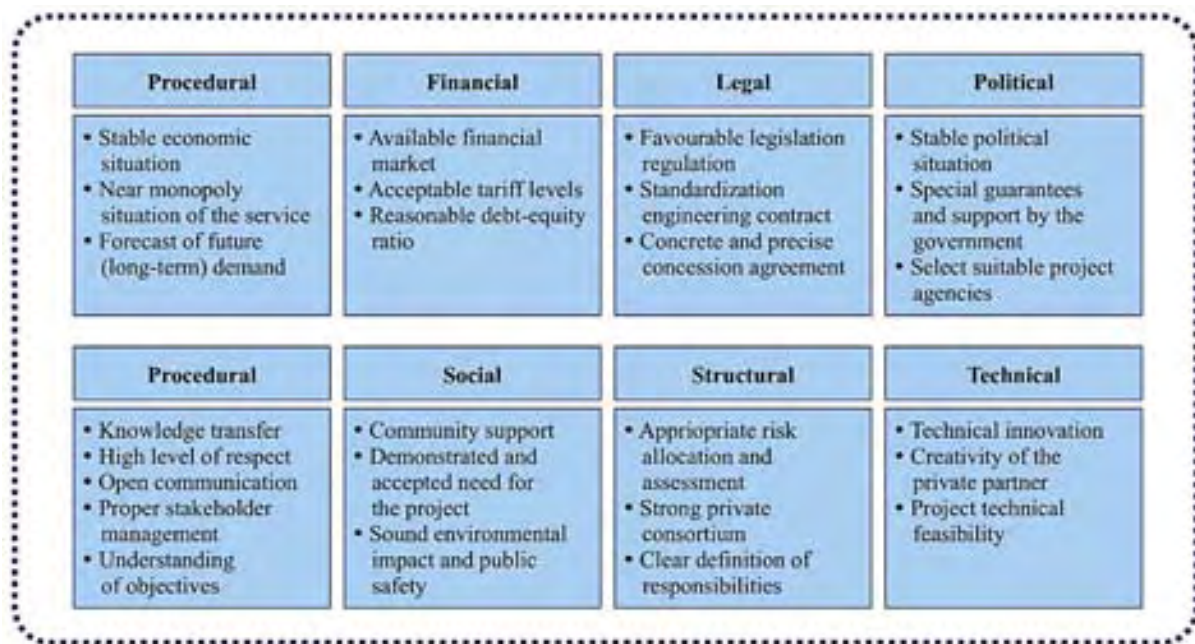


Figure 1. The Critical Success Factors of PPPs. Source: own elaboration, based on Aerts et al. (2014), p. 278.

CSFs offer a useful framework for the analysis of PPP projects and should be taken into account prior to the conclusion of a PPP contract. Not doing so may increase the risk of PPP project failure (Toriola-Coker et al., 2021).

3. Risk factors in PPPs

The identification and proper allocation of risks within a PPP project pose a key element of success. A PPP risk factor not being properly accounted for has the potential to significantly lower the chance of the PPP project being completed (Khahro et al., 2021). This paragraph outlines the main types of risks within public-private partnership projects, as well as the mechanisms of risk allocation.

The Project Management Institute (PMI) defines individual risk as “(...) an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives” (Hillson, 2014). PMI states that overall project risk, on the other hand, is defined as “the effect of uncertainty on the project as a whole [constituting] more than the sum of individual risks within a project, since it includes all sources of project uncertainty [and] represents the exposure of stakeholders to the implications of variations in project outcome, both positive and negative” (Hillson, 2014). Although project risks can be both – positive and negative, negative risks are more frequent and impactful on the project outcome “[...] because there are many more things that can go wrong than go right, and because we are always trying to place emphasis on doing the job as quickly and cheaply as possible” (Vose, 2008, p. 474).

Public-private partnership projects are generally characterized by all of the parties involved having a preference to be allocated as little of the project risk as possible (Jiang et al., 2021). From the perspective of the private entity, the more of the PPP project risk is retained by the granting authority, the safer and more lucrative it becomes. The public entity therefor may increase PPP competition for the project by retaining a larger portion of the risk. An increase in competition, on the other hand, is known to lower the final price, as well as is likely to drive up the quality of the final infrastructure investment (Nisar, 2007). It must however also be noted that the majority of public entities is opposed to retaining a larger amount of the project risks (Zimmermann et al., 2014). The preference for retaining as little risk as possible is understandable, however may ultimately prove to be more expansive, as well as lead to a lower quality end result.

Wolański et al. (2017) outlined the seven main risk categories which apply to public-private partnership projects:

1. Completion risk
→ A group of risks that appear at design and construction stages.
2. Operating risk
→ Risks of higher operating costs during the operation phase.
3. Revenue risk
→ Risk of lower revenues, caused by low demand.
4. Financial risk
→ Due to increased financing costs etc.
5. Force majeure risks
→ Such as wars, natural disasters.
6. Legal, regulatory and political risks
→ Caused by strategic changes of government policy.
7. Project default risk
→ An ultimate result of other risks.

The above mentioned risks should be determined as they apply to a given project prior to the procurement process. Once the risks of a given project are identified, they should then be divided between the public entity and project company in accordance with the entity's specific qualifications in managing said risks.

Wolański et al. (2017) showcased the ways in which said PPP risks can be allocated, namely:

1. Retained by a granting authority.
2. Transferred to a project company:
 - Retained by it.
 - Passed to its subcontractors.
 - Covered by insurance.
 - Covered by sponsors.
3. Transferred to end users.

In the specific case of PPPs, all of the parties involved (the public sector, the private sector, insurance companies, financial institutions etc.) should determine the amount of risk willing to take, according to their expected return (Sastoque et al., 2016). A phenomenon frequently observable in PPPs is the so-called optimism bias, according to which the company with unrealistically optimistic forecasts has a higher likelihood of winning the contract, thereby increasing the risk of revenue shortfalls. This should be taken into account by public entities seeking PPPs as to avoid an increased likelihood of project failure. Wolański et al. (2017) grouped the PPP risks they outlined into a risk matrix, showcasing the allocation of the specific risk types visible in Table 1.

Table 1.

The risk matrix and allocation of the specific risk types for a PPP project

	Main risks that are usually retained by public authority	Main risks that are usually transferred to the project company (<i>a way how the project company deals with the risk</i>)	Main risks that may be shared or transferred in different ways
Completion risk	Land acquisition, protestors, changes made by a public authority	Cost overruns, construction delays (passed to the general contractor – <i>completion bond, partially insured</i>)	Site risks (geological archaeological, environmental)
Operating risk	General price level increase	Increase of opex in real terms (mostly retained, mitigated by long-term contracts), additional maintenance or defects (passed to general contractor – <i>maintenance bond</i>)	-
Revenue risk	-	-	Risk of low usage (although there are tendencies to limit its' transfer to the project company)

Cont. table 1

Financial risks	Risk of changing conditions at financial markets before financial close (in most of cases)	Loan availability and rates, exchange rates after financial close (mostly handled by the project company using hedging tools, but can be decreased by a public party by such tools as guarantees)	-
Force majeure risk	-	Natural disasters (<i>insured</i>) Wars, acts of terrorism (<i>retained by the project company</i>)	-
Legal, political and regulatory risk	Project or PPP specific legal, political and regulatory changes	General legal, political and regulatory changes, for example changes in general tax rates (<i>retained by the project company</i>)	-

Source: Wolański et al. (2017), p. 42.

In summary, the proper definition and allocation of risks within a PPP project constitute an important element in the overall success of the project. The more of the risk is placed onto the project company, the higher the price of the project. Optimism bias constitutes a risk for the public entity and should be taken into account in public procurement procedures.

4. Political instability and PPPs

Political instability is understood as the propensity for government change and is proven to have a negative impact on economic growth (Gurgul and Lach, 2013). The growth and development of any nation is however greatly dependent on the availability of basic public infrastructure and services (Otairu et al., 2014).

Political instability falls under the sixth PPP risk category outlined by Wolański et al. (2017) – that of legal, regulatory and political risks caused by strategic changes of government policy. According to Otairu et al. (2014) “[p]olitical stability is an essential factor in any development process, and this happens to be one of the most distinguishing factors between developing and developed countries. Political stability does not mean the absence of violence alone; it also includes program continuity, which is responsible for development failures in developing countries. Too often, new leadership tends to see discontinuing the previous government’s programs as their first act in office, thereby creating additional risks for PPP investors” (Otairu et al., 2014, p. 190).

Independent courts are essential for the success of public-private partnerships, in combination with an emphasis on the protection of property rights. A good institutional and legal framework offer protection against corruption and political abuse of power, which is observable in developing and emerging economies in need of social infrastructure investment. Although many nations utilize private-sector involvement via PPPs for the financing of social infrastructure, PPP schemes are underutilized in developing economies, where the potential financing gaps are significant, in combination with an enormous potential for more private

sector involvement (Queiroz, 2007). Otairu et al. (2014) discovered five factors responsible for the slow growth of PPPs, namely:

1. Government policy on infrastructure.
2. Lack of consensus among policy makers.
3. Political instability.
4. Lack of understanding of the PPP concept.
5. High participation costs

The third factor outlined by Otairu et al. (2014) – political instability, has negatively impacted numerous PPP projects. It acts as a disincentive for private entities seeking to conduct PPPs due to politically unstable governments not being considered trustworthy partners. Particularly the lack of proper institutional and legal frameworks is a phenomenon frequently observable in politically unstable nations, making PPP projects significantly more risky for the private entities involved (Aladağ et al., 2021). An example of the negative impact of political instability on PPP project success can be found when analyzing the case of the Hungarian M1/M15 motorway project.

5. Case study of the Hungarian M1/M15 motorway project

The fall of the Soviet Union led to fundamental economic and political changes, providing Hungary with large opportunities for development. Said opportunities were however undermined by a lack of adequate transportation infrastructure, restricting the access to new markets, as well as the free flow of passengers and goods (Timár, 1994). During the wake of political changes, characterized by Hungary's transition toward a market economy, the country faced significant budgetary constraints, which limited public financing or borrowing for the construction of the necessary transportation infrastructure (Adam, 1995). Hungary hence sought public-private partnerships for the financing of motorways, which was made possible by a new regulatory framework enabling Build-Operate-Transfer (BOT) concessions.

The Hungarian PPP motorway program began in 1992 and constituted a pioneering development for PPPs in the former Eastern Bloc, being the first privately financed and tolled infrastructure project in Hungary. The first investments within said program were the M1 and M15 motorways connecting Budapest with Vienna as part of the Trans-European Transport Network (TEN-T) Helsinki Corridor IV. The stretch of road to be covered by the PPP program was below 60 km – 43 km on the M1 and 14 km on the M15. (Koszyó and Mészáros, 2005). ELMKA Rt. won the procurement process and was granted the concession to build and operate the motorway. The motorway was successfully delivered on time and within the predicted budget in January of 1996, despite a high inflation rate (up to 30%) and heavy snowfalls during the end of the construction phase (Wolański et al., 2017). The role of the Hungarian government

was limited to providing the necessary land, as well as to build new feeder roads for the motorway – placing the majority of the project risk on the private partner.

The loan for the financing of the project was granted to ELMKA Rt. in USD and DEM by a consortium of international banks under the leadership of the European Bank for Reconstruction and Development in London. Considering the growing inflation rate in Hungary, the foreign currency of the loan would present an increasing problem to ELMKA Rt. The interest, amortization and operating cost of the project were to be fully financed with toll road charges collected in HUF, the value of which would drastically deteriorate throughout the project's lifetime. The tolls were to be regulated according to a price-capping scheme in which tolls could be adjusted according to the increase in the consumer price index and exchange rate changes (USD/HUF, DEM/HUF), without prior permission of the authorities (Kosztjó and Mészáros, 2005). Toll started to be collected in 1996. It however quickly turned out that the agreed toll rate from 1993 became insupportably high by the opening date. The Hungarian currency faced significant inflation, combined and a drop in real incomes. The motorways hence mostly attracted international travelers possessing a higher willingness to pay for high quality roads. Domestic drivers in need of using the road more frequently almost exclusively switched to secondary roads due to not possessing the necessary purchasing power. This led to an increasing disapproval of the project by the Hungarian population. Shortly after making the road available for use, a large number of legal cases were filed against ELMKA Rt. Although the private company charged the amount to which the Hungarian government contractually agreed, courts ruled against ELMKA Rt. stating that the toll charges were unfair and extremely high as compared to other public services, enforcing the lowering of the toll charge. The company was also accused and found guilty of abusing its' dominant market position, despite not breaking the concession agreement in any way.

This came in addition to another negative development of the project – traffic flows between Yugoslavia and Western Europe, which were predicted to use this corridor, significantly decreased due the Yugoslavian War. Hungarians also limited their visits to Austria, with most of the previously unavailable consumer goods becoming available in Hungary. Said reduced traffic in combination to the high cost associated with the legal cases placed a lot of strain ELMKA Rt., and in 1999 it ultimately went bankrupt. The Government then decided to nationalize the project company, taking over the responsibilities and liabilities of the motorway.

The failure of the PPP project and ultimate bankruptcy of the project company acted as a strong deterrent for private entities to conduct PPPs in Hungary. They no longer viewed the Hungarian government as a trustworthy partner – ELMKA Rt. delivered the project within budget and time, and at no point broke the concession agreement. Hungarian courts however ruled against the project company, accusing it of price gouging and abuse of its' dominant market position.

5.1. The success framework of the M1/M15 motorway project

The M1/M15 PPP motorway project showcases an example of the theory outlined by de Wit (1988), according to which there is a distinction to be made between the project management success, and the overall success of a project.

From a project management perspective, the motorway project can to a certain degree be considered successful. ELMKA Rt. delivered the project on time and within the predicted budget, despite a high inflation rate and heavy snowfalls during the end of the construction phase. The project company at no point broke the concession agreement, and the road itself was well constructed.

An overall success was however not present. De Wit (1988) argued that the success of a governmental project can primarily be defined in terms of satisfaction by those affected. Hungarian citizens, who needed to use the motorway most frequently, were unable to do so due to not possessing the necessary purchasing power. This led to a number of court cases, in combination to a growing pressure on politicians, leading to the ultimate nationalization of the project company. Therefore, the M1/M15 motorway project can be considered a failure from an overall project perspective.

5.2. Risk division of the M1/M15 motorway project

When applying the risk criteria developed by Wolański et al. (2017) to the motorway project, it becomes evident that the majority of the risks within the PPP project was transferred to ELMKA Rt. The private company took over the project completion risk, which became present with unfavorable weather conditions (heavy snowfall) during the construction phase. The operating and revenue risks were also placed onto ELMKA Rt., as became evident when the road traffic fell below the predicted rates due to the lowering of the purchasing power of the Hungarian currency. This in turn significantly decreased the revenue of the project company, which was in no way mitigated or reimbursed by the public authorities.

The private company's revenue was to be collected in Hungarian currency. The loans for the construction of the project were however taken out in foreign currencies. The high inflation rate of the HUF hence placed an increasing strain onto ELMKA Rt., placing the financial risk of the project onto the private company as well.

5.3. The presence of critical success factors in the M1/M15 motorway project

Only two of the five PPP CSFs outlined by Osei-Kyei and Chan (2015) were present in the M1/M15 motorway project. The project showcased a strong private consortium, in combination with a transparent procurement procedure. ELMKA Rt. was granted the concession of the project after providing the cheapest offer in the procurement process. The loan for the financing of the project was granted to the company by a consortium of international banks under the leadership of the European Bank for Reconstruction and Development in London.

Project risks were however not allocated properly, placing the majority of risks onto the project company. Community / public support was also not present, as the Hungarian population did not possess the necessary purchasing power to use the road. Citizens were hence forced to switch to secondary roads as to avoid the toll charges, leading to a growing level of dissatisfaction. Said dissatisfaction caused the filing of lawsuits, as well as a decrease of political support for the project, with Hungarian courts ultimately ruling against the project company. Taking into account the lack of the majority of PPP CSFs, it is no surprise that the project ultimately failed.

5.4. The role of political instability in the failure of the M1/M15 motorway project

The motorway project took place in the early to mid-1990s, shortly after the fall of the Soviet Union. At that point in time, Hungary was undergoing major economic and political changes, characterized by the country's transition toward a market economy. This also led to significant institutional changes, such as the passing of new laws and a complete overturn of the previous regulatory framework supporting a centrally planned economy.

During that time period, Hungary's political and institutional systems were unstable, negatively affecting of the PPP project. According to Kosztyó and Mészáros (2005), one of the primary determining factors for the project's failure was the Hungarian institutional framework's susceptibility to regulatory risk. Regulatory risk refers to a situation where the private investor has already made their investments (in the form of 'sunk costs') and thereby becomes exploitable by the government or regulatory authorities. Said regulatory authorities, on the other hand, are largely guided by public pressure, which became present with the Hungarian population's growing dissatisfaction over the high toll charges.

Taking into account that social infrastructure is by its very nature used by a large percentage of the voting population, politicians have an incentive to exploit the investor's weak bargaining situation. In the case of the project, this exploitation took place with Hungarian court's ruling against the project company and forcing it to lower the toll charges.

The exploitation of said bargaining point is however only possible in an environment without strong institutional safeguards against opportunistic behavior. According to Kosztyó and Mészáros (2005), such safeguards can be present in the form of an inviolable tradition of protecting property rights, as well as strong and independent courts. Hungary's institutions at the time of the M1/M15 PPP motorway project did not offer the necessary safeguard against such behavior. In the 1990s, the legal and institutional system in Hungary was in the transformation process from a centrally planned economy to a market economy. Said framework was in many ways insufficient, causing serious mistakes during the implementation of the project.

This drastically increased the regulatory risks for the private investor – After financing the infrastructure investment and thereby possessing a sunk cost, the concessionaire became exploitable, and ultimately exploited, by the Hungarian government.

6. Conclusions

The failure of the M1/M15 motorway project showcases the importance of a stable institutional and political framework for the success of a public-private partnership project. For the implementation of a successful PPP process, there are pre-requisites which must be met, such as a regulatory framework for PPPs and the creation of the right environment, placing an emphasis on the rule of law. Said environment frequently is not given in politically unstable countries, putting private entities seeking to conduct PPPs at risk.

This understandably disincentivizes private entities to invest into politically unstable nations in need of infrastructure investment. Although such nations should ideally seek to solve the domestic instability and improve their legal system, this is not always possible and achievable within a short period of time. The economic growth and development of a nation is however largely dependent on the availability of basic public infrastructure and services, with most politically unstable countries not possessing the financial means for the self-realization of infrastructure projects.

The availability of outlets for dispute resolution which are seen to be credible and respected by all parties involved may significantly aid in the development of a nation's PPP market. Alternative dispute resolution procedures hence may prove to be helpful, such as contractually agreeing for PPP disputes within a given project to be adjudicated by independent international courts.

Another observation made by analyzing the M1/M15 motorway project is the high importance of proper risk division and allocation for the success of PPP projects. Placing the majority of project risks onto the private company acts as a deterrent for private entities to conduct PPPs in a given nation. Particularly in the case of politically unstable nations, PPP markets may be strengthened and incentivized by the government agreeing to retain most of the project risks. Public retention of PPP risks protects the project company from failure resulting from the propensity of government change – a risk usually present in politically unstable nations. It also likely acts as a force driving down the final price of the project due to the increased competition, and may increase the quality and overall success of the PPP project.

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SOCIAL CAPITAL AND RESILIENCE OF PUBLIC GOVERNANCE NETWORKS

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Purpose: This article attempts to identify the impact of social capital factors on the resilience of governance networks.

Design/methodology/approach: Achieving the research goal is based on the questionnaire survey conducted among 199 public servants in Polish counties examined with the stepwise regression analysis.

Findings: The results point out that the importance of social capital is different, depending on the resilience dimension. When considering coping with threats only, relational dimensions of social capital are of fundamental importance. In adaptation to new operating conditions, the relational dimension still dominates, but a structural dimension factor also appears. When resilience links to transformation, all types of social capital are needed.

Originality/value: These results add value to resilience theory in public governance by identifying the impact of social capital on the resilience of public governance networks.

Keywords: resilience, social capital, governance networks, public governance.

Category of the paper: Research paper.

1. Introduction

Public governance occurs in networks, across organisational boundaries, in a set of overlapping jurisdictions, and interdependencies between resources and competencies (Duit 2016; Sørensen and Torfing, 2004). Such organisational complexity causes governance networks to struggle with many turbulences (Ansell et al., 2017). Moreover, organisational constraints, financial crises, natural disasters, political conflicts, terrorism, and pandemics increase in number, scale, and frequency. For this reason, the concept of resilience is gaining more and more importance in governance networks (Linkov and Trump, 2019; Duit, 2016).

Public governance networks' resilience is based on the combination of resources, knowledge, and competencies of many independent organisations that result from relationships between individuals from different units and activities undertaken across organisational boundaries (Kim et al., 2020; Duit, 2016; Hillmann and Guenther, 2021). Therefore social capital seems to be of crucial importance, but there is very little evidence of its influence on the resilience of public governance networks. Research in this area is mainly conducted on its impact on the effectiveness of public governance networks and not from the holistic perspective of social capital but its selected factors, e.g. trust (Klijn et al., 2010; Bouckaert and Van de Walle, 2003), norms and values (Kooiman and Jentoft, 2009; Sienkiewicz-Małyjurek, 2020), and network structure (Scott and Thomas, 2017). The relationships between social capital and resilience are researched primarily in the field of emergency management (e.g. Aldrich and Meyer, 2015; Linnenluecke and McKnight, 2017), tourism and hospitality (e.g. Musavengane and Kloppers, 2020; Chowdhury et al., 2019), sociology (e.g. Pinkerton and Dolan, 2007; Ungar, 2011), and supply chain management (e.g. Johnson et al., 2013; Zaczyk and Liebert, 2020). Although these studies indicate positive relationships between social capital and resilience, it is still unknown what exactly factors of social capital have this positive influence on resilience. In public governance networks, this issue is particularly underdeveloped. Therefore, identification and understanding the relationship between social capital factors and determinants of the resilience of public governance networks is the aim of the research presented in this paper.

2. Theoretical background

Public governance is complex as "public policy is formulated and implemented through a plethora of formal and informal institutions, mechanisms and processes" (Sørensen and Torfing, 2004, p. 3). In this perspective, the coordination of shared resources is based on governance networks that are defined as "more or less stable patterns of social relations between mutually depended actors, which cluster around a policy problem, a policy programme, and/or a set of resources and which emerge, are sustained, and are changed through a series of interactions" (Klijn and Koppenjan, 2016, p. 11).

However, conducting joint activities in public governance networks is tough, and undertakings in this area could be unsuccessful (Huxham and Vangen, 2005; Sienkiewicz-Małyjurek, 2021; Król and Zdonek, 2021). Problems may arise from network relations that base on negotiations which do not always lead to a consensus due to different procedures of actions, perception of the problems, existing misunderstandings, antagonisms, conflicts, etc. (Sienkiewicz-Małyjurek, 2021; Cristofoli et al., 2017; Sørensen and Torfing, 2004; Klijn and Koppenjan, 2000). Much research has been devoted to the concepts of trust-building,

commitment, and reciprocity in public governance networks (Klijn et al., 2010; Sørensen and Torfing, 2008). Still, no universal method has been found to solve the emerging problems, as negotiations are not easy as they involve giving up some of one's interests. The complex structure of public governance networks can also pose a problem as they do not replace bureaucratic organisations but add structural complexity (O'Toole, 2015).

Conditions such as economic fluctuations, financial crises, natural disasters, pandemics, and social threats are also just some of the challenges all contemporary organisations face. Uncertainty, discontinuity, and turbulence are typical environmental characteristics that translate into the conditions for functioning public organisations and public governance networks (Ansell et al., 2017, Linnenluecke, 2017). As a result, public governance networks' internal and external complexity creates the need to search for ways to survive and evolve. For this reason, the concept of resilience is gaining more and more attention in scientific research and is currently being studied in public administration.

Resilience is "the process by which an actor (i.e., individual, organisation, or community) builds and uses its capability endowments to interact with the environment in a way that positively adjusts and maintains functioning prior to, during, and following adversity" (Williams et al., 2017, p. 742). The adoption of this concept in public governance is because more and more often is indicated that resilience affects the effectiveness and innovativeness of the everyday processes of public service delivery (Duit, 2016; Linkov and Trump, 2019). These processes are carried out in networks (Kozuch and Sienkiewicz-Matyjurek, 2015; Keast et al., 2014; Klijn and Koppenjan, 2016), are complex (Kenis and Provan, 2009; Cristofoli and Markovic, 2016), and the context of their provision is characterised by turbulence and dynamics of change (Ansell and Trondal, 2018). Resilience helps deal with situations where resources in public governance networks are scarce and decision-making time is short. In the event of constraints and disruptions in providing public services, it allows finding a new way to implement them. For this reason, the development of research on the resilience of public governance networks seems to be important and necessary.

Researchers use various factors in resilience analyses (Hillmann and Guenther, 2021). These include improvisation and bricolage, virtual role systems, the attitude of wisdom, respectful interaction (Weick, 1993; Weick et al., 1999), cognitive, behavioural, and contextual dimensions (Lengnick-Hall and Beck, 2005), anticipation, coping, adaptation (Duchek, 2020). In this article, three resilience dimensions were adopted for the analysis (Sienkiewicz-Matyjurek, 2022):

- Coping: appropriate preparation of actions to return to stabilization.
- Adaptation: the capability to modify rules and actions according to the circumstances resulting from threats.
- Transformation: changes necessary to be introduced in the long term due to the consequences of the threat.

One of the important factors influencing resilience is social capital (Lengnick-Hall and Beck, 2005; Duchek, 2020), which is understood as "the shared knowledge, understandings, norms, rules, and expectations about patterns of interactions that groups of individuals bring to a recurrent activity" (Ostrom, 2000, p. 176). Similarly, Adler and Kwon (2002, p. 17) define social capital as "the goodwill that is engendered by the fabric of social relations and that can be mobilised to facilitate action". Social capital is generally recognised as a metaphor for benefits (Burt, 2000; Kuzior and Sobotka, 2019; Pawłowska, 2018). It increases the possibilities of acquiring, assimilating and using knowledge, facilitates joint problem solving, and fosters innovation (Inkpen and Tsang, 2005; Straub et al., 2020). It is believed that social capital in the situation of threats allows organisations to cope with complexity and turbulence, provide quick access to the information they need, and helps maintain organisational consistency (Aldrich and Meyer, 2015; Delilah Roque et al., 2020).

One of the most popular classifications of social capital contains (Nahapiet and Ghoshal, 1998; Inkpen and Tsang, 2005):

- Structural social capital: network ties, network configuration, and appropriable organization.
- Cognitive social capital: shared language and codes, shared narratives, and
- Relational social capital: trust, norms, obligations and expectations, identification.

This classification is consistent with the findings of Granovetter (1977). He distinguished two types of connections: emotionally marked strong ties (e.g. family, friendly or neighbourly contacts) and more sporadic weak ties related to involvement in various external organisations (e.g. social associations). Social capital includes both strong and weak ties. This article uses the classification of Nahapiet and Ghoshal (1998) to analyse the influence of social capital on resilience.

3. Research methodology

The research was based on a questionnaire survey. It was conducted in December 2019 and January 2020 among randomly selected Polish counties. In Poland, there are 314 land counties and 66 cities with county rights (The administrative division of Poland...). The request to fill in the questionnaire was addressed to heads of county/city with county rights.

The research took into account three adopted resilience dimensions (coping, adaptation, and transformation) and Nahapiet's and Ghoshal's (1998) factors of social capital (network ties, network configuration, and appropriable organisation, shared language and codes, shared narratives, trust, norms, obligations and expectations, and identification). The survey questions were formulated in the form of statements, to which the respondent answered on a 5-point Likert scale.

The CAWI method (Computer-Assisted Web Interview) was used for the research. It is the electronic form of the survey sent via the Internet. The data return takes the form of a data matrix generated in real-time by the respondent. The computer software navigating the online survey monitors the respondent's behaviour coding and the correctness of the path of filtered questions.

As a result of the research, 199 correctly completed questionnaires were used in the analyses. Considering a materiality level of $\alpha=0.05$ and a permissible error of $e = 5\%$, it is a representative research sample. The obtained results were examined with the stepwise regression analysis. This analysis is a method of selecting independent variables for predictive purposes. It consists of the sequential creation of a regression model by removing from the set of all variables those that have the least significant impact on the dependent variable in a given step. The relevant statistic assesses the importance of the variable. Variables are deleted until the best-fit model is obtained. The analyses were carried out using Statistica 13 software. It is a data analysis software package developed by StatSoft Inc.

4. Results

4.1. Reliability and validity analysis

Carrying out the stepwise regression analysis requires prior checking of the reliability and validity of the questions asked. It is necessary to verify whether the measurements reflect the true value of the tested characteristics. It needs to check: 1. the level of correlation between a particular variable and the total result, 2. the squared multiple correlations, and 3. Cronbach's alpha coefficient when removing the variable. The analyses are shown in Table 1.

Table 1.
Reliability and validity analysis

Variable	Scale summary: Mean = 48.5327 Standard deviation = 5.90734 N: 199 Cronbach's alpha: .895299 Standardized alpha: .900928 Avg Cor.: 443156				
	Scale Mean if item deleted	Scale Variance if item deleted	Standard deviation if item deleted	Corrected Item-Total Correlation	Alpha if item deleted
Network ties	44.18593	31.18654	5.584491	0.385354	0.897965
Network configuration	44.41206	29.87041	5.465383	0.593980	0.887588
Appropriable organisation	44.25628	30.46196	5.519235	0.431820	0.896557
Shared language and codes	44.69347	29.16735	5.400680	0.672451	0.883557
Shared narratives	44.69849	28.53221	5.341555	0.744219	0.879645
Norms	44.39698	29.75698	5.454996	0.705107	0.883106
Obligations and expectations	44.82412	28.75801	5.362649	0.581798	0.888980
Identification	44.53769	28.99230	5.384449	0.723936	0.881133
Trust	44.30653	28.96634	5.382039	0.710390	0.881668

Cont. table 1

Coping	44.74372	29.44688	5.426498	0.465030	0.896928
Adaptation	44.39698	29.12381	5.396648	0.741440	0.880668
Transformation	44,40704	29,17603	5,401484	0,683852	0,883054

Source: own elaboration using TIBCO Software Inc. (2017). Statistica (data analysis software system), version 13. <http://statistica.io>.

The obtained results prove the reliability and validity of the adopted research scale. The Cronbach's alpha coefficient for the total score is almost 0.9, and the mean total correlation between the items is 0.44. All the variables have a similar effect on the reliability of the scale, as their correlations to the total score and the internal consistency of the scale are at a comparable level. However, "Network ties", "Appropriable organisation", and "Coping" variables correlate weaker with the total score, but deletion of any of them will not significantly affect the scale accuracy of the entire model. This is indicated by Cronbach alpha if the item is deleted. Moreover, "Coping" represents a dependent variable in which the removal of items is inadvisable.

4.2. Relationships between variables

Before conducting the stepwise regression analysis, the next step is to test relationships between variables. For this purpose, Spearman's Rank-Order Correlation analysis was used, which is a measure used for non-parametric statistical relationships. The obtained results are presented in Table 2. The strongest correlations between the variables are shown in bold.

Table 2.
Spearman's Rank-Order Correlation

Variable	Network configuration	Appropriable organisation	Shared language and codes	Shared narratives	Norms	Obligations and expectations	Identification	Trust	Coping	Adaptation	Transformation
Network ties	0.491	0.342	0.144	0.174	0.269	0.119	0.309	0.303	0.181	0.381	0.356
Network configuration		0.592	0.350	0.478	0.468	0.326	0.386	0.426	0.235	0.433	0.378
Appropriable organisation			0.298	0.239	0.399	0.101	0.263	0.431	0.151	0.389	0.258
Shared language and codes				0.673	0.570	0.570	0.573	0.576	0.359	0.494	0.493
Shared narratives					0.628	0.638	0.675	0.606	0.388	0.538	0.575
Norms						0.507	0.573	0.582	0.384	0.471	0.472
Obligations and expectations							0.536	0.425	0.321	0.460	0.498
Identification								0.627	0.425	0.576	0.521
Trust									0.340	0.595	0.491
Coping										0.469	0.389
Adaptation											0.764

BD removed in pairs; Correlation coefficients are relevant to $p < 0.05000$.

Source: own elaboration using TIBCO Software Inc. (2017). Statistica (data analysis software system), version 13. <http://statistica.io>.

The analysis of the correlation shows fairly strong relationships between analysed variables. "Shared narratives", "Identification", "Trust", and "Adaptation" link the strongest relationships with other variables. Very strong relationships are, for example, between "Adaptation" and "Transformation" (0.76), "Shared narratives" and "Identification" (0.67), "Narratives" and "Codes" (0.67). Strong relationships are also found between the other variables pointed out in bold, for example, "Network configuration" and "Appropriable organisation" (0.592), "Norms" and "Shared language and codes" (0.57). Furthermore, not all of the non-bold correlations are weak. Some of them are average, for example, "Shared narratives" and "Network configurations" (0.48), and "Obligations and expectations" and "Identification" (0.54). The weak statistical relevance of relationships can be observed between "Appropriable organisation" and "Obligations and expectations" (0.1), "Network ties" and "Shared narratives" (0.17), and "Network ties" and "Obligations and expectations" (0.12). However, most of the analysed relationships are strong or average.

The obtained results lead to assume that not all factors of social capital will affect the resilience of public governance networks. Structural social capital is relatively weakly correlated with the other studied dimensions. However, it is necessary to examine these relationships in a more detailed way.

4.3. Stepwise regression analysis

The stepwise regression analysis allows us to identify those explanatory variables that significantly predict the explained variable. Irrelevant factors are not included in the model. Furthermore, this method eliminates the problem of collinearity by taking into account mutual correlations between predictors. The effect of the stepwise regression analysis is building optimal models of relationships between research variables. Results reflecting those variables of social capital that significantly affect a particular variable of resilience are in Table 3. Social capital variables not listed in Table 3 do not affect the resilience of governance networks.

Table 3.

The stepwise regression analysis

N = 199	b*	Std. Error with b*	b	Std. Error with b	t(196)	p
Coping	R = .46600354 R² = .21715930 Adjusted R2 = .20511560 F(3,195) = 18,031 p = .000279					
Intercept			0.817993	0.419907	1.948032	0.052846
Identification	0.263898	0.083087	0.346788	0.109184	3.176172	0.001735
Norms	0.170528	0.082809	0.253091	0.122901	2.059307	0.040794

Cont. table 3

Adaptation	R = .70345632 R² = .49485080 Adjusted R2 = .47906489 F(6,192) = 31.348 p = .000000					
Intercept			0.504184	0.279969	1.800861	0.073294
Trust	0.238170	0.074287	0.223277	0.069642	3.206077	0.001576
Identification	0.179230	0.077485	0.171522	0.074153	2.313088	0.021777
Network ties	0.167962	0.056606	0.154045	0.051916	2.967192	0.003388
Obligations and expectations	0.159428	0.068159	0.122526	0.052382	2.339074	0.020360
Appropriable organisation	0.139649	0.058985	0.117459	0.049612	2.367551	0.018900
Transformation	R = .66520848 R² = .44250232 Popraw. R2 = .42805937 F(5,193) = 30.638 p = .000000					
Intercept			0.677892	0.302203	2.243166	0.026023
Shared narratives	0.279241	0.084890	0.268488	0.081621	3.289447	0.001193
Network ties	0.236356	0.056449	0.230050	0.054943	4.187067	0.000043
Obligations and expectations	0.186308	0.072059	0.151955	0.058772	2.585479	0.010461

Source: own elaboration using TIBCO Software Inc. (2017). Statistica (data analysis software system), version 13. <http://statistica.io>.

The regression model proved the significance of individual variables at $p < 0.05$. In the case of "Coping" variable, two predictors were identified: "Identification" and "Norms". They explain 20% of the dependent variable. The model of "Adaptation" dimension is also significant, and its five predictors explain a total of 48% of its variability. "Transformation" variable is explained in up to 43% by "Shared narratives", "Network ties", and "Obligations and expectations". Statistics used (the multiple correlation coefficient R, the significance test t, the slope coefficient of the regression line b) confirm the positive correlation between the examined variables.

The obtained results show that although many factors influence resilience, social capital plays an important role. In particular, there is a significant influence of the factor "Identification" on "Coping" and "Adaptation" and "Network ties" on "Adaptation" and "Transformation". The impact of all dimensions of social capital (structural, cognitive, relational) on the resilience of governance networks is visible but in a varied range. Only the relational dimension of social capital affects "Coping". Adaptation is influenced by the structural and relational dimensions, and "Transformation" by all dimensions of social capital. Moreover, the dimensions of social capital influence higher "Adaptation" and "Transformation" than "Coping." This indicates that they affect the processes of introducing changes and developing public governance networks.

5. Conclusions

The article is based on theory-driven empirical research. It checks which social capital factors identified by Nahapiet and Ghoshal (1998) affect resilience manifested through coping, adaptation, and transformation. The correlation analysis indicates that structural social capital has the least importance in building the resilience of public governance networks (Table 3). It is justified considering the importance of inter-organisational relations in public governance networks and the need for flexibility of joint activities. It can be assumed that rigid structures imposed in advance may limit this flexibility.

However, the stepwise regression analysis indicates that the factors of structural capital influence the two dimensions of resilience: "Adaptation" and "Transformation" (Table 4). Both dimensions of resilience are affected by "Network ties", and "Adaptation" is also affected by "Appropriable organisation". None of the structural and cognitive capital factors affects "Coping", which means that inter-organisational relations play an essential role in governance networks in direct response to an event. In the longer term, when there are changes related to adaptation to new operating conditions, relational capital is still of key importance (especially "Trust" and "Identification"). However, the impact of structural capital on the resilience of governance networks is also visible ("Network ties" and "Appropriable organisation") that proves the importance of the previously developed principles of network organisation in the long run.

Interestingly, a factor of cognitive capital – "Shared narratives" – in the stepwise regression analysis is indicated only in the case of "Transformation" (Table 4). Nevertheless, the correlation analysis demonstrates cognitive capital's significant impact on other social capital factors (Table 3). In the case of "Transformation", "Shared narratives" matters most. Therefore, it can be anticipated that cognitive capital has an indirect impact on the resilience of public governance networks, affecting the remaining determinants of social capital. Moreover, it is of particular importance in the long term of building the resilience of public governance networks.

The obtained results indicate that the ability to deal with emerging problems is needed first. It is also necessary to adapt to new operating conditions, allowing flexible responses to changes. Moreover, relational capital seems to be of key importance, but the other two types of social capital are necessary for the long term. Public managers wanting to ensure the resilience of their governance networks should focus primarily on the relational dimensions of social capital, which develop and properly manage inter-organisational relations. They should also consider the structural and cognitive dimensions of social capital because building resilience in public governance networks, in the long run, depends not only on relational factors but also on appropriate organisational arrangements and building a big picture of the situation.

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DETERMINANTS OF MAKING DECISIONS IN IMPROVING THE QUALITY OF PRODUCTS

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Purpose: The basic purpose of research was to determine the causes of making the decision that manufacturers on their way to improve the quality of their products.

Design/methodology/approach: The research method applied in article is mainly standardized survey research making based on survey conducted in contact and remote way conducted in 78 enterprises in south-eastern Poland. The research process also accompanied analysis of the source documentation.

Findings: It was concluded that decision during improving quality of the product were making mainly in simultaneously with considering customers' requirements of the customers about the quality of the products and the impact of products on the natural environment.

Research limitations/implications: Most of the verified enterprises from SMEs are tried integrating qualitative-environmental actions as part of improving the quality of products. This is a favorable condition for further research, so that it is possible to adjust the quality and environmental approach when improving the quality of products in SMEs.

Practical implications: Discussion of the results of research have a series of practical implications mainly for product management staff. Especially in organizations that designed new products or also in significant modification of these products.

Social implications: Building awareness improves not only quality of products, but also simultaneously in line with sustainable development, including in improving environmental aspects.

Originality/value: The article has cognitive value for development of knowledge, science, quality, and environmental in the area of management of products.

Keywords: decision support, management, quality management, production engineering, improving quality of products, customers' requirements, mechanical engineering.

Category of the paper: Research paper.

1. Introduction

Decisions in the area of product quality are one of the most difficult decisions made in an enterprise (Gładkowska-Chocian, 2018; Pacana, Siwiec, 2022). There are complex decisions, which usually include creating a new or changing existing products and services. Economic, social, and environmental forecasts are included (Ostasz, Siwiec, Pacana, 2022). The key to this type of decision is to achieve customer satisfaction, which is identified with the quality of the products (Siwiec, Pacana, 2021). The quality investigation is based on processes and also the high value of the enterprise (Gajdzik, Wolniak, 2021). The need to make an improving decision is not referred only to enterprises about long-range (enterprise world scale). Small and average enterprises operating in regional and world markets also compete by the quality of their products (Pavlovskaja, 2014; Siwiec, Pacana, 2021). This pursuit of a better quality of its products leads to changes, referring to improving production processes, implementing innovation, and changes in organized character (Jonek-Kowalska, Wolniak, 2022; Zarte, 2022; Szymanik, 2016). The development of management concepts and methods causes, on the one hand, the emergence of new organizational solutions, and, on the other hand, it is a source of decision-making problems in relation to the solutions already used (Stoma et al., 2018; Siwiec, Pacana, 2021). In a moment of a new concept occurring, managers are standing by resignation from previous management methods and tools, and their improvement to the direction of following changes or maintaining the existing solutions (Ejdys, Kobylińska, Lulewicz-Sas, 2012; Maik, 2017).

A single of the most commonly used management instruments is a modern approach to management processes and its simultaneous improvement, which comes down to the use of, for example, formalized management systems (Woniak, Jonek-Kowalska, 2022). New management concepts refer to broadly understood quality management: physical products and services, and more and more often the natural environment surrounding man (Pacana, Siwiec, Bednárová, 2020; Siwiec, Hajduk-Stelmachowicz, Bełch, Czerwińska, Pacana, 2021). Despite that, mainly SMEs have a problem with making the right qualitative-environmental decisions. This problem refers to decisions during the determination of products, which will be simultaneously satisfactory to customers and environmentally friendly (Ulewicz, Siwiec, Pacana, Tutak, Brodny, 2021).

Hence, the purpose of the article was to perform research as part of the identification of determinants of making decisions to improve products in SMEs.

2. Methods

The purpose of the analysis was to determine the determinants of making decisions to improve the quality of products in production companies in the SME sector. It results the most the share of these enterprises in the Polish industrial sector. It was considered that if these enterprises had the right tools for product design, it would contribute to their growth, competitiveness and less consumption of the natural environment. In this purpose, survey research was created, which was directed to persons responsible in enterprises for product design and to managers of productions and board members. The survey consisted of record and survey questions (open and closed). Questionnaire questions (Krok, 2015):

- type of enterprise (micro, small, medium, large),
- company headquarters (rural area, urban area),
- scope of activity (local, regional, national, international),
- implemented systems ISO 9011:2015 and ISO 14001:2015.

On the other hand, the survey questions referring to the decision-making determinants included questions concerning:

- actions that are made as part of the improving the quality of the product,
- type and number of decision criteria the most often included in the enterprise during improving product quality,
- awareness of the enterprise to making decisions qualitative-environmental as part of improving the quality of products,
- attitude of the enterprise to making decisions in a shot of qualitative-environmental as part of improving the quality of products.

The survey questions were developed on the basis of the literature review on the subject, e.g. (Ejdys, Kobylińska, Lulewicz-Sas, 2012; Ostasz, Siwiec, Pacana, 2022; Pacana, Siwiec, 2021; Siwiec, Pacana, 2021; Pacana, 2015; Świrk, 2020). The analysis of the survey results is presented in the next part of the article.

3. Results

The survey research was conducted in the first quarter of 2022. The research sample was selected in a random way. The results from 78 enterprises. There were mainly industrial enterprises in south-eastern Poland belonging to SMEs. The sample was obtained as part of the initial research; therefore, it was considered enough to verify the determinants of making decisions in improving the quality of products. Therefore, it is a planned extension of the research sample in future research and confronting the obtained results with the current ones.

The results of the survey research are presented in Figure 1.

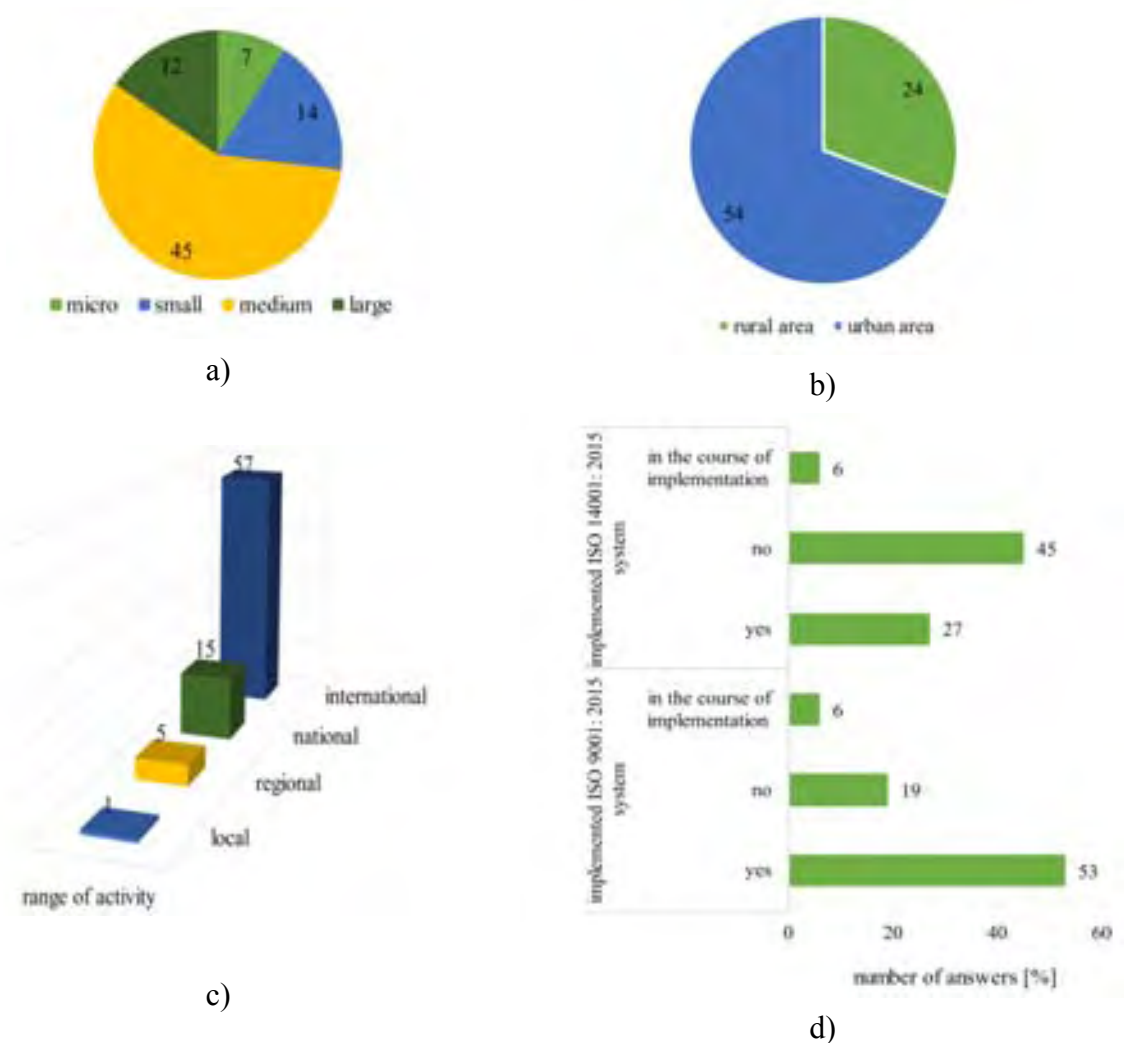


Figure 1. Survey certificate test results: a) type of company, b) location of the enterprise, c) range of activity, d) implemented ISO 14001: 2015 and ISO 9001: 2015 system. Source: own study.

The most number of enterprises surveyed were the medium-size enterprises (45 from 78). A relatively similar number has large and micro- enterprises (appropriately 14 and 12). The verification companies were localized in the vast majority of cases in an urban area (54). The range of activity of these enterprises was mainly international (57). Most of the surveyed enterprises (45) were not implemented ISO 14001:2015 system, but more than half of the verified enterprises (53) declared that implemented ISO 9001:2015 system. Among these enterprises, the determinants of decision making for improving the quality of products were analyzed.

First, actions realized as part of improving the quality of the products were analyzed. The results are shown in Table 1.

Table 1.*Actions carried out as part of the improvement of the quality of products in small businesses*

Answer number	Answer	Number of answers
1	catalogues (specifications) of products are developing	55
2	researches on customers satisfaction on quality of products are making	51
3	catalogue of actions as part of improving products are making	29
4	computer software supporting making qualitative and/or environmental decisions as part of improving products are using	23
5	catalogues describing the impact of products on the natural environment are developed	17
6	customer satisfaction surveys and interested parties are conducted on the impact of products on the natural environment	13
7	others	8

Answer number	Number of answers
1	55
2	51
3	29
4	23
5	17
6	13
7	8

Source: own study.

It was shown that the most number of verified enterprises developed catalogues (specifications) products and made research on customers' satisfaction with the quality of products (above 50 from 78). Slightly fewer enterprises (29) showed that they realized catalogues of improvement actions and used computer software (23) that supports making qualitative and/or environmental decisions as part of improving products. Definitely, a small number of companies have developed catalogues that describe the impact of products on the environment (13). Only eight enterprises showed other actions as part of improving the quality of products.

Then, the awareness of the companies to make quality and environmental decisions within the scope of product quality improvement was analyzed. The results are shown in Figure 2.

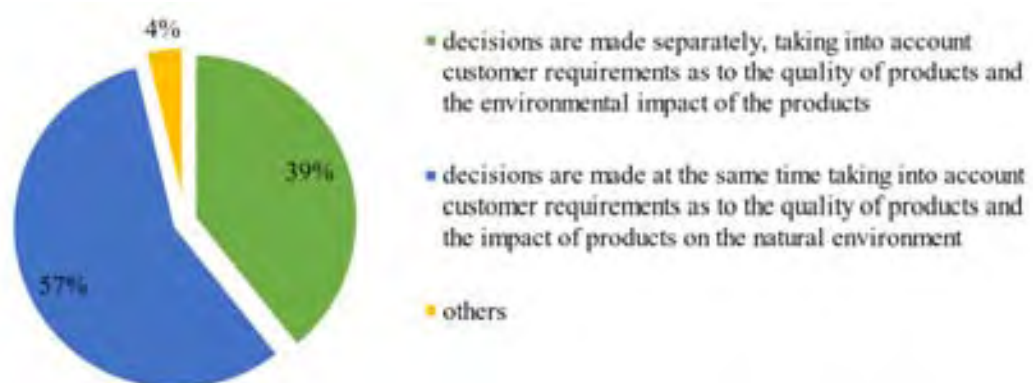


Figure 2. Awareness of enterprises to make quality and environmental decisions within the scope of improving product quality. Source: own study.

It was shown that the overwhelming number of enterprises (57%) make decisions simultaneously including customers' requirements and impact products on the natural environment. Fewer enterprises (39%) considered making decisions separately considering customers' requirements and impact the product on natural environment. Only a few enterprises considered (4%) mentioned decision making in another way.

Then, the attitude of the enterprise to making decisions in the qualitative-environmental shot as part of improving the quality of products with including customers' requirements was analysed. The results are shown in Figure 3.

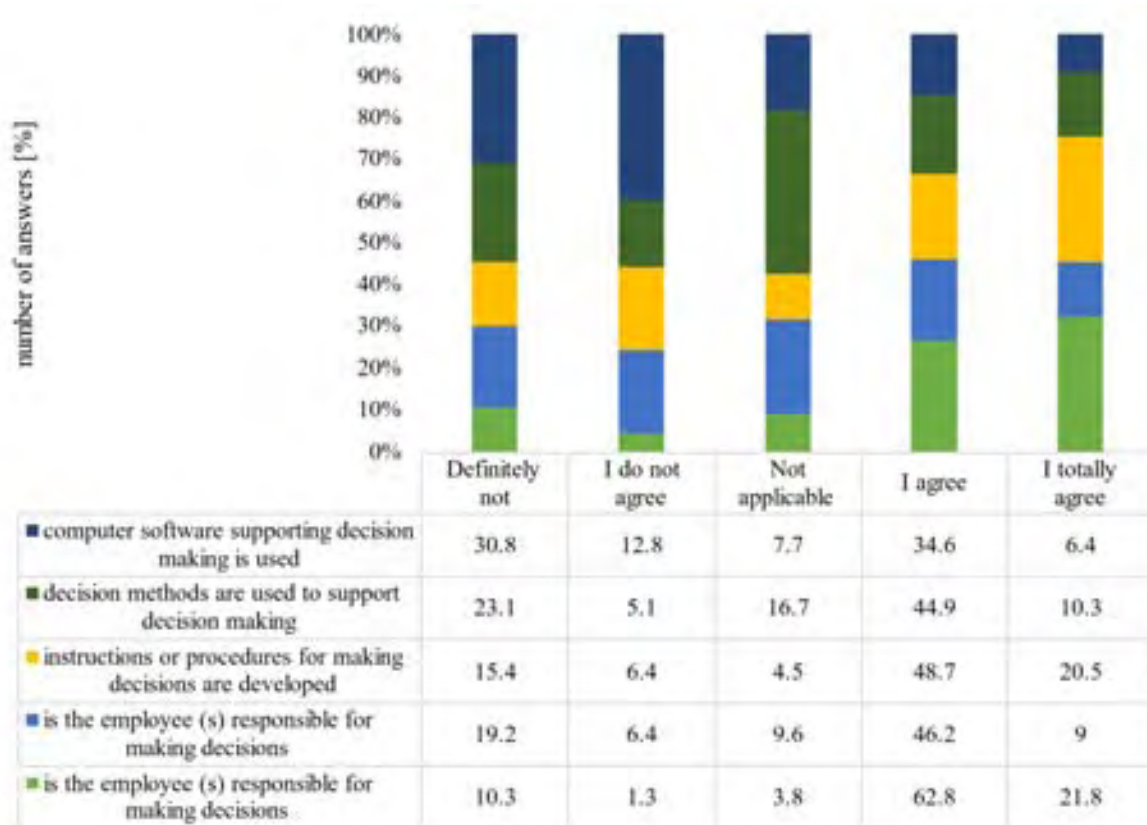


Figure 3. Attitude of the enterprise to making decisions as part of improving the quality of products with including customers' requirements. Source: own study.

It was shown that nearly half of the verified enterprises were not using computer software supporting making decisions in the context of quality of the product (average 22%). Other forms of enterprises shown that using this software (average 20%). Additionally, enterprises declared using decision methods (average 28%) and developed instructions or procedures to make decisions as part of improving the quality of products considering customers' requirements (average 35%). About half as many enterprises declared that they do not use decision-making methods for this purpose (average 14%) and do not develop instructions or procedures for making these decisions (average 11%).

Then, analysis was the attitude of companies towards organizing training in decision making. It was shown that an average of 30% of analyzed enterprises make these training. Additionally, the vast majority of companies (average 42%) confirmed that hire an employee

who is responsible for making qualitative decisions in the company. Only a few enterprises (average 6%) showed a lack of employees responsible for it. The verification of survey questions includes only the remaining percentage of companies that replied "not applicable" to the above questions.

Then, analysis was the attitude of the enterprise towards making decisions as part of improving the quality of products considering the impact of the products on the environment. The results of the survey research are shown in Figure 4.

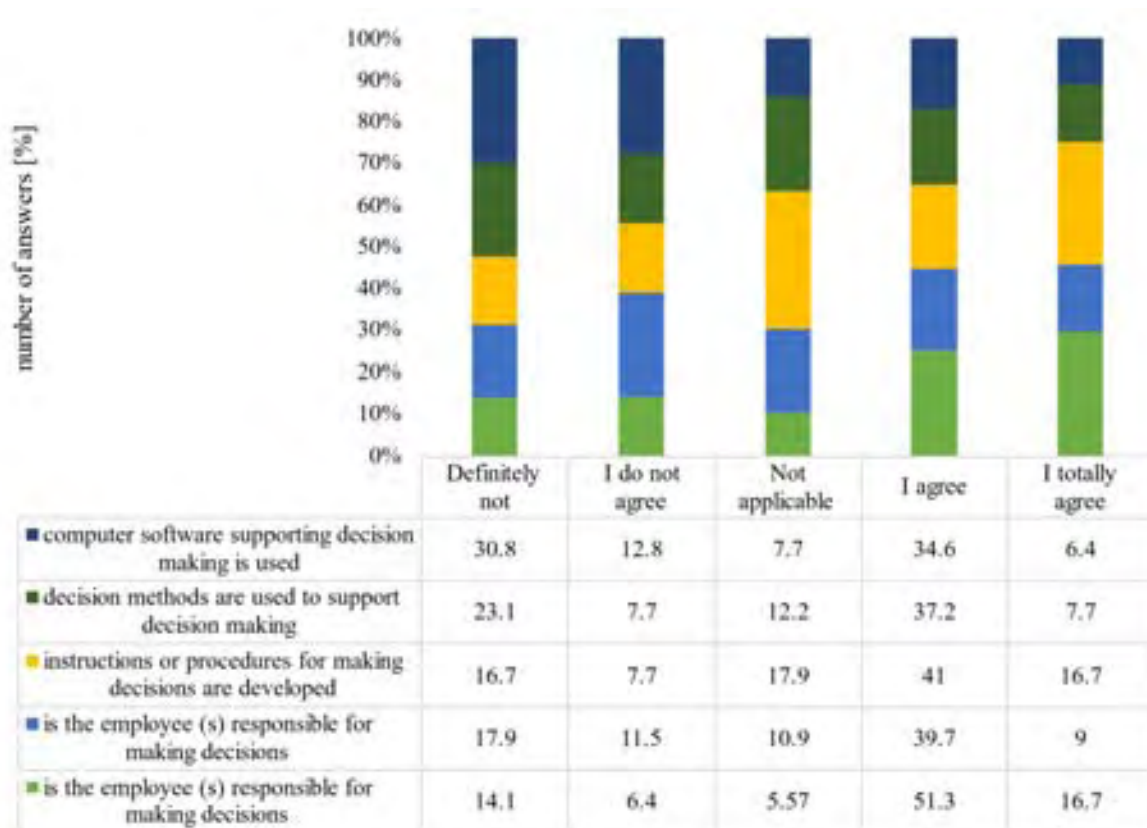


Figure 4. Attitude enterprise to making decisions as part of improving quality of products considering impact products on environmental. Source: own study.

It was concluded that similar to the case during the improvement of the quality of products, a little larger number of enterprises are not use computer software supporting making decisions as part of improving the quality of products considering impact of these products onto environmental (average 22%), where the average 20% enterprises confirmed that do so. Despite that, a similar number of enterprises have shown that they use/or do not use decision methods (average 22%). In turn, the vast majority of enterprises declared that they develop instructions or procedures (29% on average) for making product quality decisions taking into account the environmental impact of products, where on average 12% of enterprises admitted that they did not. It was concluded that average 24% of enterprises are making training for making qualitative-environmental decisions as part of improving the quality of products, and on average 15% of enterprises are not organizing these trainings. Most of the analyzed enterprises (average 34%) confirmed that in their company an employee is responsible for

making decisions as part of improving quality of products considering the impact products on environment. Despite this, the average 10% of enterprises shows a lack of employee responsible for the decisions mentioned. The verification of the indicated survey questions also covers the remaining percentage of enterprises that answered the indicated questions ‘not applicable’.

Then, the analyses were types and number of decision criteria most often included in enterprise during the improvement of quality of products. The results are shown in Figure 5.

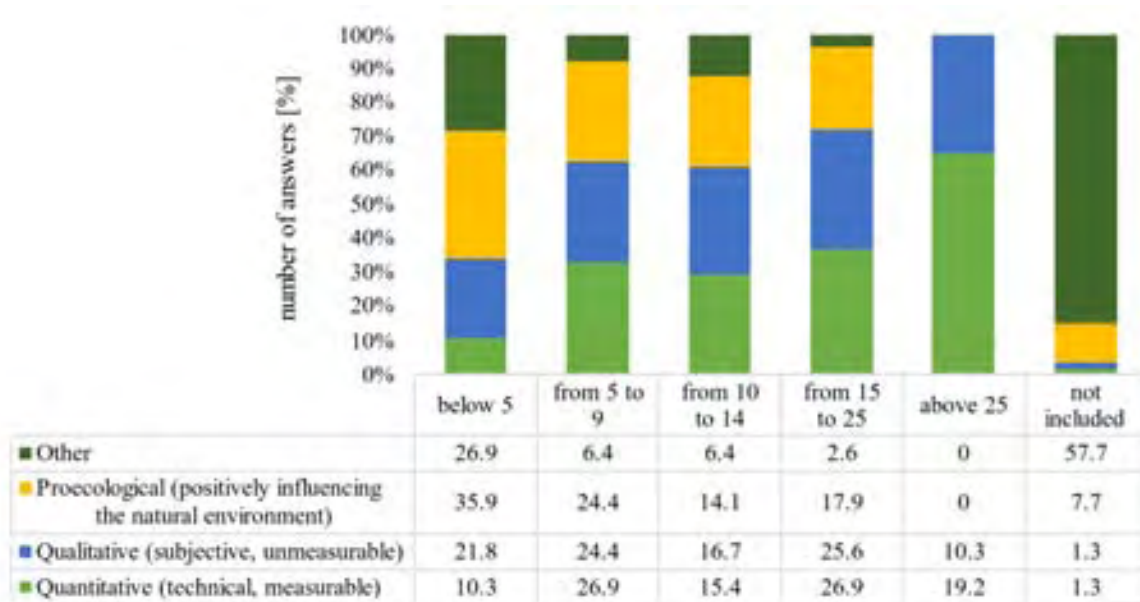


Figure 5. Type and number of decision criteria the most often included in the enterprise during the improvement of quality of products. Source: own study.

More than half of the enterprises declared that include mainly qualitative, quantitative, and proecological criteria (about 58%). In the group of proecological criteria usually includes more than 5 criteria (36%) or from 5 to 9 criteria (24%). Therefore, in the group of qualitative criteria included, the most from 15 to 25 criteria (26%) or 5 to 9 criteria (25%), where relatively fewer answers showed that the number of these criteria is above 5 (22%). Similarly, quantitative criteria, the most often show that it is a group that counts from 15 to 25 criteria or from 5 to 9 criteria (27%). Slightly fewer responses indicated that the quantitative criteria constitute a group of more than 25 criteria (19%). Furthermore, it was observed that approximately 27% of the enterprises declared that they take into account criteria other than those indicated, where their number is not greater than 5 criteria.

4. Discussion and conclusion

The new concept of management includes an approach to managing quality of products and includes impact of products on sustainability (Pacana, Siwec, Bednárová, 2020; Siwec, Pacana, 2021). However, mainly SMEs still have problems with making the right quality and

environmental decisions. As part of identifying determinants of making decisions in improving products in SMEs the survey research was realized. The research was carried out among 78 enterprises. It was concluded that during improving the quality of products in SMEs, the decision was made mainly in simultaneously considering customers' requirements about the quality of products and considering the impact products on sustainability. Additionally, based on analysis, it was considered that the determinants of improving the quality of products in the context of qualitative-environmental considerations were mainly:

- making controls and actions of improving the quality of product considering mainly the customer's requirements, where the impact product of environment is mostly negligible,
- creating catalogues of improving actions and catalogues of products mainly in case of including customers' requirements,
- using the computer program as part of improving the quality of products, where including customers' requirements and impact on the environment,
- use of decision-making methods and the development of instructions or procedures to support decision-making,
- training and appointing the employee responsible for making decisions,
- taking into account the criteria from groups qualitative, quantitative, and proecological criteria,

It was shown that relevant similar number of criteria included during improving products are qualitative and quantitative criteria. In turn, the less number of criteria included during improving products are proecological criteria. This proves that enterprises have relatively high awareness about a need including customers' requirements during the improvement of product quality. Simultaneously, it was shown that enterprises include less impact of the impact product on environment. However, most of the verified enterprises from the SME sector are trying to integrate quality and environmental activities within the scope of improving product quality.

This is a favourable condition for further research, so it is possible to adjust the quality and environmental approach when improving the quality of products in SMEs.

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EUROPEAN INTEGRATION AND DEVELOPMENT OF THE EU-10 COUNTRIES IN VIEW OF SELECTED SOCIAL PHENOMENA

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Purpose: The aim of this paper is to determine the level of development in the EU-10 countries in view of social phenomena.

Design/methodology/approach: the TOPSIS method was applied to rank countries in terms of social phenomena – the list comprised countries, which in 2004 accessed the EU. The paper focused on social phenomena, i.e. health, the labour market, housing, demography and education.

Findings: It refers to the basic assumptions and the importance of integration in the international context as well as the related theories. Moreover, it presents the relationship between integration and the level of development in countries in terms of the social aspects. At the same time it discusses the process of social changes which have taken place in the Central and Eastern European countries (CEESs) since their accession to the European Union.

Research limitations/implications: The text discusses problems related to the European integration and social development in the EU countries.

Practical implications: The manuscript concerns social development in the EU-10 countries and European integration. It may be of interest for the broadly understood governmental sector. Social consequences: Conducted studies will constitute the basis for the development of European and national development strategies in terms of improvement of welfare for the populations, while also indicating the direction of changes and ensuring comparability of the results concerning transformations in the countries, which accessed the EU in 2004.

Originality/value: The originality of the study will stem from the application of the TOPSIS method, required to classify the countries and to determine the standard of their development in terms of social phenomena.

Keywords: European integration, EU-10 countries, TOPSIS, level of development, the social aspect.

Category of the paper: the authors' own research and review.

1. Introduction

Processes of economic integration constitute one of the most important phenomena observed at the turn of the 20th and 21st centuries. Doliwa-Klepacki (2000) stated that they are major factors promoting solution of economic problems and determining the rate of development in individual countries. In the international perspective the concept of integration in literature on the subject is defined as economic, cultural and political integration or cooperation of countries. Its primary objective is to establish a supranational organ (Bodenstein, 2017; Schimmelfennig, 2018; Pacana et al., 2021; Hooghe et al., 2021). Contemporary theoreticians of economic integration indicate five stages in its evolution: the free trade area, the customs union, a single market, the economic and monetary union and complete integration.

Studies on the European integration have been conducted e.g. Gorzelak (2002), Grosse (2001), Firlej (2010), Bodenstein (2017). In turn, Malendowski (2010), Ostasz et al. (2020), Pleśniarska (2017) and Kriesi (2020) investigated the problem of Euroscepticism and national sovereignty, while Foster et al. (2021) presented several benefits resulting from cooperation. Kiryluk-Dryjska (2012) and Klaus (2019) focused on changes taking place in policies aiming at European cooperation, while Pouliquen (2011), Klepacki et al. (2013) and Spsychalski (2015) studied a dependence between integration and agriculture. In turn, the relationship between European integration and development of the countries participating in the integration processes was investigated by Gorzelak (2002) and Jastrzębska (2008).

In turn, Kosach et al. (2020) in their studies focused on the capacity of public management to address internal problems and the dynamics of socio-economic development (Gorb et al., 2017), whereas Atkinson et al. (2000) and (2004) presented this dependence in view of social phenomena (Urmanaviciene et al., 2021).

The process of the establishment of the European Union may serve as an example of international integration. Its primary objectives include promotion of peace, protection of shared values and welfare of its citizens, among other things by attaining sustainable development based on viable economic growth, measured e.g. in terms of GDP per capita (Sadowski, 2012). However, in the opinion of Machowska-Okrój (2014) economic growth may not necessarily have a direct impact on increased social welfare (Miskiewicz et al., 2019). In view of this theory, welfare is understood as meeting the needs of individuals in relation to basic goods. As a rule goods are useful, which means that their consumption is to satisfy social needs, such as e.g. access to food, but also access to education, medical infrastructure and housing as well as the labour market. In this respect the social policy in the EU is run on the national level and is subjected to a degree of harmonisation at the EU level. What is important, it depends first of all on the national authorities, which leads to many controversies resulting from its importance for the process of convergence between the EU countries. Mucha-Leszko (2016) indicated the following problems in the structuring of social elements in the EU

countries: diverse models of welfare states in the EU countries and varied levels of financing for social needs, a lack of a development strategy for social policy, a crisis of the welfare state policy, monetary integration and the requirement to meet monetary union criteria stipulated in respective treaties¹.

The aim of this paper was to determine the level of development in the EU-10 countries in terms of the social aspect of development. The time frame covers the years 2004, 2010 and 2019 in order to compare changes which took place in these countries at the time of their accession to the EU; this scope also results from the currently available data. Analysis covers 10 Central and Eastern European countries (CEECs)², and to realise the objective of this study source data was collected from the Eurostat database.

The scope of the paper is as follows. Firstly, a brief review was presented concerning literature on European integration, its evolution and importance in terms of development, including social development of individual countries. Secondly, the research method was described. Thirdly, the TOPSIS method was applied to order countries in terms of social phenomena in the countries, which in 2004 accessed the European Union. Finally, the position of countries was described in terms of national conditions for development. This paper is concluded with a discussion on the importance of integration in the EU-10 countries as well as their development.

2. Integration processes in Europe

After WWII the primary cause for the initiation of integration among the European countries was connected with the need for their reconstruction. Following the war the economies of those countries were much weaker and their infrastructure was in decline. Moreover, there were serious concerns related both to the economic expansion of the USA and military and ideological expansion of the Soviet Union. Winston Churchill was one of the first politicians after WWII to voice the need to establish a unified Europe³, so as to prevent the recurrence of war and tyranny.

In the 1950s in Western Europe a growing trend was observed towards elimination of barriers in trade between neighbouring countries, at the simultaneous increase in their cooperation. These processes resulted in the development of the Schuman Declaration and establishment of the European Coal and Steel Community in 1952⁴. This plan assumed the

¹ Requiring improved budgetary balance and reduced government debt.

² Cyprus, Czechia, Estonia, Lithuania, Latvia, Malta, Poland, Slovakia, Slovenia, Hungary, alternately the term EU-10 was used.

³ During his speech he referred to the division of Europe and the Iron curtain, separating all the CEEC capitals (Berlin, Warsaw, Prague, Budapest, Belgrade, Bucharest, Sofia and Vienna).

⁴ Belgium, France, the Netherlands, Luxemburg, West Germany (at present Germany) and Italy.

equality of West Germany to the other parties to this project in relation to the production of coal and steel, at the same time allowing for mutual control and management of the heavy industry. With time other European countries started to be attracted by the integration processes and this trend stimulated development of cooperation in other parts of the world. It became a common model for the formation of similar integrated structures (Sadowski, 2012).

In 1957 the Treaty of Rome established the European Economic Community⁵, aiming at the harmonious economic development of the member countries, strengthening their economic stability and promoting cooperation between them thanks to the creation of a common market. Social policy was not focused on, since it was believed that it is a natural consequence of economic benefits brought about by the liberalisation of trade. The 1960s were the period of elimination of tariffs in trade between the member countries and a common policy aiming at food production control (Spychalski, 2015). Moreover, in 1961 the European Social Charter was signed, thus underlining the social functions of the state and the need for increased public welfare.

In 1973 the communities were joined by Denmark, Ireland and Great Britain (the so-called first enlargement of the EU⁶), while its policy in the 1970s focused on environmental protection and promotion of democracy. The 1980s marked two enlargements. In 1981 Greece joined the Union and in 1986 the same was done by Spain and Portugal. In terms of its social impact the most important event was the signing of the Single European Act, thus altering the approach to integration in terms of the social aspects (including working conditions and social welfare) (Machowska-Okrój, 2014).

The 1990s were the most important years for the formation of the European Union. At that time a single market was established ensuring free movement of individuals, capital, goods and services, the EU Treaty entered into force⁷ and Austria, Finland and Sweden joined the union (Sadowski, 2012). In 1994 a White Paper was prepared, describing a model of the EU social policy, while minimum objectives of the policy were specified at the same time honouring national diversity. The document identified social problems and main objectives were defined, aiming at improvement of the situation on the labour market, guaranteeing social progress and preventing social exclusion.

The next step towards full integration was connected with the introduction of a single currency. Moreover, in the “new decade” the focus was on the creation of new jobs and efforts made towards greater social cohesion⁸. Social policy was no longer understood as an element of the economic system. The year 2004 marked the greatest enlargement in the history of the European Union. The union was joined by as many as 8 Central and Eastern European

⁵ It comprised the same countries, which formed the European Coal and Steel Community.

⁶ It is arbitrarily termed EU enlargement, although it was the European Community at that time.

⁷ The Maastricht Treaty – signed in 1992, entered into force in 1993.

⁸ The Lisbon strategy.

countries, including Poland as well as Cyprus and Malta, which symbolically seemed to end the division of Europe. Bodenstein (2017).

In 2007 the EU was joined by Bulgaria and Romania and the Treaty of Lisbon was signed, transforming the EU into a more efficient, more democratic and transparent organisation. These actions were to ensure effective actions related to climate change, security and sustainable development. In 2013 Croatia became the 28th member of the European Union. In turn, in 2020 as a result of a national referendum Great Britain left the Union. At present the candidate and potential candidate countries include Albania, Bosnia and Hercegovina, North Macedonia, Kosovo, Montenegro, Turkey, Serbia and most recently Ukraine.

There are numerous benefits connected with cooperation with the European Union. First of all integration is to lead to interdependencies between all the member countries, support individual countries in their socio-economic development and efforts to ensure their population's welfare, provide security and justice as well as scientific and technical assistance (Machowska-Okrój, 2014). However, the progress in the unification of the EU policy, including social policy, is difficult, due to a lack of interest on the part of some EU member countries, among other things as a consequence of increasing costs of meeting all social needs as well as the necessity to reduce government expenditure. Each country implements reforms at their own pace.

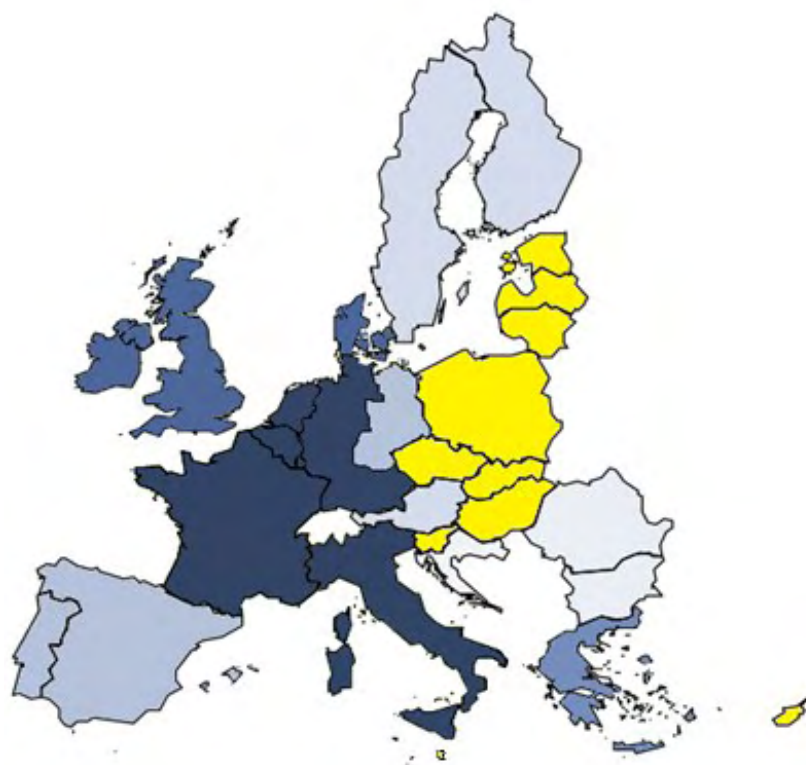


Figure 1. Enlargements of the European Union 1957-2013. Source: the authors' study based on <https://european-union.europa.eu> [accessed: 23.03.2022].

3. Material and Method

The extensive range of this study concerning development in European countries made it possible to select characteristics and the structure of a synthetic measure. By focusing on the social aspect of development the analysis comprised indexes related to education, health, demography, labour market and housing (Table 1). The material for analysis included information from the EUROSTAT database. Due to the availability of data the conducted analysis covered three years, i.e. 2004, 2010 and 2019, thus facilitating observations of changes in the discussed phenomenon over time.

The diversified level of social development in the EU-10 countries was investigated using a synthetic measure of development based on the classical TOPSIS method. This method is a tool frequently applied in research to construct a synthetic characteristic (Głowicka-Wołoszyn, Wysocki, 2018), among other things by using several simple traits concerning various types of socio-economic phenomena.

The proposed method consists of the following stages (Wysocki, 2010):

1) Selection of simple characteristics

For the purpose of this analysis it was decided to select the characteristics given in Table 1. Their selection was based on their informative value and statistical merit. Since the set of diagnostic characteristics may have contained variables, which repeated the same information, they were verified statistically. This verification was based on the coefficient of variation and Pearson's linear correlation.

Table 1.

Variable adopted for the analysis of the level of social development in the EU-10 countries

no.	Simple characteristics
X1	The rate of natural increase per 100 inhabitants
X2	Net migration rate per 1000 inhabitants
X3	The percentage share of individuals aged min. 60 years in the population structure
X4	The percentage share of individuals with higher education in the total population
X5	The percentage share of individuals with elementary education in the total population
X6	The percentage share of economically active individuals with higher education
X7	The percentage share of unemployed in the total population
X8	Young unemployed (the percentage of unemployed aged 20-29 years in the population aged 20-29 years)
X9	Number of people per 1 physician ⁹
X10	Number of hospital beds per 1000 people ¹⁰
X11	Mean number of rooms per person ¹¹

Source: the authors' study based on EUROSTAT data.

⁹ In the case of characteristic x9 for Poland the data from 2004, 2010 and 2018 was used.

¹⁰ In the case of characteristic x10 for Cyprus the data from 2005, 2010 and 2019 was used.

¹¹ In the case of characteristic x11 for the analysed countries the data from 2005, 2010 and 2019 was used.

In view of the potential presence of characteristics potentially leading to a distortion of results they were statistically verified. Among the selected diagnostic variables it was decided to reject characteristics x1 and x6, which exhibited low variability (the coefficient of variation below 10%). The structure of the inverse of the matrix of Pearson's linear correlation showed an excessively correlated characteristic (x8), which was removed from the set of selected simple characteristics.

2) Normalisation of values of characteristics

In the next stage of this procedure it was assumed that six characteristics are destimulants – x3, x5, x7, x9, x10 and x11, while the other characteristics are stimulants. This ordering made possible transformations according to the following formulas:

In the successive step of the procedure it was assumed that six characteristics are destimulants – x3, x5, x7, x9, x10 and x11, while the other are stimulants. This ordering made possible transformations using the following formulas:

- for stimulants

$$z_{ij} = \frac{x_{ij} - \min_i\{x_{ij}\}}{\max_i\{x_{ij}\} - \min_i\{x_{ij}\}}$$

- for destimulants

$$z_{ij} = \frac{\max_i\{x_{ij}\} - x_{ij}}{\max_i\{x_{ij}\} - \min_i\{x_{ij}\}}$$

1) Determination of coordinates of model units – model A^+ and antimodel A^- of development.

$$A^+ = (\max_i(z_{i1}), \max_i(z_{i2}), \dots, \max_i(z_{iK})) = (z_1^+, z_2^+, \dots, z_K^+)$$

$$A^- = (\min_i(z_{i1}), \min_i(z_{i2}), \dots, \min_i(z_{iK})) = (z_1^-, z_2^-, \dots, z_K^-)$$

When determining the coordinates of the model and the antimodel of development the maximum and minimum values were assumed. In this way the coordinates of model (A^+) were 1, while coordinates of antimodel (A^-) were 0.

2) Calculation of Euclidean distances for each evaluated object from the model and antimodel of development.

$$d_i^+ = \sqrt{\sum_{k=1}^K (z_{ik} - z_k^+)^2}, \quad d_i^- = \sqrt{\sum_{k=1}^K (z_{ik} - z_k^-)^2}$$

$i = 1, 2, \dots, N$

3) Calculation of the value of a synthetic characteristic.

$$S_i = \frac{d_i^-}{d_i^+ + d_i^-}$$

4) Linear ordering of countries, indication of the position in the ranking.

4. Results

The TOPSIS method made possible linear ordering of the countries within the analysed phenomenon, while the adopted measure showed considerable differences in the position of the countries in the analysed years (Table 3).

Table 2.

Selected descriptive statistics for the value of the synthetic measure for the EU-10 countries in 2004, 2010 and 2019

List	2004	2010	2019
max	0.6603	0.6749	0.6017
min	0.4112	0.4472	0.5098
mean	0.5164	0.5332	0.5675
med.	0.5088	0.5239	0.5800
range	0.1514	0.0919	0.0144
coefficient of variation (%)	14.0	12.4	5.1

Source: the authors' elaboration based on their studies.

It needs to be stressed that the value of the coefficient of variation decreased in the investigated years. This means that the EU-10 countries in the analysed years were characterised by low variability. In 2004 its value was 14.0 %, in 2010 it was 12.4 %, while in 2019 it was 5.1 %, which may be interpreted as a positive phenomenon. This means that countries exhibit increasing social cohesion, as confirmed also by the decreasing value of the range between the highest and lowest value of the measure in the investigated years. Moreover, an increase was observed in the minimum value of the investigated phenomenon and a decrease in the maximum value, which also confirms progress in the discussed phenomenon.

Table 3.

Values of the synthetic measure of the level of social development in the EU-10 countries in 2004, 2010 and 2019

countries	Value of the measure			Position in the ranking		
	2004	2010	2019	2004	2010	2019
Cyprus	0.6603	0.6749	0.5777	1	1	6
Czechia	0.5087	0.5112	0.5363	6	6	9
Estonia	0.5626	0.5392	0.5859	3	4	3
Hungary	0.5121	0.5043	0.5098	4	7	10
Latvia	0.4239	0.4764	0.5824	9	9	4
Lithuania	0.5038	0.4825	0.5678	7	8	7
Malta	0.4112	0.4472	0.5402	10	10	8
Poland	0.4954	0.5643	0.5913	8	3	2
Slovakia	0.5089	0.5367	0.6017	5	5	1
Slovenia	0.5771	0.5949	0.5822	2	2	5

Source: the authors' elaboration based on their studies.

The values of the measure of the level of social development in the EU-10 countries were comparable, in the investigated years ranging from 0.4112 to 0.6749 (Table 2, Table 3). Moreover, in the years of analysis the mean value of the measure of development increased from 0.5088 in 2004 to 0.5800 in 2019. In the years 2004 and 2010 the highest values of this

measure and the 1st position in the ranking were recorded in Cyprus (with 0.6603 and 0.6749, respectively), while in 2019 it was in Slovakia (0.6017). The lowest values of the measure in the first two years of analysis were recorded for Malta (0.4112 and 0.4472), which was reflected in the lowest position in the ranking.

Changes in the values of the measure led to more evident changes in the ranking position of individual countries. In the analysed years in most EU-10 countries the value of the measure increased, which in many cases caused advances in the ranking positions (Slovakia, Poland, Malta, Lithuania, Latvia, Estonia). In 2019 Poland was 2nd, which when compared to 2004 meant progress by as many as 6 positions in the ranking (2004 – 8th), at a simultaneous increase in this measure by 0.0959. It may also be stated that in comparison to 2004 it was the greatest progress in terms of the ranking position and the value of the measure (an increase by 0.0959). In turn, Slovakia in 2019 turned out to be the leader of the social development ranking with the value of the measure amounting to 0.6017. Nevertheless, it needs to be added that in 2004 it had a good initial social situation, which was reflected in the country's 5th position in the ranking and a high value of the measure (0.5089).

In 2004 and 2010 consistently the same positions in the ranking were maintained by Czechia (6th), Lithuania (9th), Malta (10th), Slovakia (5th) and Slovenia (2nd). In 2019 their ranking position changed as follows: Czechia (9th), Lithuania (4th), Malta (8th), Slovakia (1st) and Slovenia (5th). In 2010 in the case of Lithuania and Estonia a decrease was recorded in the value of the social development measure compared to 2004 by 0.0213 and 0.0234, respectively. For Czechia and Slovenia no marked increases were observed for the measure of development, as a result of which their ranking position decreased in relation to the first period of the study (2004). An exception in the analysed group was found for Cyprus and Hungary, in which a decrease in the level of social development was recorded in comparison to the other EU-10 countries. In the case of Cyprus the value of the measure dropped by 0.0826, which resulted in the fall from the 1st position in 2004 and 2010 to the 6th position in 2019. The level of social development in Cyprus to a considerable extent resulted from the prolonged recovery from the global financial crisis (Pastuszka, 2021). In turn, in Hungary the value of this measure decreased by 0.0023, in 2019 leading to the country's lowest position in the ranking. As it was stated by Moździerz (2016), in Hungary since 2010 the negative economic trends were connected with the world crisis, as well as the tax policy, which affected social changes in Hungary.

Changes in the values of the measure of social development in the EU-10 countries and their ranking positions resulted from the transformations made in the case of many of the indexes adopted in the analysis. Extremely strong variability was observed for the index expressing net migration per 1000 inhabitants (the coefficient of variation over 650%). However, it is not a phenomenon, which could be found surprising, since characteristics representing demographic changes as a rule exhibit strong variability both in terms of the time frame and the analysed countries. Strong variability (56.1-57.6%) was found for the indexes referring to education (the percentage of people with elementary education), the labour market

(the percentage of unemployed in the total population, the percentage of young unemployed) and health (Number of people per 1 physician). In this case it may be considered a positive trend for the values of passive factors to decrease (e.g. the percentage of individuals with elementary education or the percentage of unemployed), which affected the observed diversity. From the point of view of social development in the EU-10 countries it indicates a continuous improvement of intellectual capital as well as progress in terms of access to the labour market and health care. It may be problematic to consider the index related to the mean number of rooms, which increased in the investigated countries, at the same time exhibiting average variability (the coefficient of variation at 28.9%). Obviously it was connected to a greater extent with demographic changes (a decrease in the population size), which caused an increase in the mean number of rooms per person.

Results of these investigations are consistent with those presented by other authors analysing this problem. Examples of such research may be provided e.g. by studies of Łuczak and Wysocki (2019), who analysed EU countries in terms of social and economic development. Those investigations showed in 2016 progress in social development in the EU-10 countries except for Cyprus, where the socio-economic situation deteriorated, leading to a worsening of the development status. Research conducted by Stec (2004) concerning a comparative analysis of socio-economic development in the EU countries including candidate countries indicated weak positions in the ranking for the countries applying for EU membership, which provides another point of reference for the stated marked progress made since 2004. The evident reduction of differences in the level of social development shown in this study is consistent with the results of analysis conducted by Klonowska-Matynia (2018), who identified the process of decreasing disproportions in social cohesion.

5. Conclusion

This paper compared the level of social development in the EU-10 countries and presents the position of Poland by establishing ranking lists for three periods of time, i.e. 2004, 2010 and 2019. The scope of social indexes initially comprised 11 variables, representing health, housing, education, demography and the labour market, next it was reduced to 8 variables. Values of the adopted set of variables using the TOPSIS method made it possible to determine the ranking position of the countries in terms of the proposed statistical characteristics.

Changes in the values of the measure led to marked changes in the ranking positions of individual countries. In 8 countries the value of the measure increased in the analysed years, with Hungary and Cyprus being exceptions to this trend. Hungary was the only of the analysed countries which showed no marked positive changes in the social aspect. An improved ranking position was recorded for Lithuania, Malta, Poland and Slovakia. The greatest improvement in

the ranking position and the biggest increase in the measure of development were found for Poland, which in 2019 ranked 2nd (2004r – 8th). In turn, in 2019 Slovakia took the leading position. It also results from a study by Mucha-Leszko (2017) that Slovakia and Poland developed most dynamically. An interesting situation was observed in the case of Czechia, since despite the increase in the value of the measure of development ranked as low as 9th in 2019. It may be stated that accession of the analysed countries to the European Union, in most cases led to their dynamic social development (Mucha-Leszko, 2017; Ižová et al., 2021).

Realisation of the assumed research aim made it possible to identify a diverse approach to social aspects in the EU-10 countries. However, it may also be observed that between the countries diversification within the analysed aspect decreases, which may indicate their attempts towards uniformity in terms of social aspects (Berbeka, 2002; Wydymus, 2017).

Moreover, it may be stated that the recorded results may constitute a source of reference for the developed national strategies for social phenomena. Research may also facilitate the elaboration of support programmes in the problematic areas.

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EMPLOYEE SATISFACTION – EMPIRICAL STUDY AMONG MEDICAL RECORD CLERKS IN POLAND

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Purpose: The main purpose of this research was to indicate the level of medical record clerks satisfaction related to their work in medical entities in Poland.

Design/methodology/approach: Job satisfaction is a positive emotional state that results from interactions between work experience and organizational environment. In theoretical part the difference between satisfaction, morale, enjoyment and disenjoyment were discussed as well as methods and implications of employee satisfaction examining were presented. Empirical studies were conducted in December 2021 among medical record clerks using Google questionnaire and included 125 participants to the research sample. To create the questionnaire used in the research, short form of Minnesota Satisfaction Questionnaire (MSQ) was utilized. MSQ is publicly available for all researchers on the University of Minesota website. The survey was supplemented with additional statements related to work content to receive more information.

Findings: The outcomes revealed that most respondents perform tasks beyond the scope of their duties, there is a significant imbalance of work between different days, and suggested improvements are rarely or never taken into consideration. Among the main suggestions mentioned by the respondents as leading to improvement was a change in work procedures.

Research limitations/implications: The conducted research deserves to be repeated, taking into account a larger group of respondents, but also through differentiation depending on job positions. It would also be a recommended to conduct qualitative studies to go deeper with received answers or to utilize long version of the MSQ.

Practical implications: As an outcome of the research, potential actions to be taken to improve work satisfaction were suggested. Findings of this research can be applied by managers of medical clerk departments to reorganize working conditions in order to enhance job satisfaction.

Social implications: It is worth to investigate the level of employee satisfaction because it affects motivation to perform tasks and work attitude.

Originality/value: Medical record clerks work in medical entities, which are characterized by specific operational conditions. Managing employees involves particular actions, yet no similar study has been conducted among this occupational group.

Keywords: employee satisfaction, medical records clerk.

1. Introduction

Work is a source of fulfilment of various human needs in modern societies. In particular, it satisfies biological, social and psychological needs. Satisfactory work is a substantial element of a fortunate life (Głowacka and Mojs, 2015). Employee satisfaction has a direct impact on individual's behaviour at workplace. It influences manners of employees' perception on positive and negative emotions connected with vocational tasks fulfilment (Abuhashesh, Al-Dmour and Masa'deh, 2019). Happier employees achieve higher productivity. This encourages employers to examine employee morale and job satisfaction in order to adjust the working environment (Yeleyko and Yarova, 2021). The importance of employee satisfaction is becoming increasingly relevant for organizations as research confirms that satisfaction affects both attitude toward work and motivation to complete tasks (Głowacka and Mojs, 2015).

The delivery of public services, including health services, and the continuous improvement in quality is determined by motivation, competence and performance of employees. Therefore, affecting employee motivation and providing a suitable career path is crucial (Ren and Marcinkowski, 2021). In addition, a positive relationship between employee satisfaction and job stability can be demonstrated (Abuhashesh et al., 2019). Moreover, lower absenteeism, commitment, drive towards work and loyalty also show a positive correlation (Jędrzejczak-Gas and Wyrwa, 2020). Job satisfaction can be defined in many ways (Ingram and Głód, 2014). One of the job satisfaction definitions is a pleasant or positive emotional state that results from complex interactions between the work experience and the organizational environment (Filho, Souza and Elias, 2016). Satisfaction can be obtained through the degree to which individual needs are met, individual values are satisfied, and from differences between the individual expectations and what the job offers (Batura et al., 2016). To clear the meaning of concept, in the next part of the article differences between satisfaction, morale, enjoyment and disenjoyment are presented.

It is worth underlining that enjoyment is an individual variable and it is not the same as morale which is a group variable. Morale refers to attractiveness of the group and the willingness of individuals to remain in it (Armstrong and Taylor, 2016), while job enjoyment is identified as a positive attitude towards working conditions, performed tasks, and interactions with co-workers and supervisors. Moreover, work enjoyment is an insufficient however an obligatory condition for job satisfaction achievement. In addition, it is compulsory to create conditions for development and to enable the employees to use their skills and talents, as well as to give them freedom of action to achieve job satisfaction (Juchnowicz, 2014). In contrast, the factors that shape satisfaction are different from those responsible for employee disenjoyment. Consequently, these concepts cannot be treated as opposites (Filho et al., 2016). However, there is a link between job disenjoyment and the motivation of employees to perform

their jobs and accomplish their tasks. It leads to the conclusion that employee dissatisfaction indirectly affects the costs suffered by the organization due to negative occurrences (Głowacka and Mojs, 2015).

The consequences of employee disenjoyment are numerous, including decreased engagement, creativity and quality of decision-making, lower productivity, higher levels of personnel turnover, and higher rates of short-term absenteeism (2-3 days). Moreover, it contains more frequent work-related accidents, experiencing stress, aggression or alienation, more frequent workplace conflicts, decreased satisfaction and quality of life. Once an employee feels content, it does not yet mean that they are experiencing job satisfaction. In the case of job enjoyment, the determinants of positive attitude are external conditions, while achieving job satisfaction requires the interaction of internal factors (Juchnowicz, 2014). Factors determining employee satisfaction or contributing to lack of satisfaction can be divided into three categories: personal, situational, and internal. Personal factors are related to employee's individual personality traits and education. Situational factors refer to the characteristics of the job itself and the nature of the organization in which the employee is hired. Internal factors concern the conditioning of the pursued profession (Domagała et al., 2018).

Among factors affecting job satisfaction that are worth mentioning are the following: intrinsic motivational factors that relate to work content; quality of supervision that affects employee attitudes and relates to informal contacts between employees; success, by itself, enhanced if employees recognize it as the full realization of one's potential; failure, triggering a mechanism opposite to success (Armstrong and Taylor, 2016). When characterizing job satisfaction, three aspects can be distinguished:

1. the cognitive aspect, which includes the employee's knowledge of various working conditions, forming opinions and beliefs,
2. the behavioural aspect, which is expressed in actions taken, as well as behaviour and a certain attitude towards work,
3. the emotional aspect, associated with the attitude towards the job and the environment (Juchnowicz, 2004).

In the following part of the article methods of job satisfaction measurement and practical implications of this action are discussed.

2. Methods and implications of examining employee satisfaction

In practical terms, the need for employee satisfaction studying results from the necessity to identify actions that managers should undertake to motivate employees and prevent them from leaving the organization (Kopertyńska, 2009). In addition to the necessity to retain employees within the units, unstable economic situation, legislative changes along with increased

competition and growing awareness of patients represent some of the challenges for medical entities in Poland (Gołębiowski, Wojnarowska and Jędrzejczyk, 2017). In health care organizations, staff plays an important role in fulfilling the mission of public entities and achieving the goals set. In addition, the employees hired in the organization determine the efficiency of the operation. Therefore, it is crucial to pay attention to adequate human resource management, especially in the areas of service provision (Ziółkowska and Szmit, 2018). Among many benefits of conducting employee satisfaction surveys, the most notable are: finding out employees' opinions about the management tools and methods used within the organization, revealing the pros and cons of the motivational tools in use, identifying factors determining employee satisfaction, pinpointing malfunctions in the employee motivation process and specifying their causes, improving communication and cooperation (Głowacka and Mojs, 2015). To perform employee satisfaction measurement, mainly quantitative research using survey questionnaires is used (Juchnowicz, 2014). Research on employee satisfaction can be performed by analysing individual groups of factors that shape satisfaction, with a focus on a selected aspect of work.

A common example of a measurement tool is the Job Satisfaction Survey (JSS), developed by P. Spector of the University of South Florida in the United States. Questionnaire consists of 36 statements which allow to assess job satisfaction in 9 dimensions (Serafin and Doboszyńska, 2018). These dimensions are following: benefits, contingent rewards, communication co-workers, nature of work, pay, promotion and supervision. JSS was developed to conduct satisfaction measurement among employees in public sector (Batura et al., 2016). JSS tool is recommended for group surveys and should not be used for individual assessment. In 2018, JSS was used to assess the satisfaction of nurses working in public hospitals in Poland. Analysis of the results can help in creating a work environment that encourages people to enter and pursue work in the health care field (Serafin and Doboszyńska, 2018).

Globally popular method used to assess overall employee satisfaction is the Minnesota Satisfaction Questionnaire (MSQ), available on the University of Minnesota website (Ingram and Hunger, 2014). The tool was thoroughly tested and validated using the Cronbach's alpha coefficient, which is used to assess the reliability of psychological tests and corresponds to the internal consistency of the test (Martins and Proença, 2012). MSQ allows the measurement of social values and work needs on the basis of job satisfaction. The questionnaire comes in a long version and a short form (Kamarulzaman and Nordin, 2012). The survey in the shortened version includes twenty issues that most accurately represent the baseline areas from the original one hundred item version. The statements included in the questionnaire should be rated using a five-point Likert scale (with a range of 1-5: 1 – very dissatisfied, 2 – dissatisfied, 3 – neutral, 4 – satisfied and 5 – very satisfied), designed to assess the acceptability of a phenomenon (Martins and Proença, 2012). According to the Vocational Psychology Research, University of Minnesota website, *All forms are available under a Creative Commons Attribution-NonCommercial 4.0 International License. This license permits the free use of this*

tool for research or clinical purposes without written permission, thus making it free to use for scientific purposes.

MSQ has already been applied to study the satisfaction level of employees working in health care in Poland on the example of oncological nurses (Piotrkowska, Jarzynkowski and Książek, 2020), physiotherapists (Barabasz et al., 2017) and hospital employees overall (Ingram and Hunger, 2014). Conducting a survey dedicated to medical record clerks will determine the average satisfaction level of administrative staff.

3. Research method and research sample

The aim of the research is to assess the general level of satisfaction of administrative personnel in health care units in Poland. Also, to identify areas and factors that are of key importance for shaping job satisfaction in the opinion of respondents. It is worth highlighting that job satisfaction study is based on subjective feelings of the respondents (Kopertyńska, 2009). The obtained results will allow to present changes that are possible to implement in medical entities aiming employees satisfaction improvement in administrative positions.

For the purposes of this study, the Minnesota Satisfaction Questionnaire (MSQ), available on the University of Minnesota website, was utilized. The authors translated the original questionnaire into Polish in an attempt to make it meaningful on many levels to the study population while taking the utmost care to ensure that the statements corresponded as closely as possible to the original version. The study was conducted in December 2021 via online Google forms made available to a private social media group of female medical registrars or medical statisticians. Participation in the research was voluntary and the responses provided were anonymous. Respondents were informed that survey results would be used only for scientific purposes and will be analysed collectively. In order to ensure the reliability of the answers, the questions in the metric were designed in such a manner that it was not possible to verify the place of work of the participants. Basic information concerning the respondents is presented in the Table 1.

Table 1.
Interviewee basic information

Variable	Share (%)
Gender	
Female	100%
Years of occupational practice in a particular entity	
Less and equal to 5 years	62%
6-20 years	36%
More than 20 years	2%

Cont. table 1

Years of occupational practice in general	
Less and equal to 5 years	22%
6-20 years	64%
More than 20 years	14%
Type of employment contract	
Employment for an indefinite period	80%
Employment for a specific period	17%
Others, including contract of mandate	3%
Number of workplaces	
1	84%
More than 1	16%
Type of facility according to source of funding	
Public	63%
Private	30%
Both, public and private	7%

Source: own elaboration based on own research.

Only women participated in the survey due to the way the questionnaires were made available. The largest share of respondents is employed under an indefinite contract at a single workplace. Most individuals work for an entity whose medical services are publicly funded. Furthermore, most respondents work in hospitals. Taking into account years of practice in a particular entity, the most numerous group consisted of people working at their position from 1 to 5 years, while considering occupational practice in general the most significant number of respondents had 6-20 years of experience. The results obtained are discussed in detail in the following section.

4. Findings

Respondents were asked a number of questions related to perceived satisfaction as well as to aspects of their work associated with job satisfaction. In the initial question, study participants were asked to evaluate their overall job satisfaction including all aspects of their job, while the following question was focused on overall life satisfaction. The results are presented in Figure 1 and Figure 2.

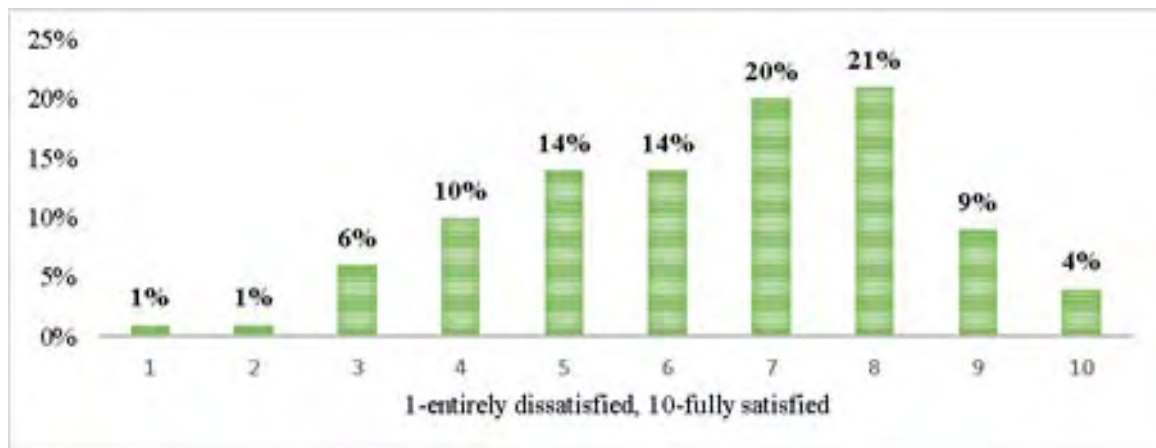


Figure 1. Taking all factors into account, how satisfied are you with your current job? Source: own research.

The largest number of respondents indicated a score of 8 (21%) and 7 (20%), with an average job satisfaction indicated as 6.42. This means that the average satisfaction is above median. Satisfaction with the current job took a greater divergence of results in relation to work experience.

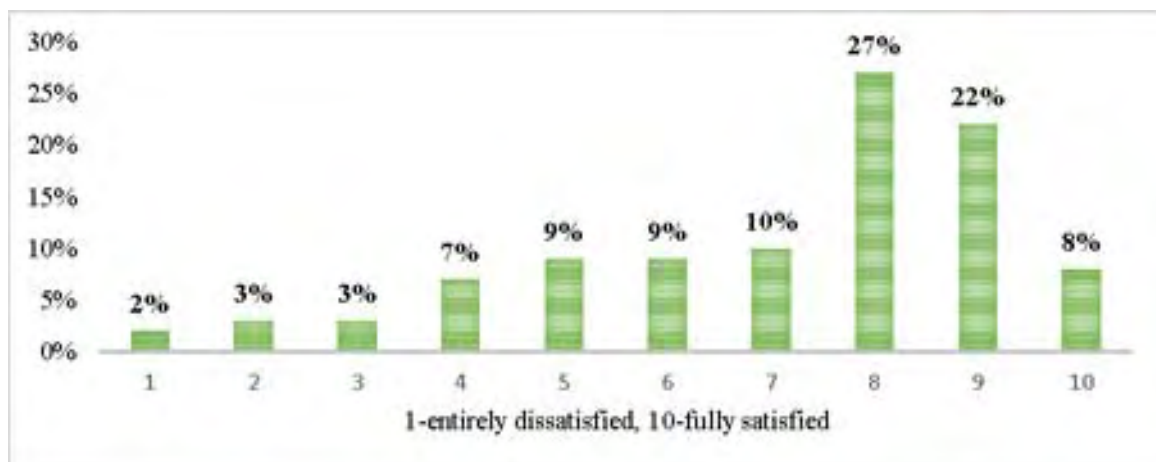


Figure 2. In general, how satisfied are you with your current life? Source: own research.

Analysing responses to the life satisfaction question, the mean of responses was 7.02, with the most number of responses ranking scores 8 (27%) and 9 (22%). This means that the respondents of the study, on average, are more satisfied with their life than their occupation.

The core question of the research was to determine the level of satisfaction for each work-related aspect using a five-point Likert scale. The number of indicated values and the arithmetic mean of the results are presented in the Table 2.

Table 2.
MSQ results

Statement	A	B	C	D	E	Average
The chances for advancement on this job	41	45	24	14	1	2,11
My pay and the amount of work I do	43	38	23	17	4	2,21
The way company policies are put into practice	29	41	36	15	4	2,39
The working conditions	27	33	39	24	2	2,53
The praise I get for doing a good job	32	35	21	25	12	2,60
The chance to be "somebody" in the community	22	36	31	29	7	2,70
The freedom to use my own judgment	20	31	38	30	6	2,77
The feeling of accomplishment I get from the job	19	31	39	30	6	2,78
The way my job provides for steady employment	19	39	28	28	11	2,78
The chance to do something that makes use of my abilities	23	28	32	35	7	2,80
The competence of my supervisor in making decisions	29	23	29	30	14	2,82
The chance to tell people what to do	22	20	43	35	5	2,85
The chance to try my own methods of doing the job	24	20	39	30	12	2,89
The way my boss handles his/her workers	16	37	23	36	13	2,94
Being able to do things that don't go against my conscience	12	26	41	41	5	3,01
The chance to do different things from time to time	15	23	37	39	11	3,06
Being able to keep busy all the time	14	28	24	51	8	3,09
The way my co-workers get along with each other	18	21	25	38	22	3,18
The chance to work alone on the job	10	28	26	49	12	3,20
The chance to do things for other people	15	10	21	54	25	3,51

Legend: (A-very dissatisfied, B- dissatisfied, C-neutral, D-satisfied, E-very satisfied).

Source: Vocational Psychology Research, Minnesota Satisfaction Questionnaire, University of Minnesota, retrieved from: <https://vpr.psych.umn.edu/msq-minnesota-satisfaction-questionnaire>, date of access: 19.12.2021.

When analysing the mean scores obtained for each statement indicated in the questionnaire, the discrepancy ranged from 2.11 to 3.51. Six aspects were rated above 3.0 on average and they include: being able to do things that don't go against my conscience, the chance to do different things from time to time, being able to keep busy all the time, the way my co-workers get along with each other, the chance to work alone on the job, the chance to do things for other people.

Survey participants were also asked several additional job-related questions concerning occurrence of certain phenomena that may negatively affect satisfaction in order to deepen the understanding of the satisfaction issue and to draw more insightful conclusions. Therefore, survey participants were requested to rate the frequency of these phenomena on a scale of 1 to 5 (where 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always). The first of these questions and the distribution of responses are shown in Figure 3.

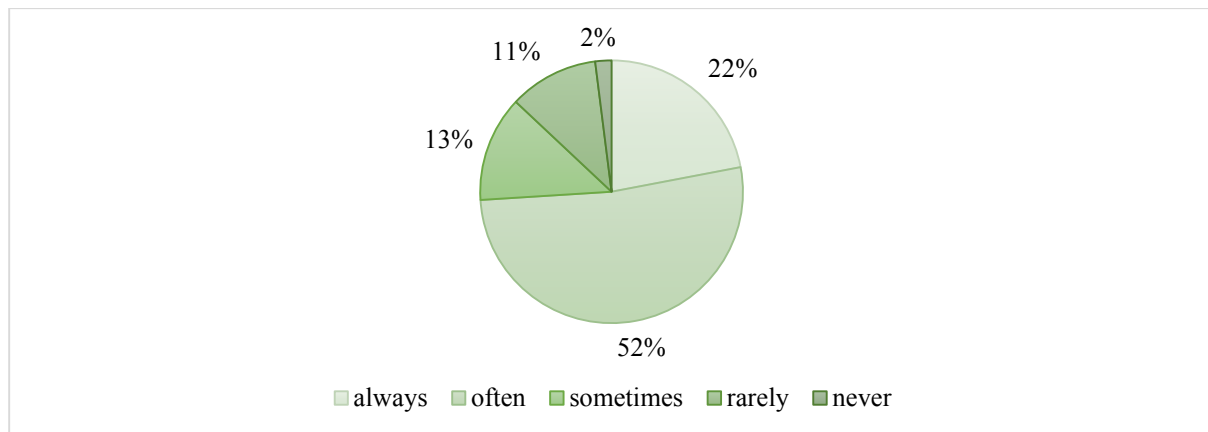


Figure 3. How often are you expected to do work exceeding the scope of your job? Source: own research.

Nearly 3 out of 4 respondents indicated that they are always or often expected to do work beyond the call of their duty, and only 2% indicated that they are never asked to. This indicates a severe pressure to do extra-curricular work not included in the contract. From the supplemental question, it appears that in most cases, medical record clerks are carrying out tasks to be handled by a physician.

The next question concerns the occurrence of disparity in the amount of work load according to a particular workday. The results are shown in Figure 4.

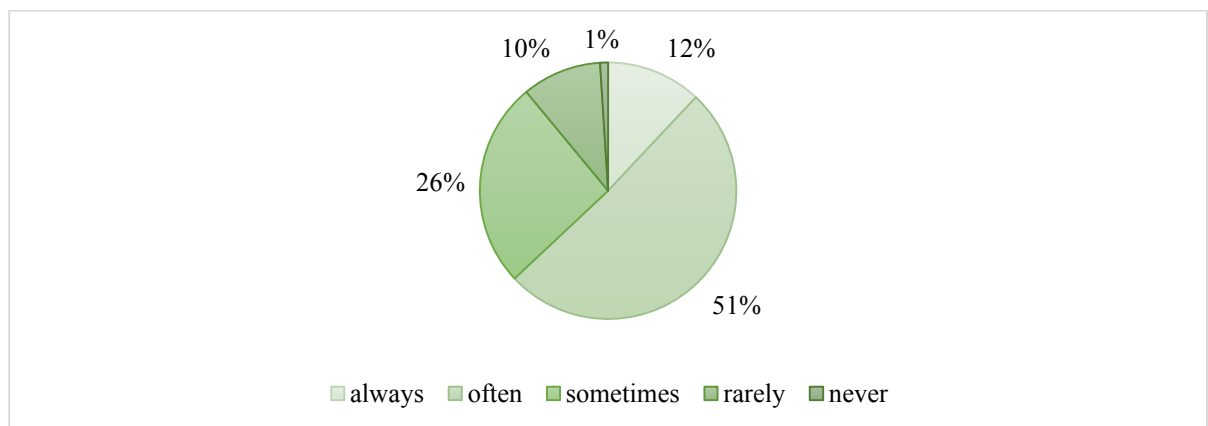


Figure 4. How often in your everyday work is there a great disparity in the amount of work to be done per day? Source: own research.

When analysing the disproportion of workload per day, more than half of the respondents indicated that such a phenomenon occurs frequently. The amount of work per day may vary due to informal requests to perform particular ad-hoc tasks. In relation to this, the next question concerns the possibility to complete all daily tasks before the end of the workday. The results are presented in Figure 5.

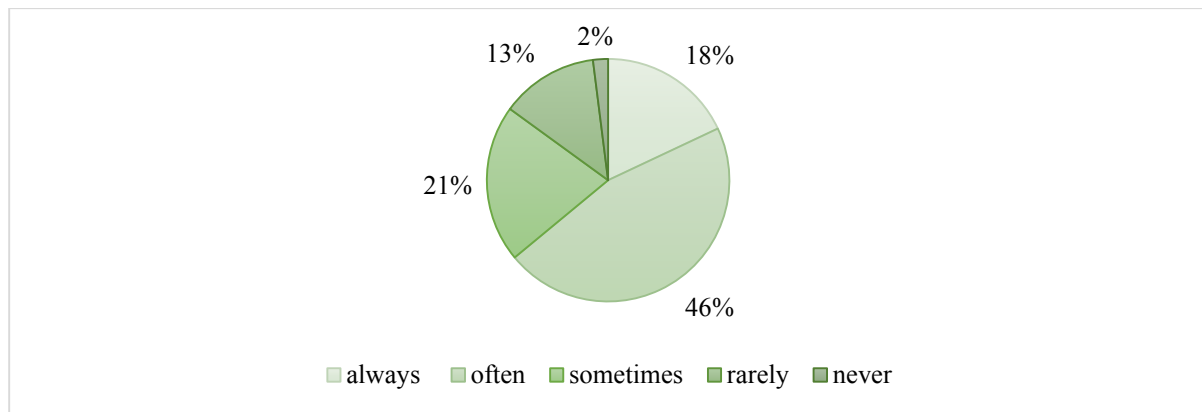


Figure 5. How often do you complete all your assignments before the end of your shift? Source: own research.

The results are similar to the ones in the workload disparity question, so it is reasonable to assume that the potential of completing all daily tasks before the deadline is related precisely to the amount of work given during the day. This means that almost half of the respondents indicated that they are able to complete all tasks often, while 21% sometimes and 18% always, respectively. It can also mean that employees are well organized because they are usually able to complete all of their duties within the same day, despite differences in the workload.

Another question addressed the incorporation of suggestions shared for improving procedures and working conditions (Figure 6).

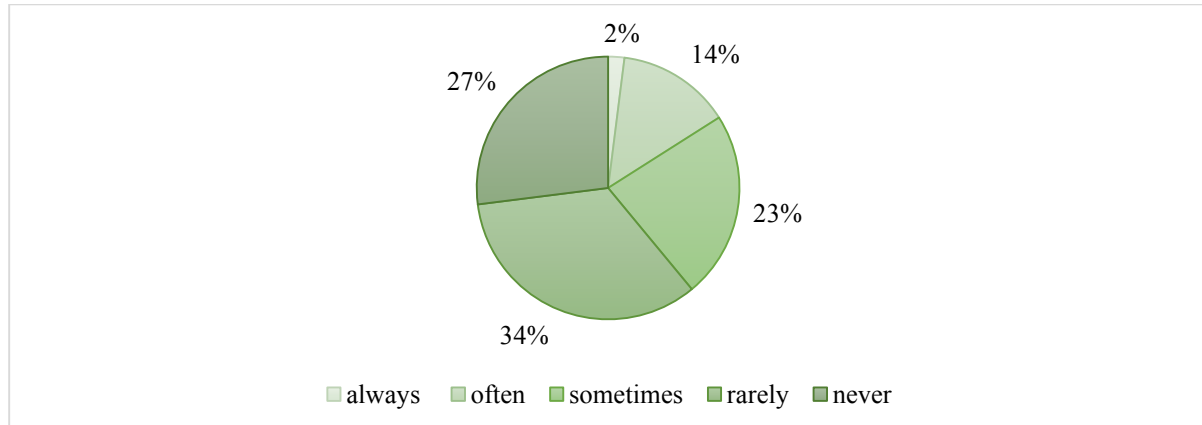


Figure 6. How often are your suggestions for improving procedures and working conditions implemented on an ongoing and effective basis? Source: own research.

Considering the results obtained, as many as 61% of the respondents indicated that the suggestions given on improving procedures and working conditions are rarely or never being implemented. What is more, suggestions made by only 16% of participants are taken into practice more frequently than sometimes, while suggestions made by as many as 27% of respondents have never been implemented. This illustrates a reluctance towards changes and improvements in operational areas that could significantly aid work organization and reduce the disparity of workload over particular days.

Lastly, an open question regarding possible actions to be taken to improve satisfaction was included at the end of the questionnaire. Among mentioned actions that could potentially increase medical record clerks' satisfaction, most respondents indicated that changing the procedures applying to the job (46%), as well as paid overtime (45%) would be the key. Moreover, necessity of greater computerization and work automation (29%) and task-based rather than time-based work model (27%) were commonly mentioned. Surprisingly, a salary increase (9%) and a change of supervisor (7%) were relatively rarely mentioned. Among others, respondents also listed the hiring of additional staff due to an overabundance of work for one person, the need to establish precise tasks for the job, improvement of social conditions, as well as greater appreciation and respect from patients.

5. Conclusion and recommendations

The answers received in the survey represent diversity of opinions. Satisfaction of employees is associated with motivation to perform tasks and their productivity. The declared average level of satisfaction according to the Minnesota Satisfaction Questionnaire is 2.81 (where 2 means dissatisfied and 3 means neutral), therefore in order to increase employee engagement efforts to improve employee satisfaction are worth taking. When considering the supplemental questions, 75% of the respondents perform tasks beyond the scope of their duties, thus it seems crucial to redefine the range of responsibilities assigned to the profession and to adhere to the terms of the contract, otherwise to implement benefits for extra-curricular work. With half of the respondents indicating the occurrence of work disparity varying from day to day, introduction of a task-based work model should be considered even more so. As for the question about suggestions to make improvements, 61% of those usually do not meet with supervisor approval. At this point, it would be relevant to investigate further what is the exact reason for the rejection of the proposed solutions. Perhaps the reasons for rejection are financial issues, the absence of positions responsible for improving procedures, or reluctance to implement any changes. Remarkably, the majority of participants are most frequently able to complete the tasks assigned for the day. Among the key improvements mentioned by respondents, the necessity to change work procedures was the number one priority. Adequate management of health care entities is essential to ensure sustainability of care which is vital to the lives and health of patients, so it is advisable to ensure its effectiveness.

6. Limitations

Considering all the results obtained in the empirical study, some limitations were found and they represent potential directions for future research. First of all, individuals participating in the study represented a variety of healthcare entities. For future study, it is relevant to conduct dedicated surveys for a specific group of employees according to the type of medical facility, department, or specific responsibilities in order to obtain the maximum comparability of results. Secondly, it is reasonable to explore the topic in qualitative research and to conduct individual in-depth interviews with respondents in order to understand the underlying reasons of the declared phenomena. Lastly, the study utilized the short version of MSQ questionnaire, which revealed some significant domains affecting job satisfaction in the group of medical record clerks. In order to improve the insight into the issue, it would be recommendable to use the full version of the research questionnaire, which would require more time spent by the respondents, as well as a direct supervision over the survey's undertaking, both of which would be far more achievable from the organizational level.

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THE IMPACT OF ENERGY TRANSITION ON THE CHANGES TO THE ENERGY COMPANY'S BUSINESS MODEL

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Purpose: The article focuses on the issue of energy transition in relation to Polish entities operating in the energy sector. The aim of the article is to analyse and assess the scale of the changes in the business models of energy companies resulting from the transformation.

Design/methodology/approach: The literature on the study of energy models and transformation has proposed theoretical frameworks to support energy transformation. They provide inspiration to examine the impact of energy transition on the business models of Polish traditional energy companies operating in the form of integrated capital groups. Three energy companies of the Polish energy sector, operating in the form of integrated capital groups – PGE, TAURON and ENEA – were selected for the study. The research used such methods as literature review and materials concerning the current situation and market trends in the energy sector as well as case study research. The research model uses the approach proposed by A. Osterwalder and Y. Pigneur, describing the rationale behind the way in which an organisation creates value and provides and profits from the value created.

Findings: The article summarises the results of research devoted to the changes in the configuration of the business model of a traditional energy company in the context of building a new energy market structure, characterised by distribution of generation sources, fast-growing prosumerism, intelligence of solutions resulting from the innovative ICT technologies applied and virtualisation of the offered customer value. The research covered selected Polish energy companies operating within the structure of capital groups.

Practical implications: The presented summary of the impact of the energy transition confirms that its presence triggers profound changes in the business model of the traditional energy company and its components.

Originality/value: The article presents a synthesis of the regulatory, legal and market conditions shaping the scope and depth of the transformations in the energy sector. The article summarises a review of new business models in the power industry and defines directions of changes in the business model of an energy company, which were determined as a result of the research. The article also discusses a possible scenario for further restructuring and changes in the business model of an energy company in the light of governmental programmes for the transformation of coal production assets and hard coal mining.

Keywords: business model, energy company, energy transition, energy sector, climate change, restructuring.

Category of the paper: research paper.

1. Introduction

Building a new energy sector, one that would be using digital technologies as well as the ICT industry on a large scale, by replacing coal- and gas-fired generation sources with renewable energy sources is the main prerequisite for the transformation which is currently taking place (Popczyk, 2018). The energy transition process is changing the structure of the energy sector (Giehl et al., 2020). Functioning of the Polish energy sector entities is significantly determined by the political and regulatory environment in Poland and the European Union (EU). Decarbonisation and the resulting transformation of the energy sector towards a permanent change in the structure of electricity production and a reduction of the share of coal with an accompanying increase in the share of Renewable Energy Sources (RES) in the energy mix are the key challenges for the Polish energy sector. A rapid transition of the power systems towards modern, low-carbon pathways and technologies will be necessary to achieve climate goals, while at the same time enabling other key objectives to be achieved such as economic development, energy access and resilience of the energy system (Sadie et al., 2020).

Adjusting the energy sector entities to the challenges resulting from the energy transition process means restructuring these entities, while assuming a fundamental remodelling of the activities conducted by them so far. Restructuring is defined as systematic rebuilding, modernisation or updating the organisational structure as well as the principles of operating. It represents a strategy of growth and reorientation (Borowiecki and Wyslocka, 2012), a thorough, conceptual redesign of business processes. It is a complex process of fundamental changes in a company, whose aim is the operational and strategic shaping of the attributes of its subjectivity in terms of changes in the environment and internal needs (Suszyński, 2003).

The article focuses on the issue of energy transition in relation to Polish entities operating in the energy sector. The aim of the article is to analyse and assess the scale of the changes in the business models of energy companies occurring as a result of the transformation. Taking up the subject in the article results from the importance of the problem in the light of the current regulatory and political conditions related to climate, both in the context of the scale and volume of the process and property changes associated with the transformation, but also in the context of the future structure of the energy sector in view of the inevitable resource, process and organisational changes, changes in competitive conditions and reformulation of the expected and offered value on the energy market in the future.

The article summarises the results of research devoted to the changes in the configuration of the business model of a traditional energy company in the context of building a new energy market structure, characterised by distribution of generation sources, fast-growing prosumerism, intelligence of solutions resulting from the innovative ICT technologies applied and virtualisation of the offered customer value. The research covered selected Polish energy companies operating within the structure of capital groups.

The article presents a synthesis of the regulatory, legal and market conditions shaping the scope and depth of the transformations in the energy sector. It also summarizes a review of the directions of the changes in the current business models and creation of development of new models in the area of energy. The article also defines a possible scenario for further restructuring and changes in the functioning of Polish energy companies in the light of the governmental programmes for the transformation of coal production assets and hard coal mining.

2. Energy company business model

Building long-term value of a company that guarantees its success on the market can be achieved by adopting an appropriate business model. It should enable implementation of effective measures for the company to become a market winner or a strong, stable market player (Jabłoński, 2013).

A business model describes the design or architecture of the mechanisms of value creation, delivery and capture that it employs. In the concept of a business model, an enterprise is treated as a set (system) of logically connected elements that allow the enterprise to create value and enable it to profit from that created value (Teece, 2010).

In recent years, the business model concept has become increasingly popular. This is due to the underlying holistic approach to business management, both from a static perspective, emphasising the resources and competences underlying competitive advantages, as well as from a dynamic perspective, encompassing the realisation of processes in order to use these resources and generate value.

P.B. Seddon and G.P. Lewis treat a business model as an abstract representation of some aspect of a company's strategy (Seddon and Lewis, 2003). Ch. Zott and R. Amit, define a business model as an abstract, rational way of describing how a corporation creates, delivers and obtains value and the basic competitive advantage of the enterprise from the point of view of value creation (Zott and Amit, 2009). D.J. Teece's concept of a business model is created around a set (system) of logically connected elements, which allow a company to create value and enable it to profit from this value (Teece, 2010). According to A. Afuah and C.L. Tucci, a business model is a method of building and using resources to offer customers better value than its competitors, which at the same time ensures the company's profitability through a system consisting of components, links between components and activities (Afuah and Tucci, 2001). In turn, the business model as a representation of the underlying logic and strategic choices of value creation and retention in the value network area is presented in the works of S.M. Shafer, H.J. Smith, J.C. Linder (Shafer et al., 2005). Similarly, H. Chesbrough and R. Rosenbloom, call a business model a structure that combines technical potential with economic value, in which the factors of the resource aspect of the business model, should lead

to the creation of added value (Chesborough and Rosenbloom, 2002). Many other definitions of a business model can be listed, emphasising its essence as a description of the roles and relationships between a company's consumers, customers, allies and suppliers that identify the main flow of products, information and money and the main benefits for the participants (Weil and Vitale, 2001), or product, service and information architecture, including a description of the different business entities and their roles, a description of the potential benefits for the different business entities and a description of the revenue streams (Timmers, 1998), either content, structure and transaction management designed to create value by exploiting business opportunities (Casadesus-Masanell and Ricard, 2010). In the concept of A. Osterwalder and Y. Pigneur, a business model describes the rationale behind how an organisation creates value and delivers and profits from the value created. As a construct of nine basic elements (customers, value proposition, channels, customer relationships, revenue streams, key resources, key activities, key partners, cost structure), it provides a sketch of the strategy to be implemented within structures, processes and systems (Osterwalder and Pigneur, 2010).

Interest in the business model is indeed noticeable also in the Polish literature. One can mention here the works of K. Obłój (Obłój, 2002), J. Rokita (Rokita, 2005), J. Brzóska (Brzóska, 2009), T. Gołębiowski et al (Gołębiowski et al., 2009), A. Jabłoński (Jabłoński, 2013), B.E. Matusiak (Matusiak, 2013) and many others.

The above review of selected definitions and theoretical approaches to the application of business models confirms the role and importance of this interesting tool in company management and strategy implementation. Therefore it implies the need to analyse the factors that influence and will influence in the future the manner and models of operation of entities in the energy market.

An analysis of the body of literature indicates that researchers are interested in both identifying and defining new business models in the energy market and in the impact of the energy transition on the business models of energy companies.

A general division of models in the energy market was proposed by L. Frantzis, S. Graham, R. Katofsky and H. Sawyer. These are: prosumer/customer-side, large-scale generator business models (building off-shore and on-shore wind farms, solar farms, VPPs, biomass CHPs, tri-generation, etc.) (utility-side) and service business models (service provider and/or aggregator models and medium supplier models: electricity, heat or gas) (Frantzis, 2008).

S. Bryant, K. Straker and C. Wrigley identify a Traditional Energy Utility, a Green Energy Utility, a Cooperative Utility, a Prosumer Utility and a Prosumer Facilitator (Bryant, 2018). B.E. Matusiak's concept of new business models in the energy market includes the prosumer/customer model, the ESCO (Energy Saving Company)/HSCO (Home Service Company) model, the generator's business model, the market aggregator's business model and the business model of electric car users in the energy market (Matusiak, 2013).

Examples of studies of the impact of transformation on selected business models in the energy industry are presented in Table 1.

Table 1.
Studies on the impact of transformation on selected business models in the energy sector

No.	Author	Subject of the study
1.	M. Provance, R.G. Donnelly, E.G. Carayannis/ 2011	The impact of political and socio-institutional dynamics on the business models of microgeneration ventures in geopolitical context.
2.	M. Richter/ 2012, 2013	Impact of the transformation on business models, in particular in the context of climate aspects and adaptation of business models to them. Investigating the business models of traditional companies in the energy sector in the context of renewable energy transformations.
3.	B.E. Matusiak/ 2013	New business models in the energy market using smart solutions, so-called e-energy.
4.	L. Strupeit, A. Palm/ 2016	PV deployment in the context of accelerated diffusion of distributed PV systems.
5.	J. Brzóška, M. Krannich/ 2016	Concepts of business models in the context of technological and organisational transformations based on a wide range of implemented innovations.
6.	S.P. Burger, M. Luke/ 2017	Analysis of business models in the context of distributed energy resources, photovoltaic applications, energy storage using an empirical approach.
7.	M. Hamwi/ 2019	Analysis of innovative changes in business models in the electricity system initiated by energy start-ups in the context of energy transition.

Source: own elaboration based on: Provance M., Donnelly R.G., Carayannis E.G. (2011); Burger S.P., Luke M. (2017), Richter M. (2012), Richter M. (2013), Strupeit L., Pal A. (2016), Matusiak B.E., (2013), Brzóška J., Krannich M. (2016), Hamwi M. (2019).

In a study of the impact of the transformation on business models in the energy industry, J. Giehl, H. Göcke, B. Grosse, J. Kochems, and J. Müller identified three research gaps, based on which they developed a framework of the Business Model for Energy Transformation (BMFE). The identified research gaps include (Giehl et al., 2020):

- existing business model systematisations are not sufficient to characterise business models for energy system transformation;
- there is no comprehensive overview of currently existing business models in the field of energy;
- there is no adequate approach to describe the impact of the energy system transformation on the interactions between business models and the structure of the energy industry.

The BMFE framework describes business models in the energy industry, classifying them, based on primary (practice-based) and secondary (theory-based) data, identifying a total of 638 business models classified into 69 prototypes and 17 classes of business models according to the dimensions of "customer proximity" and "proximity to the classic value chain in the energy industry". Complementing these results is a framework for classifying the business model of start - ups in the energy sector by M. Hamwi (Hamwi, 2019), which is a conceptual tool for managing R&D business models.

The above literature review highlights the different logics of business models and their applications to accelerate energy transition. New business models are emerging based on value creation in sustainable development conditions combining environmental and community aspects, using renewable energy sources and break-through innovations. The literature review indicates a lack of an adequate approach to studying the effects of the transformation on Polish energy companies in relation to the current situation. The factors determining the resilience of the business model of an energy company to transformational changes have not been sufficiently investigated. Thus, an adequate methodological framework for measuring and assessing the resilience of the business model of an energy company in this context has not been developed.

3. Energy transition

3.1. Energy transition – the legal and regulatory aspect

Redefinition of political and regulatory priorities results in the transformation of the traditional energy sector model into a completely new dimension of the new energy industry. Regulatory actions play an important role in this process, stimulated by the European climate policy, which assumes drastic reduction of carbon dioxide emissions by 2050. The transformation of the energy sector is necessary to face the challenges resulting from limited fossil fuel resources and to end Europe's dependence on energy imports from politically unstable areas (Sobolewski, 2019).

The following key EU regulations address the long-term vision of trying to achieve climate neutrality in the EU by 2050 resulting from the climate and energy policy as well as the regulatory mechanisms stimulating the achievement of the objectives in the coming decades:

- United Nations Framework Convention on Climate Change of 2015, the so-called Paris Agreement, and the Katowice Climate Package of 2018, implementing the postulates of the Paris Agreement;
- the 2019 regulatory package Clean Energy for Europeans, which operationalises the EU's 2030 climate and energy targets (PEP2040, 2020);
- The European Green Deal of December 2019, as a strategy to transform the EU into a modern, competitive climate-neutral economy in 2050, sets out the EU's goals to achieve climate neutrality by 2050;
- European climate law (COM 4.3.2020, 2020);
- Climate Plan 2030 – a proposal to further reduce greenhouse gas emissions by at least 55% by 2030 – included in the Commission Communication of 17 September 2020 (COM 17.9.2020, 2020);

- A new EU Climate Adaptation Strategy;
- Communications from the European Commission on an EU strategy for the integration of the energy system and the EU Hydrogen Strategy (COM 8.7.2020, 2020);
- The 'Fit for 55' legislative package (Council of the European Union, 2021).

The European Commission's September 2020 targets aim to increase the target level of greenhouse gas emissions reduction, including emissions and removals, to at least 55% by 2030 compared to 1990 levels. Financial support and technical assistance for the regions most affected by the transition to a green economy could amount to €100 billion between 2021 and 2027(www.ec.europa.eu).

The July 2021 'Fit for 55' legislative package involves updating and aligning existing regulations with a greenhouse gas emissions reduction target of at least 55% by 2030 (Council of the European Union, 2021).

Poland supported the 2019 European Green Deal target for the EU to achieve climate neutrality by 2050. Due to the difficult starting point of the Polish transformation and its socio-economic aspects, a specific national derogation was developed. Over the past several years, Poland has implemented measures aimed at reducing the environmental impact of the energy sector, in particular through modernisation of generation capacity and diversification of the energy generation structure. However, dependence on fossil fuels is still significantly higher than in other EU Member States. A just transition remains crucial for Poland, which means taking into account the starting point, the social context of the transition, and counteracting the uneven distribution of costs among countries, burdening economies with high coal fuel use more (PEP2040, 2020).

The objectives for the Polish energy sector and the directions of changes in the energy mix are defined by the Energy Policy of Poland until 2040 (PEP2040, 2020) approved in February 2021. A just transition, a zero-emission energy system and good air quality make up its three pillars. The objectives of the Policy assume the optimal use of own energy resources, expansion of the generation and grid infrastructure of electricity, diversification of supplies and expansion of network infrastructure for natural gas, crude oil and liquid fuels, development of energy markets, implementation of nuclear energy, development of renewable energy sources (RES), development of district heating and cogeneration and improvement of energy efficiency. The gradual abandonment of electricity generation in high-emission coal units and the simultaneous development of low- and zero-emission sources are in line with the EU energy policy.

The specific objectives of PEP2040 include (PEP2040, 2020) optimal use of own energy resources, development of generation and grid infrastructure of electricity, diversification of supplies and development of grid infrastructure for natural gas, crude oil and liquid fuels, development of energy markets, implementation of nuclear energy, development of RES, district heating and cogeneration, as well as improvement of energy efficiency. In terms of the expected effects, this indicates (PEP2040, 2020):

- no more than 56% of coal in electricity generation in 2030,
- at least 23% of RES in gross final energy consumption in 2030,
- deployment of nuclear power in 2033,
- a 30% reduction in GHG emissions by 2030 (as compared to 1990),
- reduction of primary energy consumption by 23% by 2030 (as compared to 2007 consumption projections).

The National Energy and Climate Plan 2021-2030 sets out the objectives and targets, as well as policies and actions to achieve the energy union dimensions encompassing energy security, internal energy market, energy efficiency, decarbonisation and research, innovation and competitiveness. On 2 February 2022, the Regulation of the Minister of Climate and Environment on energy market processes was published. It is an implementing act to the so-called Metering Act of 20 May 2021, introducing the smart metering system in Poland. The regulation will enable the implementation of the Central System for Energy Market Information (CSIRE) operated by the Energy Market Information Operator (OIRE). This function will be performed by PSE S.A. company. The task of CSIRE will be to process energy market information, which will allow, among other things (Rozporządzenie..., 10.01.2022):

- quicker supplier switching,
- free and easy access to information about one's contracts and energy consumption,
- obtaining information on offers and savings available on the competitive electricity market,
- further secure integration of RES in the energy system,
- the use of synergies in the sector, including increased flexibility of the system and the potential of active consumers.

Further tightening of EU climate policy is to be expected. From the perspective of the challenges facing energy companies, other regulations, both EU and national, also remain important. A selection of these is indicated below.

Implementation of Directive 2019/944 of the EU Parliament and of the Council of 5 June 2019 on common rules for the internal market in electricity (Dyrektywa..., 2019), introduces to the Energy Law an obligation to install remote reading meters on a mass scale. By the end of 2028, at least 80% of the total number of energy consumption points of end users in households should be equipped with a remote reading meter, and 100% by 30 June 2031. At the same time, if the installation is not completed, the Distribution System Operator (DSO) may be subject to a penalty of no more than 15% of the fined entrepreneur's revenue from licensed activities achieved in the previous fiscal year.

Law on Electromobility and Alternative Fuels of 11 January 2018 (Ustawa o elektromobilności..., 2018), sets out the rules for the development and operation of infrastructure for the use of alternative fuels in transport, the obligations of public entities within

the scope of developing alternative fuel infrastructure and the conditions for the operation of clean transport zones, as well as the national policy framework for the development of alternative fuel infrastructure and the manner of its implementation. It also defines the obligations related to the construction by DSOs of publicly available charging stations for alternating current electric cars.

Also the BAT conclusions (Ustawa o rynku mocy..., 2017), the RES support system, the so-called RES auctions and participation in them as well as the regulations related to the so-called "capacity market" concerning reservation of capacity of coal units together with the mechanism of remuneration for generating capacity change the processes, costs and conditions of operation. The launch of the capacity market, within which electricity is supplied by generating units, results in the simultaneous idling of the mechanisms of operational capacity reserve and intervention cold reserve. The system of support for electricity generation in dedicated sources (coloured certificates), on the one hand results in costs related to the redemption of the certificates for the energy selling entities to end users and on the other hand brings revenues from the sale of the certificates to energy generators.

From the point of view of resources and generating capacities of energy entities, it is important to take into account the growing requirements related to environmental protection as a consequence of the changes introduced to the Environmental protection law, the so-called anti-smog resolutions, as well as the planned amendments to the regulations relating to the Act of 25 August 2006 on the system of monitoring and controlling the quality of fuels, i.a. the quality requirements for solid fuels.

Changes in regulations concerning the energy sector, as well as changes in the legal environment, including tax law, commercial law, environmental protection, and changes in regulations concerning the operation of the Polish Power Exchange are other important issues from the perspective of energy sector entities.

The above review of selected EU and national regulations on the broadly understood business activity in the energy sector shows the significant impact of these regulations and provisions on the structure, processes and resources of current and future business models in the energy market.

3.2. Energy transition – the market conditions

Transformation of the energy sector to a completely new dimension, apart from being burdened with political and regulatory priorities, is the result of changes in market conditions, putting stress on disruptive innovations that, thanks to ICT technologies, allow the use of alternative network, generation or customer service solutions. It is also the result of a new configuration of forces and market mechanisms on the energy market in the conditions of a new combination of factors, including the development of new models of operation and new players getting involved in the links of the existing value chains.

The contemporary energy market is shaped by a decreasing demand for coal, reduction or even elimination of coal use by individual users by 2030, development of electric heating, decreasing share of coal and increasing share of RES in the domestic energy mix, development of photovoltaic, wind, marine and nuclear energy, electromobility, electricity storage technologies and the use of hydrogen. The behaviour of individual and business customers is changing, shaped in particular by the increasing environmental awareness and responsible business.

These days, for the energy industry, “transformation” as a term denoting a transition, transformation, metamorphosis in the light of historical experience, is taking on a new, groundbreaking meaning. Deep changes in the European regulatory systems promoting liberalisation and integration of energy markets that have been taking place since the beginning of the 1990, as well as the structural changes in the national energy sector – demonopolisation, commercialisation, privatisation and consolidation – have created the current shape of the energy sector and the business models of energy companies that cover the full value chain from coal mining to the sale and distribution of energy, heat and gas.

Historically, changes in the sector were aligned with the then-current EU energy policy, priorities of governmental restructuring programmes and changes in the organisational, functional and ownership structure. The changes in energy market conditions changed the strategic reorientation of enterprises in the sector, and the restructuring was reflected in the scale and level of concentration of energy enterprises, currently operating within vertically consolidated capital groups. Governmental actions at the time were aimed at creating a competitive energy market and unbundled entities in the sector. They included the introduction of competition in the generation and trading phases and the regulation of electricity transmission and distribution activities, as well as the division of activities between three subsectors: the distribution subsector (33 power plants), the trading subsector and the generation subsector (heat and power plants). Commercialisation was initiated by the Act on Ownership Transformations of 1993. Six consolidated electricity trading and distribution groups were established (Enea, Energia Pro KE, Enion, PKE, WGE), two energy trading and distribution companies were privatised (GZE, Stoen), two fuel and energy groups were established (PGE, PKE). In total, over a dozen power plants and combined heat and power plants were privatised. On the basis of the government's 2006 Programme for the Power Sector, consolidation of four energy groups (PGE, Energetyka Południe (currently TAURON), Energa and Enea) and the separation of distribution system operators was carried out. IPOs of Polish companies were also finalised (Enea in 2008, PGE in 2009, TAURON in 2010, Energa in 2013) (Staszewska, 2014) The organisational transformations were not accompanied by sufficient modernisation and development processes in generation of assets for today's needs. At present, the Polish energy sector faces new, important challenges.

For the most part, due to historical conditions and access to domestic fuels, the Polish power sector is based on units powered by hard coal and – to a lesser extent – lignite. The position of power sector entities has not changed significantly in recent years. The three largest generators, grouped in capital groups around companies with State Treasury shareholding, i.e. PGE Polska Grupa Energetyczna S.A. (PGE) , ENEA S.A. (ENEA), TAURON Polska Energia S.A. (TAURON), have almost 2/3 of installed capacity and generate about 67% of the country's electricity. More than 70% of the installed capacity in the National Power System comes from 30 years ago. Their technology is much less efficient than the current state of technology allows, moreover, they require relatively frequent and capital-intensive maintenance. In this state of affairs and with the growing demand for electricity, multi-billion investments in new generation sources are needed. The transition must ensure energy security and economic efficiency for decades to come, which is why it is based on low- and zero-carbon sources. The current structure of generation assets, concentrated in three energy groups, limits the investment potential of these companies in the segment of low- and zero-emission sources and slows down the pace of the country's energy transition. (MAP, 2021).

The macroeconomic situation in Poland, the EU and global level of the economy, including changes in interest rates, exchange rates, etc., which affect the valuation of assets and liabilities of energy entities, remains important for the operations of energy companies. Revenues and the level of generated costs are influenced by the market situation in Poland and the EU, as well as the global economy, including changes in energy prices, prices of CO₂ emission allowances, prices of raw materials, etc. Poland has the highest wholesale electricity prices in Europe. This is a consequence of the large share of coal in the Polish energy mix, high prices of CO₂ emission allowances and low competition on the Polish market.

Geological and mining factors as well as natural hazards may affect the volume of fossil fuel extraction, resulting, in the case of energy groups which include coal extraction in their chain, in a decrease in extraction and the need to increase external purchases and related costs.

Access to financing for the transformation also remains important. On the one hand, it is limited by the changes in policies of financial institutions in relation to financing coal-based energy sector, on the other hand, there is a possibility of using European funds supporting transformation of the energy sector and mitigating the social effects of the changes (TAURON, 2020).

Transformation of the energy sector is a difficult process, due to the characteristics of the industry connected with the specific nature of the product which electric energy is, including the constant need to balance supply and demand, and its strategic importance for the economy and the state. After the restructuring process initiated in the 1990s, in the light of the current regulatory and market realities, on the one hand it faces the challenge of transforming its generation portfolio towards low- and zero-emission sources, while on the other hand it also faces the challenge of shedding the burden and unprofitability of coal-fired generation units and coal production facilities.

Summarising the above considerations, it should be stated that achieving the goal of climate neutrality by 2050 requires the participation of Polish energy enterprises in the energy and climate transformation. A change in the business models of these enterprises is unavoidable, to the extent that will enable them to actively participate in the transformation and then to achieve long-term strategic goals in the new balance of power in the transformed energy sector. Today, a total of 21 Member States are already coal-free (Estonia, Latvia, Lithuania, Belgium, Malta, Luxembourg, Cyprus) or have committed to phase out this fuel with specific dates in their National Energy and Climate Plans (Sweden and Austria – 2020, Portugal – 2021, France – 2022, Slovakia – 2023, Italy and Ireland – 2025, Greece – 2028, Netherlands, Finland, Hungary, Denmark, Spain – 2030, Germany – 2038, Czech Republic – 2038). Gradual withdrawal from coal is also planned by Slovenia. (MAP, 2021) This status confirms and emphasises the scale and scope of changes in the Polish energy sector, including changes in the business models of energy companies.

4. Changes in the business model of an energy company under the conditions of energy transition

4.1. The research process

Literature on the study of energy models and transformation has proposed some theoretical frameworks to support energy transformation. They provide inspiration to examine the impact of energy transition on the business models of traditional Polish energy companies operating in the form of integrated capital groups. Three energy companies of the Polish energy sector, operating in the form of integrated capital groups – PGE, TAURON and ENEA – were selected for the study.

The first step of the research was to conduct a literature review. This approach was aimed at analysing and synthesising current information and research works on business models applied in the power industry. At this stage, the approach to business model construction proposed by A. Osterwalder and Y. Pigneur, which describes the rationale behind the way an organisation creates value as well as provides and profits from the value created, was used directionally as a research model framework.

This was followed by a review of literature and materials on the current situation and market trends in the energy sector in the context of the challenges and directions of energy transformation. An analysis was made of the EU and national regulations underlying the construction of a low- or zero-emission economy. Selected reports and national reports of energy sector entities and industry reports were reviewed. The aim of this stage was to review and synthesise the legal, regulatory and market conditions shaping the changes and the future shape of the energy system and the entities operating within it. It also made it possible to review

the business practices and to summarise the key trends in market changes relating to the particular components of business models used in the energy sector.

The interest in the Polish energy sector in the context of studying the impact of the energy transition stems from the fact that the vast majority of the Polish energy sector, due to historical conditions and access to domestic fuels, is based on units powered by hard coal and – to a lesser extent – lignite. Over 70% of the capacity installed in the National Power System dates from 30 years ago. Their technology is much less efficient than the current state-of-the-art, moreover, they require relatively frequent and capital-intensive maintenance. In this state of affairs and with the growing demand for electricity, multi-billion dollar investments in new generation sources are needed. The transformation of the energy system must ensure energy security and economic efficiency for decades to come, and is therefore based on low- and zero-emission sources. (MAP, 2021).

Based on the conclusions from the above-described stages of the research and expert interviews with energy specialists, the criteria were identified that served to isolate the components and characteristics of the business model necessary to analyse the impact of the energy transformation on the business model in the next stage of the research. These are the significance and scale of impact of the transformation on the components of the business model (including costs/inputs), the use of innovation in building competitive advantage, customer perspective, impact on the shape of the energy sector. Assuming certain criteria, the following components and characteristics of the business model were identified for further research: role, dominant model kinds/types, main products, value offered to customers, forms and channels of customer service, type of competitive advantage, sources and methods of generating profit related to value capture, material resources – size and structure of assets, characteristics of manufacturing potential, organisation / value chain and strategic skills.

In the next stage of the research, using the results of the previous stages and expert interviews as well as the author's own experience from many years of professional practice in the power industry, by means of analysis and synthesis as well as interpretation and deductive reasoning, the directions of changes in the business model that are determined by the energy transformation were defined in specific cross-sections of the analysis, which consist of components and characteristics of the business model.

The presented methodological approach makes it possible to identify and analyse the impact of energy transformation on the business model of the studied energy companies, which constitutes the research problem of this study.

4.2. Research findings

The traditional power industry concentrated in energy companies currently covers the full value chain, including fuel extraction, electricity and heat generation, distribution, wholesale, retail and customer service. The Polish power sector is dominated by large entities, mainly energy groups (Staszewska, 2014), integrated vertically. In the literature, traditional business models are seen as constructs of an organisation's internal values, strategies and resources

(Provance, 2011). An energy company's business model includes the value proposition for the participants in the model, the Consumer Relationship model used, the model of return on the capital employed, and the configuration of all tangible and intangible assets involved in achieving this value (Matusiak, 2011).

The transformation of the energy system and the changing conditions in which it operates are changing the energy market structures. The existing value chain is being transformed from a unidirectional energy flow into an information flow (Savenije, 2014). The development of digitalisation and innovative information technologies, as one of the biggest challenges of today's electricity sector, is becoming the creator of new business models, causing traditional business models to fall behind.

The process of creating an information and measurement environment in the energy market with the use of intelligent SG networks (Smart Grid), advanced metering infrastructure AMI (Advanced Metering Infrastructure) along with the smart SM meters (Smart Metering) creates a new reality of the so-called e-energy. This makes it possible to create completely new products and services, as well as activities and areas in the energy market that did not exist before. Energy companies face the challenge of actively searching for and implementing new areas of activity, new products and services and new functionalities of ICT systems, which they should develop in the integrated energy utility market, metered in real time (Matusiak, 2013).

New technologies, micro grids and distributed generation based on micro RES sources (Popczyk, 2017) and intelligent networks of interconnected, small and medium-sized market participants (nodes, prosumers, generators, service providers, traders, intermediaries, trading and clearing operators or information operators) are replacing the outdated system based on large-scale energy sector and centralisation of large generation units. The heterogeneous structure of the energy market is replacing the traditional energy market and creating new market players. The current balance of competitive forces in the energy market is changing, resulting in changes in the business models of market participants. The transformation is changing the conditions of competition for the sector's entities. The competitive environment determines the growth of activity, structure and competitive strategies in the energy market. The development of the prosumer market, two-way energy flows and the potential changes to the prosumer billing system affect the energy sales and distribution processes in the value chain.

The increase in demand for electricity, the development of energy market products taking into account the changes resulting from seasonality and weather conditions and the development of peri-energy products change the perspective of the value offered in business models.

A summary of the research results on the impact of the energy transition on the business models of the traditional energy company (system generator) using case study analysis for the entities surveyed is presented in Table 2.

The table shows similar directions of changes in the business models of the surveyed companies identified by the research.

Table 2.

The impact of transformation on the business model of a traditional energy company on the example of the Polish Energy Group PGE S.A., TAURON Polska Energia S.A. and ENEA S.A.

General features of the model	Description of the predominant features of the energy company's pre-transformation business model	Directions of change in the business model of an energy company as a result of the transformation
Role	Business model as a tool for strategy implementation.	Business model as a tool to implement sustainable development, social responsibility and ESG issues ¹ .
Dominant model kinds/types	<ul style="list-style-type: none"> – A business model focused on creating value by exposing customer value and leveraging this value for corporate profitability through appropriate business architecture and gradual innovation. – A high degree of integration. 	<ul style="list-style-type: none"> – A business model focused on long-term value creation combining the concepts of corporate social responsibility and value management by balancing company capabilities/capitals and disruptive, radical innovations targeting low and zero carbon generation assets. – Decentralisation and distribution using digitalisation and better, cheaper and faster monitoring, recovery and servicing of assets and components building a smart network of interconnected, small and medium sized sources of market participants: hubs, prosumers, generators, service providers traders, intermediaries, trading and clearing operators and clearing or information operators.
Main products	<ul style="list-style-type: none"> – Electricity. – Thermal energy. – Distribution services of electricity. – Distribution services of heat. – Wholesale and retail trade in electricity. – Gas. 	<ul style="list-style-type: none"> – New energy and energy-related products and services based on green and innovative approaches, using ICT technologies (electromobility, hydrogen technologies, blockchain, and others). – Integration and use of distributed energy business models (prosumer energy development, operator services, including microgrids). – Products based on the principles of circular economy.
The value offered	<ul style="list-style-type: none"> – Reliable, low-cost supply of electricity and heat from own sources (based on coal and RES) and supply of gas. – Competitive prices. 	<ul style="list-style-type: none"> – Providing customers with a secure and stable supply of electricity and heat combined with building relationships with the external environment, including the social environment. – Tailoring the offer to the personalised expectations of current and future customers. – Creating value from the perspective of the entire portfolio of stakeholders, using the model as a vehicle for different types of innovation, especially process innovation (new technologies for energy generation) and marketing innovation (relationships with customers - prosumers). – Energy, heat and gas offered in various packages with other energy and energy-related services (installation services of photovoltaics, air conditioning, air purifiers, energy efficiency, smart-home, charging stations, car-sharing).

¹ E – environmental, S – social responsibility, G – corporate governance.

		<ul style="list-style-type: none"> – Increasing importance of non-financial factors - quality, ecology/clean energy, smart solutions, social responsibility. – Transparency of practices in customer relations implemented in the framework of the Proclient Social Policy.
Forms and channels of customer service	<ul style="list-style-type: none"> – Own customer service points, partner points with customer facilities (comprehensive service, convenient location and opening hours). – Traditional meter service. 	<ul style="list-style-type: none"> – Internet-based sales and customer service and communication channels using innovative information technologies, feedback systems on the effectiveness of service forms and channels. – Service within the information environment (e-energy) with the use of intelligent networks SG (Smart Grid), AMI (Advanced Metering Infrastructures) with SM (Smart Metering) meters.
Type of competitive advantage	<ul style="list-style-type: none"> – Natural advantage derived from distribution system ownership and location. – Advantage based on reputation, brand and trust. 	<ul style="list-style-type: none"> – Price and differentiation advantage resulting from complexity (integrated products and services), quality and reliability. – Innovation and technology.
Sources and methods of making profit related to value capture	<ul style="list-style-type: none"> – Profit from the scale of transactions (customer base, power exchanges). – Capacity contracts. – Efficiently allocated operating costs. 	<ul style="list-style-type: none"> – Efficiently allocated operating costs, high operational efficiency. – Complexity of the offer/operational and cost synergies. – Financial capital as a basis for effective use and development of other capitals.
Material resources - size and structure of assets, characteristics of production potential	<ul style="list-style-type: none"> – Base of regulated assets (power grids), conventional assets and few RES assets. – Generation potential based on coal (mines, power plants, CHP plants) and to a small extent RES. – Underdeveloped and outdated distribution networks. 	<ul style="list-style-type: none"> – Turning to renewable energy sources. – Generation capacity based on RES, gas and heat using innovative/smart generation and IT/ OT technologies. – Distributed energy in the generation portfolio in place of large coal-fired generating units. – Flexible distribution networks, meeting the requirements of distributed generation sources and active customers. – Automated and smart metering of energy consumption.
Organisation / value chain	<ul style="list-style-type: none"> – A vertically integrated group with operations in all key segments of the energy sector. 	<ul style="list-style-type: none"> – Value chain leveraging virtualization effects and innovation ecosystem as well as innovative technologies, including information technologies. – Gradual transition from a linear cycle of activity to a closed system aiming to achieve the assumptions of circular economy.
Strategic skills	<ul style="list-style-type: none"> – Management of regulated activities. – Electricity production. – Handling wholesale market operations and energy market instruments. – Management of the capacity market. 	<ul style="list-style-type: none"> – Innovative projects and technologies, research and development. – Organisational culture and employees (knowledge and competences of employees). – Intellectual capital management (employee rationalisation, utility models, industrial designs and patents).

Source: own study.

The presented summary of the impact of the energy transition confirms that its presence triggers profound changes in the business model of the traditional energy company and its components.

6. The scenario of further changes in the energy sector in the light of the government's transformation programme

The government's solutions for the shape of the Polish coal mining and power sector constitute a response to the challenges facing the Polish electricity sector. One of them is the April 2021 draft concept of spinning off the assets related to electricity generation in conventional coal units from the Polish energy groups with State Treasury participation. It assumes that heat and cogeneration units will remain within the structure of the concerns, which will be gradually replaced with gas units adapted to be powered with zero-emission hydrogen in the future. Once the coal assets are spun off, the energy groups will focus on implementing low- and zero-carbon investments. The coal assets will be owned by the National Energy Security Agency (NABE), operating as a company with 100 per cent state ownership. This entity will be the guarantor of the country's energy security, ensuring the necessary availability of power in the energy system. NABE's investment processes will be limited to the necessary replacement investments and gradual phasing out of coal-fired units, with a progressive increase in the capacity of low- and zero-emission sources. At the same time, NABE will be fully independent from the existing owners. The process of spinning off coal assets is one of the key stages of the transition towards strengthening Polish entities operating in the energy sector. The purpose of spinning off the coal assets into a new entity is to facilitate the transition for the energy sector and to facilitate financing, in particular of investments in low- and zero-emission sources (MAP, 2021).

The advancement of the transformation towards the energy sector of tomorrow and the planned governmental solutions interfering with the future structure of the energy market allow us to assume that the transformation of the energy sector will become the reason for consolidation of the restructured energy groups in the future. Considering the consolidation processes in the Polish fuel sector in recent years, this scenario seems realistic and feasible in the processes of creating a strong power sector, as it serves to further strengthen the position of Polish energy companies.

As part of the transformation, a reform of the tariff model is inevitable. Tariff design is an integral part of public policy. Today's distribution system is outdated and unadapted to the rapid changes that are taking place. Smart tariffs provide consumers with incentives to do the right thing: to save energy or to use it when it is most economical for them. Well designed dynamic tariffs can help optimise the use of already existing networks and minimise future investment (Jahn, 2021). It is also necessary to improve the flexibility of distribution networks in order to meet the requirements of distributed generation sources and active customers. These issues may provide a rationale for further system and structural solutions in the area of distribution in the energy market.

7. Conclusions

1. Liberalisation and transformation of the energy system have significantly increased the pace of change and significantly affected the business model (Giehl, 2020). The zero carbon economy and energy self-sufficiency, as a new paradigm for thinking about energy, is changing the traditional value chains and business models in the energy sector. The decarbonisation of energy production towards low- and zero-carbon energy results in a decentralised structure of the energy sector. The priorities related to climate and energy policy are making the conditions for companies to compete in the market increasingly demanding. The energy transition process is forcing changes in business models to meet the demands of the new energy industry. Business models play a key role in transformational change, both as triggers of change (in the short term) and as their architecture (in the medium and long term) (Ogreaan, 2020).
2. The classic business model of an energy company operating as an integrated energy group is being transformed. The balance of competitive forces is changing, and the emergence of new entities entering the energy markets is changing the role, objectives and values offered by the existing energy operators.
3. The current structure of the energy sector and the directions of its future changes is an important subject of both empirical and theoretical research. The article summarises the results of research dedicated to the transformation of the business model configuration of a traditional energy company in the context of the construction of a new energy market structure, characterised by distribution of generation sources, fast-growing prosumerism, intelligence of solutions thanks to the innovation of applied ICT technologies and virtualisation of the offered customer value. Energy companies need to make decisions that are compliant with and consistently adjusted to changes in national and EU law, leading to effective and efficient implementation of operational and strategic goals, while taking into account the assumptions of just transformation, and make it possible to maintain flexibility of operation and adaptation to changes in the national and international environment.
4. The search for the most optimal business solutions under these conditions requires a resilient business model for the energy company. This justifies the need to conceptualise the factors influencing the resilience of the energy enterprise and to implement measures to increase this resilience. It requires qualitative as well as quantitative approaches, both to better understand the factors contributing to resilience and to consistently assess resilience in order to increase it, which will contribute to building the value of the energy enterprise.

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SUCCESS OF THE PROJECT IMPLEMENTED IN A CONSORTIUM – ANALYSIS OF KEY FACTORS FROM THE ENTERPRISES POINT OF VIEW

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Purpose: identification and quantification of the factors influencing success of the joint project carried out by a scientific and industrial consortium.

Design/methodology/approach: this paper presents results of mixed research involving preliminary qualitative research in the form of unstructured interviews with project managers implemented as part of scientific and industrial consortia, and then quantitative research conducted with the use of a questionnaire among representatives of companies from the group of this type of consortia.

Findings: the result of conducted research is the identification of key factors for the success of initiatives carried out by scientific and industrial consortia from the point of view of enterprises.

Research limitations/implications: research results will be used to better understand the factors determining success of projects implemented as part of cooperation between private enterprises and public universities. The next stage of research should include assessment of factors from the point of view of public universities participating in the joint implementation of projects by scientific and industrial consortia.

Practical implications: research results will contribute to an increase in the absorption capacity of consortia consisting of private enterprises and public universities, additionally will increase the percentage of successful projects and may result in the intensification of work aimed at obtaining funds and joint implementation of projects.

Social implications: research results may contribute to greater interest in the implementation of research and development projects by scientific and industrial consortia, which will result in the transfer of modern solutions from the world of science to industry, allowing for specific economic and social benefits.

Originality/value: developing a map of key success factors for projects implemented by scientific and industrial consortia from the point of view of companies participating in their implementation.

Keywords: key success factors, projects, scientific and industrial consortia.

Category of the paper: Research paper.

1. Introduction

Development of innovative economies is supported by the transfer of modern solutions from the world of science to industry. It is possible thanks to the cooperation of universities with enterprises. This cooperation is also widely supported by external funds, including EU funds. The result of such cooperation is most often the joint implementation of projects as part of a scientific and industrial consortium. On the one hand, it allows for a synergy effect based on diversified resources and competences of the consortium members, and on the other hand, it is associated with an increased risk of failure. Hence, it is so important to conduct research aimed at determining the factors influencing the increase in the probability of a successful project implementation.

Public universities and private enterprises have actively participated in the joint implementation of projects within scientific and industrial consortia in recent years. Many of these projects ended with the achievement of expected results, but not all of them. It is a fact that implementation of research and development projects carries a high risk of failure, but there are factors that favor the successful implementation of projects.

Based on conducted literature studies and qualitative research, an attempt was made to identify and then quantify the key success factors of projects implemented within scientific and industrial consortia as part of quantitative research. Results of this research will be used to better understand factors determining the success of projects implemented as part of cooperation between public universities and private enterprises. Moreover, they will contribute to an increase in the absorption capacity of these entities and may contribute to the intensification of works aimed at obtaining funds and joint implementation of projects by these entities.

2. Scientific and industrial consortia

Implementation of complex projects requires involvement of significant resources, both human and financial, which are not available to individual entities. As a result it becomes necessary to establish a consortium within which various entities will cooperate in order to achieve a common goal. The implementation of projects by consortia, which includes both universities and enterprises, favors establishment, sharing and exchange of knowledge. The process of creating and collecting knowledge takes place both in the entities individually as well as within the entire consortium. Additionally, knowledge exchange takes place between selected members of the consortium and within the entire consortium. The greater the number of entities in the consortium, the greater the number of possible interactions related to the knowledge management process (Fakhar Manesh et al., 2021).

In consortia whose participants are universities or other scientific units, due to their specificity, they play an important role in the knowledge management process. Universities are perceived as intermediaries in the process of creating new knowledge and preserving existing knowledge, its analysis and evaluation, as well as in the process of its dissemination and transfer to other entities. This makes scientific entities particularly important partners in the implementation of projects by many entities (Ardito et al., 2019).

3. Key Project Success Factors

In a broader context, the project's success is defined as the completion of the project as expected. The literature (Al-Tmeemy et al., 2011; Wai et al., 2012; Nguyen et al., 2013; Mukhtar and Amirudin, 2016; Silva et al., 2016a) indicates three key criteria, i.e.: project according to the schedule (time), within the planned budget (costs) and with the assumed efficiency (quality). Defining the success of the project as the completion of a project in accordance with the budget and schedule and with the achievement of required quality, we will refer to the internal definition of success (Trocki, 2011, p. 17). Moreover, the literature indicates the following key success factors: top management support, effective communication in the project, clearly defined goals and tasks, project manager's competences (Lamprou, Vagiona, 2018, p. 282; Udechukwu et al., 2021, p. 915, Garbharran, Govender, & Msani, 2013, p. 105; Spalka, 2004, p. 99; Soroka, 2015, pp. 617-626), stakeholder engagement (Trzeciak and Liebert, 2016, pp. 205-215), competences of project team members, sufficient resources, adequate information support, appropriate mechanisms for managing and responding to deviations, sensitivity to the needs of recipients and invariability of the composition of the project team (Rusan and Voitenko, 2021, p.). Moreover, as Abylova and Salykova note, success factors may also be very specific factors relevant only for a particular project or organization (2019, p. 9).

A scientific and industrial consortium established for the joint implementation of the project is an example of a temporary network. Referring to the implementation of a project in the temporary network, M. Wirkus and K. Tubielewicz indicated a set of factors influencing the project success, which included: defining a real project strategy (goals, measures, results, project outline), proper planning of activities in the project, defining the structure organizational project (appointment of a project manager and a project management office), implementation of works in accordance with the current plan, constant monitoring and control of the project implementation, definition of quality and safety procedures, monitoring and analysis of risk in the project (2018, pp. 83-84).

When analyzing the key success factors, it can be noticed that a significant part of them are factors related to humans (Unterhitzberger and Bryde, 2019, p. 59; Tabish and Jha, 2012). They refer to the project manager together with the project team, the authorities of the entity implementing the project, as well as other project stakeholders.

4. Research methodology

The study uses an explanatory sequential model, including preliminary qualitative research, and then quantitative research on a larger sample. Unstructured interviews were carried out with five project managers of this type of collaboration to identify factors that could be key factors for the success of a project carried out in a consortium of public universities and private companies. These interviews were aimed at gathering empirical material based on the use of open-ended questions that allow the interlocutor to express themselves openly and freely. During the conducted unstructured interviews, factors influencing the successful implementation of joint projects of public universities and enterprises were identified. Obtained results were used to develop a questionnaire and conduct a survey among people managing, on the part of enterprises, projects implemented by consortia consisting of at least one public university and at least one private enterprise. The study was carried out using the mixed mode method combining the CATI and CAWI techniques. The study concerned one project.

A random selection of respondents was used in the research. First, a database containing a list of projects implemented since 2014 by consortia consisting of at least one public university and at least one private enterprise has been prepared. Then, an invitation to complete the survey was sent to 192 people, 120 fully completed surveys were obtained, which represents a 62.5% feedback rate.

One of the objectives of the study was the assessment of identified factors as potential key success factors for the project implemented in a consortium of public universities and enterprises. The criteria for success of the project implementation within the consortium identified during the qualitative research and assessed during the quantitative research included:

1. Support for the authorities of public universities.
2. Support of the company's authorities.
3. High competences of the project management.
4. The use of project management methods/methodologies.
5. The use of IT tools / systems for project management.
6. High level of formalization of activities.
7. Clearly defined division of tasks between consortium members.
8. Cyclical meetings of working teams within the consortium.
9. Periodic meetings of project managers within the consortium.

10. Assignment of specific objectives to be achieved by the individual members of the consortium.
11. Monitoring the progress of the work of individual consortium members by the Consortium Leader.

The question regarding the assessment of the given criteria for the success of project implementation within the consortium, which the respondents were asked, was of a rank type, in which the answers were based on a five-point Likert scale, where on opposite sides there were extreme answers, insignificant – very important. Due to the applied ordinal scale, such statistical measures as: median, mode, standard deviation were used.

5. Characteristics of the studied population

The questionnaire survey was addressed to people managing enterprise's projects implemented by consortia consisting of at least one public university and at least one private enterprise. Among the respondents, 13.33% were people representing the Consortium Leader, while 86.67% were members of the consortium. Among the respondents, the largest group were people representing medium-sized enterprises – 30.83%. A detailed breakdown of respondents according to the size of the enterprise is shown in Figure 1.

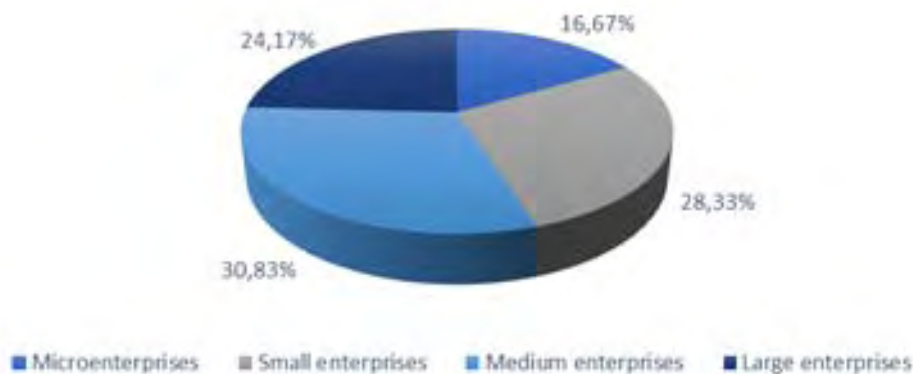


Figure 1. Size of analysed enterprises. Source: own study based on the results of the survey, N = 120.

The number of entities representing the consortium has a significant impact on the implementation of projects within the consortium. Figure 2 presents the distribution of respondents according to the number of entities included in the consortium.

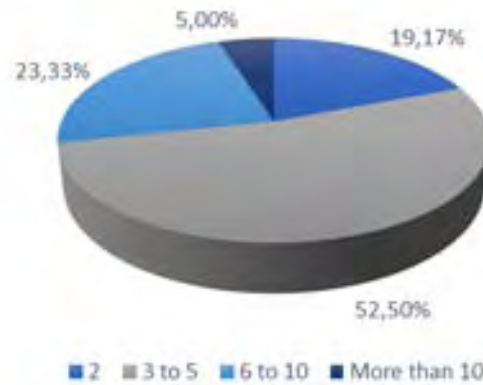


Figure 2. Number of entities included in the consortium. Source: own study based on the results of the survey, N = 120.

The largest part of the analysed projects were those implemented within consortia consisting of at least three but not more than five entities, so it can be assumed that these were medium-sized consortia established in order to jointly implement the project. Among the participants of the consortium, apart from public universities and private enterprises, there were also private universities and other types of entities.

When analyzing the success factors of a project, one should take into account the project results, i.e. its effects obtained after the end of the project. Among the examined projects, 77.50% were projects whose implementation had been completed. These respondents were asked to assess the extent to which the project objectives were achieved, the results are presented in Figure 3.

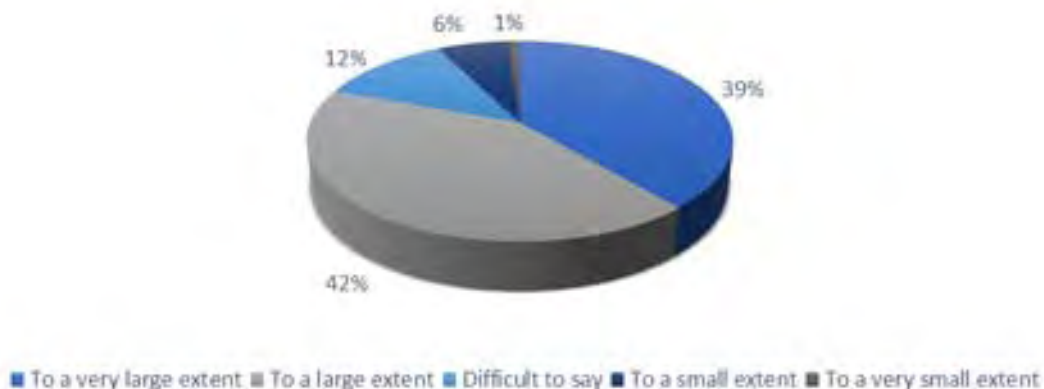


Figure 3. Assessment of the degree of achievement of the assumed project objectives. Source: own study based on the results of the survey, N = 93.

The vast majority of respondents stated that the goals set in the project were achieved to a very large extent (39% of responses) or to a high degree (42% of responses), which gives a total of 81% of all responses. Surprisingly, 12% of the respondents had difficulties to determine the level of success, which may indicate that not all assumed goals in the project were achieved. Only 6% were responses indicating a small degree of achievement of the assumed objectives and only 1% a very small degree of implementation of the planned project objectives.

6. Research results

In order to analyze data on the assessment of key success factors of projects implemented in consortia consisting of at least one public university and at least one private enterprise, the received responses were ranked. "Very important" answers were given 5 points, "important" answers 4 points, "average" answers 3 points, "little significance" answers 2 points and "insignificant" answers 1 point. On this basis, main statistical measures were calculated, such as: median, mode, standard deviation. The results, ranked by decreasing mean score, are shown in Table 1.

Table 1.

Assessment of success factors for projects implemented in scientific and industrial consortia

Specification	Mean	Median	Mode	Standard deviation
Support of the company's authorities	4,30	4	5	0,74833
Clearly defined division of tasks between consortium members	4,26	4	5	0,77991
Assignment of specific objectives to be achieved by the individual members of the consortium	4,24	4	4	0,77455
High competences of the project management	4,23	4	5	0,91708
Regular meetings of project managers within the consortium	4,13	4	4	0,86538
Monitoring the progress of the work of individual consortium members by the Consortium Leader	4,11	4	4	0,78311
Regular meetings of working teams within the consortium	4,03	4	4	0,71254
Support from public university authorities	3,87	4	4	0,99107
The use of IT tools / systems for project management	3,71	4	3	1,01157
High level of formalization of activities	3,49	4	4	1,04080
The use of project management methods/ methodologies	3,43	4	4	0,93686

Source: own study based on the results of the survey, N = 120.

Assuming the key factors with an average score of more than 4.0, based on the respondents' indications, seven key success factors for projects implemented in consortia consisting of at least one public university and at least one private enterprise can be identified. Respondents representing enterprises indicated support of enterprise's authorities as the most important (mean 4.30, median 4.0, mode 5.0 with the standard deviation 0.74833). Implementation of complex projects involving significant resources cannot be successful if it is not supported by the authorities of an entity. The next places ranked according to importance level are factors related to the organization of work in the project, i.e. *a clearly defined division of tasks between consortium members, assigning specific objectives to be achieved by individual members of the consortium, high competences of project managers, regular meetings of project managers*

within the consortium, monitoring of the work progress of individual consortium members by the Consortium Leader and regular meetings of working teams within the consortium.

Respondents representing enterprises assessed the *support of public university authorities* much lower, which of course is not of key importance from the point of view of implementation of works on the part of the enterprise, however, it may have a significant impact on the implementation and success of the entire project. What may be surprising, representatives of enterprises assessed the *use of project management methods/methodologies* as the lowest, this may indicate the lack of use or lack of awareness of the use of *project management methods/methodologies*. Also, the use of *IT tools/systems for project management* is not considered essential for the successful implementation of the project, nor is a high level of formalization of activities. The summary of the test results in a graphic form is presented in Figure 4.

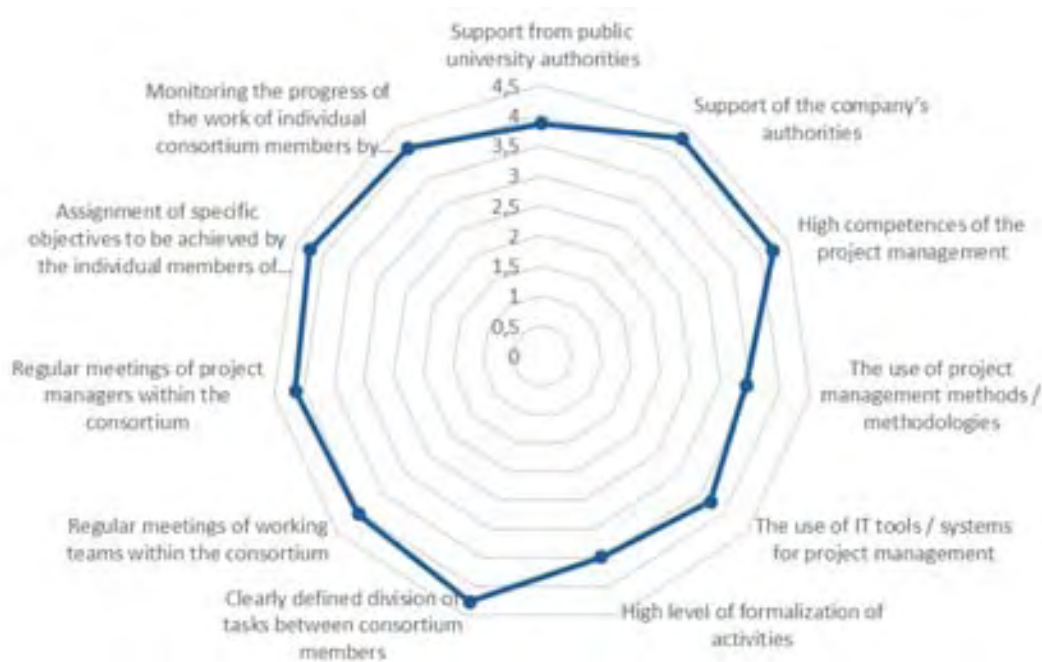


Figure 4. Map of success factors for projects implemented in scientific and industrial consortia. Source: own study based on the results of the survey, N = 120.

The in-depth analysis of the survey results was extended to include the average assessment of the indicated success criteria in individual groups of enterprises. These data are presented in Table 2.

Table 2.

Assessment of the success criteria of projects implemented in consortia depending on the size of the enterprise

Specification	AVERAGE DEPENDING ON THE SIZE OF AN ENTERPRISE			
	Micro	Small	Medium	Large
Support of the company's authorities	4,30	4,38	4,41	4,07
Clearly defined division of tasks between consortium members	4,35	4,03	4,35	4,34
Assignment of specific objectives to be achieved by the individual members of the consortium	4,20	4,35	4,32	4,03
High competences of the project management	3,90	4,18	4,32	4,38
Regular meetings of project managers within the consortium	4,20	3,91	4,22	4,24
Monitoring the progress of the work of individual consortium members by the Consortium Leader	4,00	3,97	4,08	4,38
Regular meetings of working teams within the consortium	4,10	4,12	3,86	4,07
Support from public university authorities	3,85	4,15	4,05	3,31
The use of IT tools/systems for project management	3,40	3,65	4,00	3,62
High level of formalization of activities	3,00	3,26	3,95	3,52
The use of project management methods/methodologies	2,90	3,56	3,57	3,45
Total	3,84	3,96	4,10	3,95

Source: own study based on the results of the survey, N = 120.

The respondents representing micro-enterprises considered a *clearly defined division of tasks among consortium members* ($\bar{x} = 4.35$) as the most important factor of the success of projects implemented in consortia. On the other hand, representatives of small and medium-sized enterprises indicated the *support of the company's authorities*, the average score was 4.38 among small enterprises and 4.41 among medium-sized enterprises, respectively. For respondents representing large enterprises, the key success factors for the projects implemented in the consortium were the equally *high competences of project managers* ($\bar{x} = 4.38$) and the *monitoring of the progress of the work of individual consortium members by the Consortium Leader* ($\bar{x} = 4.38$).

As the least important criterion for the success of the consortium, the respondents representing micro and medium-sized enterprises indicated the *use of project management methods/methodologies*, the average for micro-enterprises was 2.90, and 3.57 for medium-sized enterprises, respectively. Respondents from small enterprises pointed to the *high level of formalization of activities* ($\bar{x} = 3.26$) and from large enterprises to *support the authorities of public universities* ($\bar{x} = 3.31$) as factors having the least impact on the success of a project implemented as part of a scientific and industrial consortium.

7. Summary

Conducted research indicates seven key success factors of projects implemented in scientific and industrial consortia. The project managers on the part of the enterprises pointed to *the support of the enterprise's management* as the most important factor. This is not surprising, as the implementation of complex initiatives such as projects is burdened with many problems and significant risks. The project manager without the support of the entity's authorities would not be able to manage the project effectively. The second of the highest rated factors is the *clear division of tasks between consortium members*, it is extremely important not only from the point of view of deadlines for the work, but also financial settlements between consortium members. The podium ends with *assigning specific objectives to be achieved by individual members of the consortium*, this factor refers to the previous one and is associated with the settlement of substantive activities in the project, which also has consequences in financial settlements. Assigning tasks and dividing responsibility for individual goals between the members of the consortium allows, on the one hand, to better use the specialization and key competences of the consortium members, on the other hand, in the event of problems with project implementation, it is easier to identify the causes and indicate corrective actions. It is worth emphasizing that this factor was ranked first among the key success factors in the assessment of representatives of the smallest enterprises included in the group of micro-enterprises.

Another of the key factors are the *high competences of project managers*, which held the first place among the key success factors in the case of large enterprises. Project managers are primarily responsible for implementing the project according to the plan. Obtained results confirm the greater independence of project managers from enterprise owners in the case of large enterprises, where a dozen or more projects are often implemented simultaneously. In the case of smaller businesses, owners often pay more attention and get more involved in the implementation of the project.

Another two factors are also related to project management. The first indicates the *need for regular meetings between project managers in individual entities of the consortium*, while the second indicates the need for the *consortium leader to monitor the progress of the work of individual consortium members*.

The last of the key factors was the *cyclical meetings of working teams within the consortium*. Conducting research and development works within scientific and industrial consortia is primarily a research challenge, the implementation of which determines achievement of the goals set in the project. These projects, apart from the development of new solutions, are most often associated with their practical application (implementation) in the economy. Hence, an important factor is also organization of the work of substantive teams and the exchange of knowledge taking place within them.

Presented research results confirm the significant role of factors related to human capital among the key success factors, both on the part of the management of the company implementing the project, the project manager, and members of the project team. On the other hand, the second group of key success factors are factors related to the organization of work within the consortium (division of tasks and goals, cyclical meetings and monitoring of the work by the consortium leader).

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INITIAL ASSESSMENT OF THE QUALITY OF ROAD SURFACES

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Purpose: The aim of the article is to check the quality of the road and classify the selected road on a four-level scale.

Design/methodology/approach: The paper outlines the impact of comprehensive road surface quality management on the safety of vehicles and road users. The basic types of road damage were presented, as well as preliminary diagnostics of a randomly selected national road was carried out. Visual tests were carried out to determine: the type and geometry of the pavement damage, the number of damage, the area covered by the damage. In the article the damage indicators were calculated. The results allowed for the assessment of the quality of the tested pavement and its classification on a four-point scale.

Findings: The quality of the road surface was assessed and classified as level C.

Research limitations/implications: In the future, it can be suggested to change the methodology of investigate the road. It is proposal to using drone with the application.

Practical implications: The research indicates the need to plan the renovation of the road surface and suggests changing the surface material from construction asphalt to the new modified asphalt.

Originality/value: The article indicates the need to amend the documents and the current methodology of the procedure.

Keywords: surface quality, road transport, road safety.

Category of the paper: Case study.

1. Introduction

Comprehensive management of the technical condition of road surfaces is a key factor influencing the safety of maneuvers by motor vehicles. The pavement condition assessment enables rational planning of repairs and renovations (Piłat et al., 2017). In order to develop appropriate solutions in the scope of proposing the replacement of the road surface, it is first necessary to obtain detailed and up-to-date information on the technical condition of the surface (Staniek, 2013). Most of the costs incurred in the road operation process can be avoided by diagnosing the problem before the condition of the pavement deteriorates in a way that threatens the safety of travelers. Initial tests of the road surface condition are very important as they enable diagnosis and making the right decisions regarding repairs, further tests, modernization or even exclusion of a given road from use (Graczyk, and Harasim, 2008). Properly made decisions often allow to avoid potentially dangerous situations leading to accidents, material losses, and in extreme cases to the loss of life of road users (Wesołowski, 2020). The inadequate condition of roads may be caused by both an incorrect selection of materials and surface technology, as well as the constantly changing conditions of their operation (Błażejowski et al., 2004). Changes in the conditions of road surface use are caused, among others, by environmental changes (climate, earth movements, shocks, vibrations, temperature, precipitation), changes in the intensity of vehicle traffic (increase in the number of vehicles traveling on roads, including heavy goods vehicles), changes in the structure of vehicles traveling on roads, resulting in the transport of loads of greater mass, etc. (Graczyk, 2010).

The loads acting on the road surface are usually loads that change with time. It is possible to register both repeatedly repetitive, short-term and dynamic loads transmitted by motor vehicles, but also long-term static loads (Borkowski, 1973). According to the literature data, trucks and buses have the most destructive impact on the pavement. As a result of the action of mechanical loads and atmospheric influences on the road surface, five basic forms of pavement damage occur (Szpinek, 1999):

- permanent deformations, which include: impressions, waves, folds, ruts and traces,
- reflected cracks,
- fatigue cracking,
- thermally induced cracks,
- surface damages, such as: falling out of single grains of aggregate and mortar from the wearing course, losses in the asphalt mix.

Permanent deformations in road surfaces most often arise as a result of long-term loads and elevated temperature. Sometimes, to prevent the formation of ruts, rigid, rutting-resistant structural elements are introduced into road construction (Piłat et al., 2015). The solution may not be used everywhere, because as a result of repeated stresses, it leads to the appearance of road surface cracks during its operation. Another form of surface damage is fatigue cracking

(Borkowski, 1973). They arise when tensile stresses arise in the lower pavement layer and when the fatigue life of the asphalt mixture is exhausted in the outer pavement layer, which results in the formation of cracks. The fatigue destruction process is caused by repeatedly repeated stresses. Such stress is the result of repeated deflections of the pavement layers under the pressure of the wheels of passing vehicles. Thermally induced cracks arise as a result of changes in the physical properties of the pavement, i.e. expansion and contraction of materials under the influence of temperature, of which the pavement is made (Waligóra, 2022). The most common causes of surface damage are improper compaction of the asphalt mix and improperly selected materials (their quality, bonding properties, etc.). Improper selection of materials results in poor asphalt adhesion, crumbling of mortar elements or aggregate from the matrix, and easy formation of cavities in the pavement (Piłat et al., 2020).

The longitudinal evenness of the surface translates into driving comfort (vibrations, vibrations) and the safety of drivers. Unevenness of the road not only increases the wear of the vehicle's suspension components, the possibility of tire damage, but also the driving stability. Deep ruts pose a significant risk to road traffic when overtaking vehicles and changing lanes. In addition, they create a risk because they limit the drainage of rainwater, most often on sections of roads with small longitudinal slopes (Due to the accumulation of water in the ruts, a water cushion may form between the tire tread and the road surface. As a result, the vehicle's adhesion to the ground is reduced and it falls into. In extreme cases, a collective accident may occur, which is why a properly conducted inspection and preliminary visual assessment of the road surface condition is very important (Czarnecki, and Janowski, 1999).

2. Aim and investigation methods

The aim of the research undertaken in the study was to make a preliminary assessment of the technical condition of the surface of the national road located in Upper Silesia and to make a decision on its further safe operation. The object selected for the research was a road, made of the so-called asphalt road. In order to assess the initial quality of the road surface, visual tests were carried out to identify the places of non-compliance and defects, such as: cracks, longitudinal unevenness, ruts, etc. Highways pt. "SOSN Surface Condition Assessment System – Appendix A" (GDDP, 2002a) and "SOSN Surface Condition Assessment System – Appendix E" (GDDP, 2002b). The total length of the tested road section was 400 m. In addition, photographic documentation of the identified damage was made using a digital camera built into the Samsung Galaxy M12. Next, the so-called damage score for the next 100-meter road sections, using the formula (GDDP, 2002a):

$$P_{ij} = a \cdot \left(\frac{x}{b}\right)^c \cdot f \quad (1)$$

where:

P_{ij} – points for damage i at damage degree j ,

x – the extent of damage (calculated separately at different degrees of harmfulness),

a, b, c – parameters, read from tables, depending on the degree of harmfulness, in the analyzed case the degree was defined as big,

f – coefficient taking into account the influence of traffic volume, for the analyzed road coefficient $f = 0.9$.

Then, using the formula (2), the harmfulness coefficient P_i was calculated:

$$P_i = 0,9 \cdot P_{ij_{\max}} + 0,1 \cdot \Sigma P_{ij} \quad (2)$$

where: P_{ij} – points calculated for the damage and for the harmfulness j_{\max} , i.e. the harmfulness with the highest number of points.

Then, for all measuring sections, the value of the crack indices n_m and the surface condition were calculated according to the formula:

$$n_m = E(n) + \alpha \cdot D(n) \quad p_m = E(p) + \alpha \cdot D(p) \quad (3)$$

where:

E – the average value of the set of assessments for 100 m long sections belonging to the measuring section,

D – standard deviation of the evaluation set for 100 m long sections belonging to the measuring section,

α – a scaling factor of 0.3.

The parameters of the pavement condition determined on the basis of the visual assessment and the measurements of the non-compliance geometry were referred to the four-level classification of road conditions (Fig. 1).

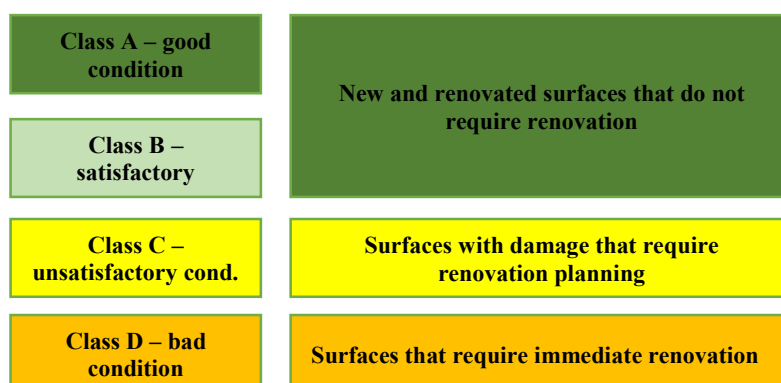


Figure 1. Scheme 1 – classification of road conditions according to SOSN Annex E (GDDP, 2002b).

The class was selected on the basis of the nm indices calculated from the formula (3) and the comparison of the results with the tolerances assigned to the class (GDDP 2002b):

- Class A – indicators nm and pm in the range 1.00-0.90.
- Class B – indicators of nm and pm in the range of 0.56-0.90.
- Class C – indicators of nm and pm in the range of 0.41-0.55.
- Class D – indicators of nm and pm in the range of 0.40-0.00.

On this basis, it was concluded whether a given pavement is suitable for use, whether it should be modernized or renovated.

3. Results of investigation

The road has two roadways with two lanes for each direction (Figure 1a). The preliminary visual assessment of the road shows that the dynamics of pavement degradation is advanced, significant damage to the pavement is visible, including mesh cracks and patches (Fig. 1b), transverse cracks along the entire width of the road (Fig. 1c) and longitudinal cracks (Fig. 1d).



Figure 2. Fragment of Matuszczyka Street in Wodzisław Śląski a) general view, b) mesh patches and cracks in the pavement, c) transverse crack, d) longitudinal crack (own elaboration).

The identified patches on the first section of the road under study (section marked 0 + 000 - 0 + 100) were assessed as high harmfulness, cracks were found at the joints of the patches with the remaining pavement. Patches occupy more than 50% of the width of the lane. The dimensions of the battens shown in Figure 1b were determined using the STANLEY

0-35-458 wooden measure. The batten shown in Fig.1b on the right side has dimensions of $0.3 \text{ m} \times 0.6 \text{ m}$, and the batten on the left – $1.2 \text{ m} \times 6 \text{ m}$. The remaining battens on the tested road section were measured similarly. The total area of battens on the 100 m road section is 36.90 m^2 .

In the next stage of the research, mesh cracks were assessed, which were also classified as high harmfulness. The examination of the pavement revealed the presence of loose pavement pieces in the area of mesh cracks. Registered changes amounted to less than 50% of the width of the assessed lane. The pavement area with all identified mesh fractures on the tested road section was 22.5 m^2 . Next, the damage was scored using the formula (1). After substituting the obtained measurement values and coefficients for the degree of harmfulness defined as high, the following results were obtained: for pavement damage in the case of patches $P_{ij} = 49.85$ and for a mesh crack $P_{ij} = 47.1$.

Then, using the formula (2), the coefficient P_i was calculated:

$$P_i = 0.9 \cdot 49.85 + 0.1 \cdot (49.85 + 47.10) = 54.56$$

Successive road sections were analyzed in a similar way. 16 transverse cracks were found in the marked section (0 + 100 - 0 + 200). For the P_{ij} calculations, the damage of the cracks was assumed to be high, the cracks were characterized by the lack of tightness and flooding of the crack. Their width is defined as large, as the cracks cover the entire width of the lane. Then, the length of the cracks was measured (for example, the crack shown in Figure 1c was 2.95 m long). The sum of the lengths of all cracks occurring over the distance of 100 m was 47.20 m. According to the formula (2), $P_{ij} = 40.77$ was calculated.

Visual tests on the section of the road marked (0 + 200 - 0 + 300) allowed to identify 13 damages in the form of longitudinal and mesh cracks. The identified cracks are harmful. Cracks are not tight and have chipping at the edges. Their total length is 52 m. The width for longitudinal cracks is not specified. The calculated damage score according to formula (2) is $P_{ij} = 41.77$.



Figure 3. Patches and cracks on the section (0 + 300 - 0 + 400) of the tested road (own elaboration).

In the last section of the road marked (0 + 300 - 0 + 400) there are patches, mesh cracks and longitudinal cracks (Fig. 3). All the damage due to its nature and the area occupied was classified as damage of high harmfulness. The number of patches on the tested road section was 5 with a total area of 31 m². Cracks were found between the patches and the surface. The calculated damage score, in accordance with the formula (1), was $P_{ij} = 47.07$. The length of longitudinal cracks was measured on the tested section of the road, the length was 24 m. The score for these damage was $P_{ij} = 34.43$. In addition, mesh cracks with a total area of 41 m² and a width exceeding 50% of the lane width were identified. For mesh cracks, the calculated damage score was $P_{ij} = 54.72$.

Then, using the formula (2), the harmfulness index P_i was calculated:

$$P_i = 0.9 \cdot 54.72 + 0.1 \cdot (47.07 + 34.43 + 54.72) = 62.87.$$

Based on the formula (3), the nm index was determined for individual measurement sections and for the entire length of the section of the tested road (0 + 000 - 0 + 400). The calculation results are presented in Table 1.

Table 1.

A fragmentary overview of the indicators n_m

Measurement distance:	0+000 – 0+100	0+100 – 0+200	0+200 – 0+300	0+300 – 0+400	0+000 – 0+400	Klasa
Indicator n_m	0,45	0,59	0,52	0,37	0,55	C

For the calculation of nm, the arithmetic mean E and the standard deviation D were calculated:

$$E = \frac{0.45+0.59+0.25+0.37}{4} = 0.48$$

$$D = \sqrt{\frac{(0.45-0.48)^2+(0.59-0.48)^2+(0.52-0.48)^2+(0.37-0.48)^2}{0.48}} = 0.24$$

$$nm = 0.48 + 0.3 \cdot 0.24 = 0.55.$$

The obtained result was compared with the tolerances assigned to a given road quality class. The quality class C was obtained for the entire measuring section. This means that the tested pavement can be used in accordance with Polish law, but requires renovation planning. Its condition is described as unsatisfactory.

4. Summary and conclusions

The conducted research shows that the road condition is unsatisfactory. The quality of the road in the four-stage classification P_{ij} was determined at the C level, the calculated factor n_m was 0.55. According to the authors, preliminary diagnostics indicate a significantly progressive process of road degradation. The pavement life cycle is in the stage of accelerated degradation, which may turn out to be dangerous for road traffic. It is recommended to conduct a more

extensive diagnosis of the road, including tests from the scope of the entire document of the "SOSN Surface Condition Assessment System". In this case, the diagnostics should enable the prognosis of failure-free operation of the pavement in the existing working conditions and with loads resulting from traffic intensity.

Initial tests carried out in accordance with the applicable document (GDDP 2002a; 2002b) are very time-consuming. Considering that every road allowed for traffic should be monitored, according to the authors, it would be advisable to amend the regulations so as to allow for the possibility of using drones equipped with specialized research programs to perform measurements. Certainly, such a solution would facilitate diagnostics and comprehensive management of the technical condition of road surfaces.

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METHODS OF MANAGING INNOVATION IN THE ENTERPRISE

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Purpose: The aim of the work was to present the concept of innovation in an enterprise. The multitude of definitions and breakdowns of innovation are emphasized. In addition, a review of scientific papers in the field of innovation management strategies in the enterprise was made.

Design/methodology/approach: Due to the cognitive nature of the article, the aim of the work will be achieved using the method of analyzing the literature on the subject. Literature studies include Polish and foreign publications.

Findings: Economists point out that innovations are essential for a company's survival in the marketplace. They play a key role in building a competitive advantage and their absence may pose serious threats to the further functioning of the enterprise. Given the importance of innovation, it is essential to manage them effectively. The need to adjust the innovation strategy to the internal and external conditions in which the company operates is emphasized, because there is no strategy that can be successfully used in every enterprise.

Originality/value: The article is a literature review on the innovation strategies. This work can contribute to emphasizing the role of innovation in the functioning of the company, making managers aware of the need to manage them and choosing the right strategy tailored to the company's capabilities and goals.

Keywords: innovation, innovation strategies, innovation management.

Category of the paper: Research paper.

1. Introduction

Innovation is seen as one of the key sources of competitive advantage and a prerequisite for the company's survival. The sooner a company responds to changing market needs, the better it has a chance of success. The role played by innovations in the enterprise indicates the need for their effective management. In the literature, there are many strategies of innovation management. Each company should adapt its strategy to the business opportunities, environmental conditions and goals that the company intends to achieve.

The aim of the article is to present innovation, its concept, classification and possible measurement methods. In addition, a literature review was carried out on innovation management strategies. Selected strategies which are considered the most popular are described. The article is based on an analysis of the literature. It can help managers in the choice of an appropriate innovation management method in enterprises.

2. Innovation – definitions and typology

The concept of innovation has been taken up in the literature for many decades. However, innovation has not been unequivocally defined. It applies to many categories, including social life, economic life, technology, ecology, etc. The most popular theory of innovation was created by J.A. Schumpeter (1939). He presents innovation as the main phenomenon in economic development, which is a combination of capital and means of production, covering the following five combinations: creating a new product or introducing goods with original properties to the market; application of an innovative production method; finding a new market; obtaining unknown sources of raw materials; introducing new market structures in the industrial organization. P.F. Drucker (1992) presents innovation as an act that gives resources a new ability to create wealth. A.H. Van de Ven (1986) describes innovation as the development and implementation of new ideas by people who, over time, engage in transactions with others within the institutional order. The definition presented in the Oslo Manual describes innovation as the introduction of a new or significantly improved product or process, a new organizational and marketing method, workplace organization or relations with the environment. The above activities may be developed by the company or adopted from other entities, however, they must be new to the company (OECD, 2018). Innovations in a narrow and broad perspective are described by Z. Orbik (2017). According to him, innovation in a narrow sense covers the first application of new ideas and inventions resulting from scientific research. Whereas, in a broader sense, innovation is the dissemination of inventions or ideas.

The most common breakdown of innovation in the literature includes (OECD, 2015):

- **Product innovations** which mean the introduction of a new good or service to the market by an enterprise, or a significant modernization of the previously offered goods/services with regard to their characteristics or intended use. Modernization may refer to technical characteristics, materials, components, software as well as various functional features.
- **Process innovations** that is the implementation of new or significantly improved methods of distribution and production into practice in the enterprise.

- **Marketing innovations** mean the use of a new marketing method involving significant changes in the appearance of the product, promotion, positioning, pricing policy or business model, which are the result of the company's new marketing strategy.
- **Organizational innovations** are the implementation of a new organization method into the company's business activities. This also applies to the organization of workplaces or the new organization of external relations. An innovative solution may be the result of personal research and development activities of the enterprise, enriching the company with intangible knowledge (purchasing licenses, patents, software, know-how, training, etc.) or concluding contracts with cooperative companies and institutions.

In innovation statistics, it is important to see different types of innovation in borderline cases. Many innovations may have features of several types. Classifying such cases as only one type of innovation can be a difficult challenge, and may also lead to questionable recording of the types of innovation activity used by companies (Strahl, 2010). For this reason, the authors of the Oslo Manual in 2018 changed the classification of innovations and distinguished:

- **Product innovation** is a new or improved product or service that is significantly different from the products and services offered by the company.
- **Business innovation** is a new or improved business process for one or more business functions that is significantly different from the company's previous activity. These innovations concern six different functions of the company's activity. Two of them relate to the basic activity, i.e. production and sales, and the rest relate to supporting activities.

Another division, based on the scale of the changes made, distinguishes radical and incremental innovations. Radical innovations, otherwise known as breakthroughs, are new products and services that change the current conditions for the functioning of the market. They are completely new, or similar to those already existing on the market, but created using a new technology. On the other hand, incremental innovations arise as a result of continuous improvement and modification of already existing products or services so that they meet the needs of customers to an ever better extent. They tend to be small in scope and almost risk free. Breakthrough innovations that come to the market are usually perfected in the form of incremental innovations in the next stage. They appear less frequently, because they require greater financial outlays and are characterized by a longer implementation time, however, they sometimes allow companies to gain a long-term competitive advantage (Christensen and Raynor, 2003).

It is indicated that introducing innovations is a chance for enterprises to survive and stand out from the competition (Porter, 1980). Despite the fact that the literature frequently attempts to assess the innovativeness of an organization, no synthetic indicator has been developed so far. Innovation can be assessed on the basis of the number and type of innovations implemented in a given period of time, the value of sales of new or significantly improved products, as well as measures referring to intellectual property rights (Pichalk, 2012). Currently, the standard

measure of the organization's innovation assessment is the number of patents and their citations (Chemmanur et al., 2014; Chemmanur et al., 2020; Elings, 2020). The popularity of measures based on patent statistics results from easy access to the necessary data by patent offices.

There is a widespread belief about the benefits of innovation. However, often these effects can be deferred over time. Many authors point to the greater importance of using innovations in business than the mere fact of their implementation (Desyllas and Sako, 2013). However, the lack of innovation can pose a huge threat to the continued functioning of the organization.

3. Review of the innovation strategies

Each organization should create its own innovation strategy, tailored to its needs and the conditions in which it operates. The innovation strategy is a long-term innovation management plan of various subjective scope (Ettlie, 2000). N. Strecker (2009) defines the concept as the sum of strategic choices made by an enterprise regarding innovation. The author takes into account only the means, disregarding the goals of innovative activity. On the other hand, others indicate that an innovation strategy is a developmental and functional plan that defines the allocation of resources to innovations to achieve the strategic goals of the enterprise. It is also an indication for the company when and how to abandon past plans and/or change them to develop the business in the future (Katz et al., 2010). The innovation strategy allows firms to define financial goals and the innovation gap, it also helps in the effective introduction of a new product or process. A very important issue is the consistent application of the selected strategy model due to the relative irreversibility of the investment.

The innovation strategy is part of a more complex long-term corporate strategy that enables the company to maintain and strengthen its competitive advantage. A feasible and efficient innovative strategy should be adapted to the changing environmental conditions. It can be based on different concepts and criteria. The main elements of an innovation strategy include: allocation of available resources, strategic management capabilities, understanding of the company's technological environment, structure and cultural context, understanding of competitors' innovation strategies (Burgelman et al., 1996). Identifying and using the full innovative capacity of the enterprise by managers is a key success factor of a given organization. There is no clearly defined division of the innovation strategy in the literature. Some of the developed divisions are presented in the table below (Table 1), while some of them are characterized. It is worth noting that some divisions overlap, they are changed to a small extent.

Table 1.
Classification of selected innovation strategies

Author(s)	Classification
Ansoff, Stewart (1967)	First to market, follow the market leader, applied engineering, develop me-too products
Miles, Snow (1978)	Prospector, defender, analyser, reactor
Porter (1980)	Cost leadership (innovation follower) product differentiation based on innovations (innovation leadership)
Lambkin (1988); Hultink, Robben (1995)	Technological innovator, rapid copier, cost reducer
Venkatraman (1989); Morgan, Strong (1998); Akman, Yilmaz (2008)	Aggressiveness, analysis, defensiveness, futurity, proactiveness, riskiness
Wright et al., (1990); Parnel et al. (2000)	Prospector, defender, analyser, reactor, balancer
Manu (1992); Manu, Sriram (1996)	Product innovator, process innovator, late enterer, non-innovator, original initiators
Gilbert (1994)	Proactive innovation strategy, reactive innovation strategy
Hultink, Robben (1995)	Technological innovator, rapid copier, cost reducer
Lynn and Mazzuca (1998)	Customer oriented, process oriented, initiator oriented, learning oriented
Roger (2001)	First to market, rapid follower, niche player, response to changing market needs and wants
Burgelman, Maidique, Wheelwright (2001)	Technological leadership or followership, market position, timing of market entry
Massini, Lewin, Greve (2005)	Innovators, imitators
Guan, Yam, Tang, Lau (2009)	Leading innovator, follower, imitator, defender, technology importer
Kylaheiko, Jantunen, Puumalainen, Saarenketo, Tuppura (2011)	Domestic and international innovator, domestic and international replicator

Adapted from: "Effects of innovation strategy on firm performance: a study conducted on manufacturing firms in Turkey." By A.T Karabulut. Copyright 2015 by *Procedia-Social and Behavioral Sciences*, 195, 1338-1347, pp. 1339.

When formulating an innovation strategy, attention should be paid to the following elements: current and future purchase opportunities, innovative activity of competitors, human and material resources, own research and development infrastructure, the current level of development of the organization and financial potential. B. C. Twiss (1986) identified the following eight strategies to promote innovation:

1. **Offensive** characterized by high risk but also potentially high profits. Usually used by large enterprises that can take advantage of the economies of scale.
2. **Defensive**, as opposed to offensive, has low risk and lower profits. Firms usually introduce substitutes for goods offered by firms employing an offensive strategy.
3. **Purchase of a license**, buying innovations from other companies.
4. **Avoidance**, usually used by small companies that are afraid of direct confrontation with their competitors. It is relying on looking for market gaps.
5. **Market creation**, that consists in offering completely new goods, which results in a small number of competitors and thus the possibility of making a profit.
6. **Independent**, relates to the product, resulting in an increase in the market share of innovative products. Combined with an offensive strategy, it allows firm to maintain a long-term competitive advantage.

7. **Acquiring highly qualified staff**, based on buying up competitors' employees. Considered to be unethical.
8. **Sourcing other companies**, which is an alternative to sourcing employees. Small businesses that are strategically offensive Often have limited financial opportunities and therefore represent an easy and attractive investment for large companies.

Differently, innovation strategies are classified by C. Freeman (1982), who distinguished six types of innovation strategies on the basis of the amount of expenditure on research and development:

1. **Offensive** in which the company allocates significant funds to research and development but also to design, testing, patent protection and employee training. Few companies are able to apply this strategy in the long term.
2. **Defensive** characterized by an active attitude to innovation, but less risk than an offensive strategy. It is characterized by following the leader but with a certain delay, so as not to duplicate his mistakes. Very important in this type of strategy is quick response to changes, patenting innovations in order to weaken the leadership position, as well as educating employees.
3. **Imitating** in which the company does not intend to catch up with the leader and follows him with a much greater delay. The activity is based on relatively quick implementation of the leader solutions. Expenditure on training and technical services is significantly lower than in previous strategies. The imitator bases its competitive advantage on lower production costs, so it should focus on innovation in manufacturing methods.
4. **Dependent**, the enterprise is to some extent subordinated to the stronger firm. Own research plays a negligible role. Major functions and services come from and are often provided by the lead organization.
5. **Traditional** in which the offered goods practically do not change. Production is based primarily on highly qualified staff. The threat to companies using this strategy is technological development. On the other hand, its application may result in backwardness in relation to global companies.
6. **Occasional**, based on finding a gap resulting from constant changes in the environment. The company's success is based primarily on good scientific and technical information, entrepreneurship and long-term planning.

P.F. Drucker (1992) distinguished four strategies of innovation:

1. **To be "the first and the strongest"**. The organization focuses on permanently assuming a leadership position. It is associated with a huge and continuous effort of the staff.
2. **"Hit them where they are not"**. There are two types of this strategy:
 - a. **Creative imitation** – it's about better understanding innovation created by others. It is market-oriented and inspired by it.

- b. **"Entrepreneurial judo"** is the adaptation of goods and services to a given market segment. Its use is aimed at gaining a leading and then dominant position by the company. It has the lowest risk and has the best chance of success.
3. **Find and occupy a specialized ecological niche**, that is, strive to master a small fragment of the market. P. Drucker distinguishes three ecological niches:
 - a. **The turnpike strategy** – the company has little influence on expanding or controlling its activity. The strategy can be used if the good is of key importance and the risk of not applying it is much greater than the price.
 - b. **Strategy of specialized skill** – requires an absolute novelty.
 - c. **Strategy of specialized market** - applies to a specific market, well-known by the company, which makes it unattractive to competitors.
4. **Make changes to the properties of the product, market or industry** in order to meet the customer's needs. It is carried out by creating utility for consumers, setting the price, adapting to social and economic realities, providing the customers with what constitutes real value for them.

It is worth emphasizing that the above strategies are not mutually exclusive, sometimes a combination of several elements of individual strategies can be found.

A tool supporting managers in choosing an innovation strategy may be the matrix of innovative ambitions (Figure 1). The X axis represents an increasing degree of innovation, pointing to further dimensions. The axis moves from the left side, denoting the modification of existing products and services to the right side, i.e. the development of combinations of new products, services and business models. These connections are extremely important because breakthrough products and services are part of a wider business model (Wagner et al., 2014). The Y axis represents markets - from existing to new markets and consumers. The matrix shows that routine innovation is important but does not create new markets. For this purpose, it is necessary to implement ground-breaking and radical innovations that allow for the expansion and development of the enterprise. The top-right corner of the matrix showing the zone of radical innovation requires the creation of new products and services that benefit new consumers but also requires the use of new business models. Creating and operating in new markets requires introducing innovations but also efforts to adapt the organization to the new structure. Innovation is so modern that the company cannot manage it within the current processes and structure. Thus, radical innovations are rarely encountered, as they often require transformation of the entire organization (Goffin and Mitchell, 2016). The middle area of the matrix between the two extremes is the center of innovation management. This is where a coherent approach to management should emerge, reflected in the innovation strategy. The higher moving along the diagonal of the matrix, the more difficult it becomes to manage innovation and it requires the use of many different tools. Breakthrough and radical innovations are of greater importance to the enterprise in the long term. This matrix can be used to diagnose whether a potential innovation is appropriate for the current business model. If the company

bases its functioning on the existing technological possibilities and continues to use the same business model, the company's strategy will be based on incremental innovations. On the other hand, in the case of greater ambitions of enterprises, managers must take into account the need to implement ground-breaking innovations and apply a new business model.

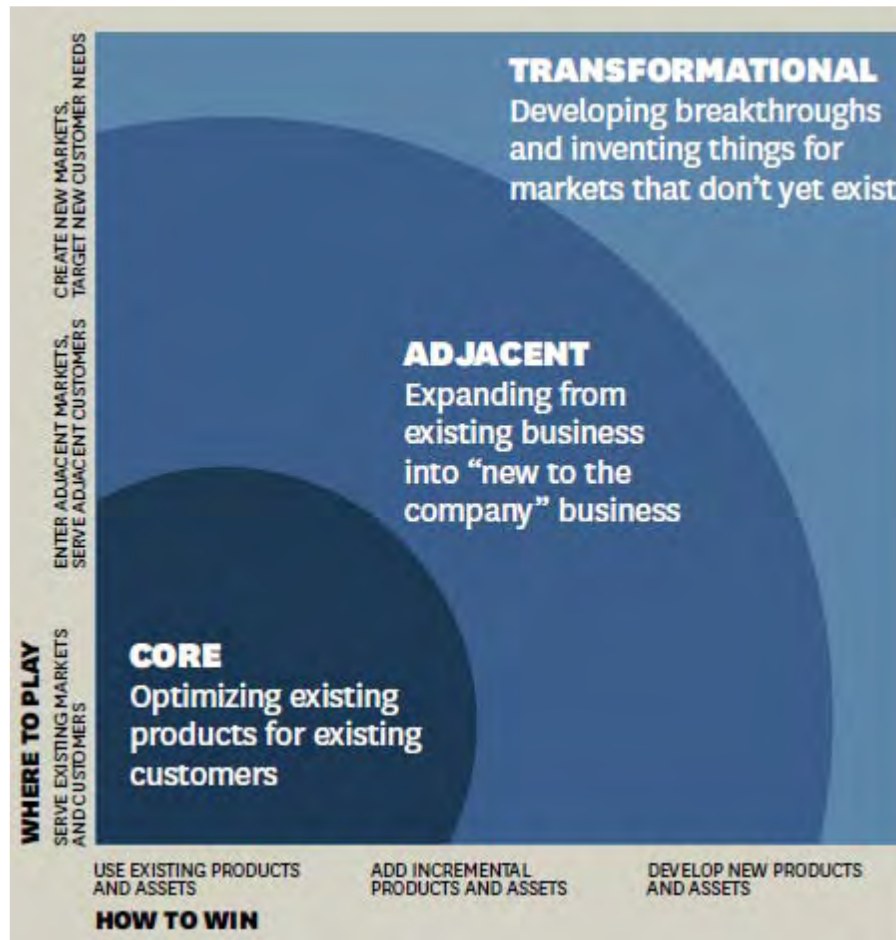


Figure 1. The innovation ambition matrix. Adapted from: "Managing your innovation portfolio" by Nagji, B., & Tuff, G. Copyright 2015 by Harvard Business Review, 90(5), pp. 69.

There is no one strategy that would fit all organizations or operate in all conditions. An appropriate innovation strategy allows firm to adjust the activity to specific market needs and protects the company against the pursuit of conflicting goals by its individual departments (Pisano, 2015). At the same time, economists emphasize that it is permissible to actively undertake innovative activities without a clearly formulated strategy. However, this is possible for small business operations in the short term. Undoubtedly, the use of a specific method of operation adapted to the internal and external conditions of the organization can contribute to its market success and will definitely improve the work of people who decide about innovations in the enterprise.

4. Summary

Enterprises operating in the modern, highly competitive market must stand out from the competition through the use of new solutions. The literature review shows that innovation is a popular topic. However, there is no universal definition. Another problem is the measurement of innovation and its classification. There is no doubt, that innovations play a very important role in building the company's competitive position. Therefore, it is necessary to manage innovation in the enterprise. Economists have developed many methods of managing innovation but there is no strategy that can be successfully used in every enterprise. Each company that wants to manage innovations in the long-term perspective should adjust its strategy to the internal and external conditions in which it operates. This will allow the company to achieve market success and build a competitive advantage.

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SURVEY OF SOCIETY EXPECTATIONS TOWARDS SUSTAINABLE 4P IN THE NEW PUBLIC MANAGEMENT PERSPECTIVE

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Purpose: The purpose of the article is to draw attention to the important problem of taking into account the expectations of buyers of products to the activities of manufacturing companies in the area of marketing mix to a more sustainable, as a way of modern social management.

Design/methodology/approach: The article has a theoretical and empirical character. The theoretical part of the study was prepared on the basis of a review of the literature concerning the subject, while the research part of the work is the result of own survey conducted among the inhabitants of the Silesian province. The research was based on the survey method with the use of distributed questionnaires, also commonly known as street surveys. The tool used to obtain data was a survey questionnaire containing a structured set of open and closed questions.

Findings: In the course of the research study it was determined that there should be a modification of the marketing mix elements in terms of environmental and social, by means of which production, trade and service enterprises directly affect consumers. Customers' decision to purchase a product is increasingly dependent on the company's active involvement in pro-environmental and pro-social activities.

Research limitations/implications: The research results obtained are not representative in the statistical sense, although they are an interesting approach to the problem and undoubtedly have a cognitive character in the area in question.

Practical implications: Business activities of enterprises should focus not only on achieving financial goals or expanding market shares, but should also take into account environmental and social objectives. Middle and high-level managers are expected to change the way of managing the organization into a more pro-environmental and pro-social one, which in turn will contribute to changing the perception of the enterprise itself among consumers, as a sustainable organization.

Social implications: Considerations contained in the article indicate the need to change the behavior and attitudes of buyers to a more responsible in terms of environmental protection and other market participants. The article draws attention to the need to make conscious purchase choices, which in turn should contribute to improving the condition of the environment and the life's quality of societies.

Originality/value: As a result of the conducted research study, a theoretical-cognitive gap was identified. It was also found that there is a scarcity of qualitative and quantitative research in

the area of the undertaken topic. Therefore, there is a need for further examinations, which should be characterized by intensity and depth in both theoretical and empirical layers. The article is addressed to managers of manufacturing companies, as well as service companies who want to conduct business in accordance with the concept of sustainable development.

Keywords: sustainable development, new public management, pro-social management.

Category of the paper: Research paper.

1. Introduction

New Public Management (NPM), which is a sub-discipline of management sciences, (Sudol, 2014; Cyfert et al., 2014) can be characterized as a set of management techniques used in public management, from which the rationale for implementing solutions based on efficiency of operations and rationality of expenditures is derived (Pierścieniak, 2011).

According to the standards set by the NPM, in order to improve the efficiency of public sector operations, a number of organizational solutions characteristic of the private sector should be used first. In management sciences, the local government organizational unit is seen, as an organization, because it has all the elements of this complex and ordered system built of people, tasks, technology and structure (Peszko, 2002). The organization realizes its goals through action, the main features of effectiveness and efficiency. Managing such an organization in the light of the NPM concept justifies the use of methods used in the private sector.

NPM is a doctrine postulating the use of mechanisms used in the private sector of the economy for efficient management of the public sector. In literature NPM is sometimes defined as: a managerial form of approach to public administration (Supernat, <http://www.supernat.pl>), which manifests itself in the application of solutions commonly used and proven in the market economy. These activities are aimed at increasing the effectiveness of particular units of the public sector.

Further considerations in this paper will focus on the managerial approach, i.e. from the NPM perspective. The managerial approach, including NPM, points out organizational similarities between the features of public administration and the private sector, emphasizes the importance of professional management and effectiveness. Each of the above presented approaches emphasizes different values, procedural or structural solutions in its functioning, which leads to a complementary view of public administration in today's world (Supernat, <http://www.supernat.pl>).

New public management was popularized in 1980s and 1990s in highly developed countries such as Great Britain, United States, New Zealand. The search for a new concept led to the formulation of its basic assumptions, which were designed to respond more realistically to the needs of highly developed societies. In the literature, the basic assumptions of NPM consist of, among others:

Efficient performance – which is one of the most salient characteristics of NPM (Hausner, 2002). They emphasize the rationality of resource management according to the principles of: maximization of effects at the assumed level of outlays or minimization of the outlays incurred while achieving the assumed effect (Kotowska, 2015). In order to achieve these objectives, NPM indicates the need to change the type of management employment from employment contracts to contracts covering the implementation of a specific project. Remuneration, in turn, should be appropriately linked to the results obtained, as it is the case, for example: in the UK (Kettl, 1997). The results achieved are not only the quality of services provided, but also a real impact on the change in the lives of residents.

The use of market competition mechanisms to achieve the above mentioned results. The use of market competition mechanisms is possible e.g. through outsourcing of services and purchased goods, which have a higher quality and lower price than those produced by the administration itself. Another example is such reorganization of public administration bodies that leads to their obtaining revenue from the sale of goods or services. The proposed reorganization forces, what is worth emphasizing, the organizational units of public administration separated in this way to compete with each other and with non-governmental and private organizations. It should be mentioned that such a reorganization carried out at all levels would lead to disaggregation of the whole public sector. The resulting smaller organizational units should be characterized by much more clearly defined tasks and thus clearly outlined responsibilities. Greater accountability to the public is one of the main goals of the NPM.

The control of services and goods by the public administration instead of their provision by the administration itself. In situations where it is possible to increase the efficiency of the services and goods provided by using other organizations for this purpose, such as for example: NGOs, non-profit organizations or finally the private sector in its broadest sense. The transition from a hierarchical system of service provision to a networked and interdependent one is also a feature particularly valued and repeatedly emphasized by co-management, which is another paradigm of public administration functioning. The precursor of this concept was H. Cleveland, who predicted that public administration will evolve towards intertwined networks, which will be characterized by less control, more dispersed authority spread over many decision-making centers. This will entail a more complex decision-making process involving organizations both inside and outside the public sector. They will be characterized by shared responsibility for action. This will entail a flattening of structures in the public administration, a dispersion of the real to the entities whose participation in the decision-making process is desirable.

Increasing results while decreasing costs. Each action undertaken by the administration should be characterized by the best possible use of available financial, material and human resources. The result of these actions is to reduce the costs of provided services while increasing their quality. This assumption manifests itself in all the above mentioned assumptions of NPM, which seeks to achieve more with less (Hood, 1995).

According to the postulates formulated by NPM, public management should focus on zones where the market cannot perform as effectively. The postulated model assumes a far developed social consciousness, and responsibility for the environment in which the social group operates. This should be kept in mind, since the creation of such a culture is the result of the evolution of societies. One cannot unreflexively try to instill this type of model in societies with underdeveloped and well-established democracy and readiness for self-determination by taking an active part in social processes.

Starting from the achievements of management sciences, the sources of public management are the well-known systemic view of organizations and organizational change management. Organizations are treated as a certain class of systems described using the conceptual apparatus of general systems theory and cybernetics – autonomous wholes separated from the environment, characterized by internal connections and couplings (Kozuch, 2004).

So, in summary, the pursuit of evolving doctrines, in this case public management, is a continuous process. Thus, the discussed doctrine of NPM should be considered only as a stop in the continuous process of reforming or searching for new ideas allowing to better adopt the resources available at a given time, the knowledge already possessed and the technology used.

One of the instruments used to improve the functioning of public management in line with the NPM concept is process management (Krukowski, 2011; Wiatrak, 2006). It is based on the assumption that public activities should be optimized in terms of processes rather than functions. Thinking in terms of functions leads to actions that optimize the effectiveness of parts of the organization at the expense of its whole. It leads to the necessity of coordinating separate parts of the organization: intertwined processes within the organization are artificially separated by cells, which means that individual processes are pragmatized and their realization takes place in distant areas, in the sense of hierarchical subordination and feedback. Moreover, the vertical division of work leads to the separation of managers from executors, which results in the separation of thinking from performing, and thus performing from improving processes. Since process is a natural determinant of achieving efficiency growth in organizations, the process approach is a consequence of searching for new sources of efficiency growth in organizations (Grajewski, 2016). Describing the organization in terms of process, it is necessary to remember about its complex system of dependencies occurring in the studied system. This leads to the necessity of capturing, in all complex reconstruction processes, the full set of cause-effect relationships. Thanks to such an approach it is possible to make a comprehensive assessment of the system under study. Otherwise, i.e. creation of process reconstruction based

on incomplete data model, it will result in implementation of actions that will disturb the logic of functioning of the whole system rather than improve it. Process management is about striving to maximize those components of the organization's process that are responsible for creating added value on the one hand, and on the other hand it is about minimizing the share of inefficient operations of the entire organizational system (Grajewski, 2016, p. 56).

Economic development of the modern world resulting from the increase of international trade and the free movement of capital, people and goods leads to the increase of social and environmental problems (Wagner, 2015). Business entities operating under pressure of increasing income and market share draw little attention to the condition of environment and to the existing social problems (Kemper et al., 2019). Manufacturing companies focused on maximizing profits, strive to meet the needs of the modern consumer, regardless of the costs in environmental and social terms (Jianu et al., 2015). Dimension of economic satisfaction of companies is one of the main objectives posed in front of modern manufacturing, services, or commercial companies (Khan et al., 2019). Manufacturing activities of the organization is clearly related to the impact on the natural environment. Reaping the Earth's natural resources needed for production is an undeniable interference with the ecosystem of our planet. The business activities of enterprises, including marketing conducted without thinking of the environmental and social aspects in the longer term is doomed to failure (Masiello et al., 2018). For this reason, there is a need to change the current way of managing businesses, including marketing activities for more sustainable economic ventures in environmental and social terms (Selby et al., 2009). It is not risky to say that the market success of future companies will depend precisely on the ability to balance economic goals of the organization while respecting the environment and corporate social sensitivity (de Koeijer et al., 2017). Achieving economic, environmental and social balance of enterprises is not an easy task. In overcoming the arising problems it may be useful to adopt and implement the principles of sustainable development (Jianu et al., 2015).

The purpose of the research work described in this paper is to generalize the concept of sustainable 4P i.e. (Product, Price, Place, Promotion) operating in the private sector and its relation to the concept of new management in the public sector by finding out the social expectations of sustainable 4P of manufacturing companies.

2. Theoretical background

The deteriorating state of our planet being a result of the increasing demand for various goods and services, technical and technological development and transformation of the attitudes of societies into consumer societies have significantly deteriorated the condition of environment. The negative impact of industry and selfish attitude of consumers have also

become the cause of many social problems. The changing factors of macro-environment including primarily the technical and technological ones, socio-cultural and environmental ones, have initiated the global discussion about deteriorating state of the environment and increasing social problems (Rudawska, 2019). The decision of the UN General Assembly in 1968, where it was decided to organize a United Nations conference in Stockholm, entitled *Human Environment* can be regarded the beginning of the creation of the sustainable development concept. In 1969, the UN Secretary General Sithu Thant presented the report titled *Man and his environment*. The secretary drew attention to the global crisis in man's relation to the environment.

Sustainable development is an interdisciplinary area which also reflects in the management sciences (Pomering and Johnson, 2018; Ertz and Sarigöllü, 2019). Because of the importance of the issue, sustainable development evokes more and more interest among scientists and the enterprise and social organizations itself. International discussions on the protection of the environment contributed to the formulation of the definition of sustainable development. According to the Brundtland Commission, *sustainable development is development that meets the needs of the present without the risk that future generations will not be able to satisfy their needs* (Hauff, 1987). Similar view on the essence of sustainable development express Dam and Apeldoorn (2008). The authors define it as a development that takes into account the needs of the present without limiting the possibility of meeting them for future generations. A different definition of sustainable development was also formulated, recommended primarily for the economics of sustainable development i.e. *sustainable development aims to ensure all people living today and the future generations sufficiently high environmental, economic and socio-cultural standards to the Earth's natural limits, applying the principle of intra-generational and intergenerational justice* (Rogall, 2000). Pearce, Barbier and Markandya (1997) cite the concept of sustainable development defined by Repetto as a strategy enabling the management of human, natural, financial and property resources contributing to the long-term growth of prosperity and wealth. Belz and Peattie (2010) say that there are many different approaches to the essence of sustainable development. The authors present a concept of hard sustainability – which is focused on maintaining the quality of the environment through protection of the environment as a result of rational economic activity – and soft sustainability, which is focused on ensuring that economic growth can be maintained by reducing the impact on the environment and society. It behooves to mention that the concept of sustainable development was originally derived from the forestry. In the nineteenth century, Hans Carl von Carlowitz introduced this concept to define a way of forest management where as much trees are cut as you can grow in the same place.

Implementing the principles of sustainable development among societies and manufacturing and trading companies is a serious challenge that modern humanity is facing. The progressive degradation of the Earth's ecosystem, along with emerging social problems can lead to catastrophic consequences (Trojanowski, 2020). People should remember that nature can exist without the presence of a man, but a man without nature is doomed to annihilation. International community is making efforts to balance the environmental, social and economic objectives. The concept of sustainable development was discussed e.g. at the Earth Summit in Rio de Janeiro 1992, at the summit in Kyoto 1997 and The Hague 2000 (Lee and Carter, 2009). However, despite the efforts and procedures to protect the Earth the question whether the future of the world will be sustainable, remains open.

Taking into consideration the research's objective, a term of marketing mix with respect to sustainability should be explained. Marketing as a major driving force of the global economy is responsible for the quality of the environment (Poczta and Malchrowicz-Moško, 2018). It is through marketing systems that most human and psychological needs are satisfied. Marketing drives the world economy and leaves a big footprint in both the environment and society (García-Arca et al., 2017; Ertz and Sarigöllü, 2019). Thus, sustainable enterprise entails sustainable marketing activities (Khan et al., 2019; Solér, 2012; Diez-Martin et al., 2019). Discussion about adapting marketing of companies to the principles of sustainable development raises contradiction. Marketing is seen as a force focused on increasing production and sales, which is contrary to the concept of sustainable development calling for a reduction in consumption (Jones et al., 2008). Marketing companies is also blamed for the creation of consumer societies. Its actions have significant impact on the development of mass consumption. It is often accused of harming customers through misleading practices, aggressive sales techniques, intrusive and persuasive advertising, offering trashy and potentially harmful products, or intentional aging of the product (Armstrong and Kotler, 2012).

Reviewing the literature from the scope of sustainable marketing, one can find several definitions of the concept, e.g. it is understood as a *socially responsible marketing, carried out with respect for the environment that meets the current needs of consumers and businesses, while maintaining or even improving the ability of next generations to meet their needs in the future* (Armstrong and Kotler, 2012). The others, involved in the area of sustainable marketing argue that sustainable marketing is designed to meet the needs and expectations of customers with respect to social and environmental criteria and objectives of the organization (Belz, 2006). This means building and maintaining a balanced relationship with customers, social environment and environmental surroundings. The creation of customer value chain followed by taking into account environmental and social aspects is another approach presented by Leitner (2010). The author claims that maintaining a balance between economic, environmental and social results of operations throughout the product life cycle is the essence of sustainable marketing. Much space to issues of sustainable marketing devote also Martin and Schouten (2012). According to the authors, is the process of creating, communicating and delivering

value to clients in compliance with environmental and social aspects. There is also an opinion that as part of the concept of sustainable marketing, companies seek to achieve the objectives focused on three aspects: environmental, social and economic (Palić and Bedek, 2010). The expanded definition of sustainable marketing can be found as well. In accordance with it (Fuller, 1999) sustainable marketing is defined as the process of planning, implementing, and controlling the development, pricing, promotion, and distribution of products in a manner that satisfies the following three criteria: organizational goals are attained, customer needs are met, the process is compatible with ecosystems. Reviewing the literature in the field of sustainable marketing the standpoint of Kadirov (2010) regarding the nature and its importance cannot be ignored. The author argues that from the viewpoint of the original thinking systems, the existing concepts of marketing systems seem to be insufficient. Kadirov points out that many marketing concepts develop alternative trading systems frameworks. Examples of such systems may be selling hybrid cars. Such actions constitute an alternative basis for the redefinition of the basic problems of macro marketing, which should be particularly useful to decision-makers and system designers.

Research and analysis of the marketing environment and the choice of target markets are the basis for the creation of programs for sustainable marketing mix. The well-known concept of the “4P” constitutes the basis for the formulation of a company’s strategy for customer interaction (Kazibudzki and Trojanowski, 2020). The examples of marketing objectives focus primarily on the matters important for the company, except for the most important market participant that is a client. Thus, some authors propose to replace the “4P” formula, aimed at ensuring the interests of the company, for “4C” composition – convenient for the customer i.e. customer solution, customer cost, convenience and communication (Belz and Peattie, 2010). In order to achieve a balance between the interests of the company and the consumer needs while respecting the principles of sustainable development the concept of “3E” must be also taken into account i.e. environment, equity, economy (Hunt, 2011).

3. Research methodology and results

The research method used in the study is the survey. Survey made it possible to obtain information from the respondents on how a person assesses and perceives the studied phenomenon. The overall aim of the used method was to learn the facts and capture possibly all details of the written statements, in connection with the questions from the field of shaping elements of 4P for companies in terms of sustainability.

A questionnaire including an ordered list of questions and consisting of four thematic parts was a tool with which the survey was conducted. It included questions about creating sustainable products by manufacturing companies, about decisions concerning the establishment of sustainable product prices, product distribution methods taking into account the principles of sustainable development and the use of instruments of sustainable promotion mix. The questionnaire contained 22 open questions that give the freedom to formulate answers and closed questions that restrict the answer to one of the given options in the poll. Sample group used in the research had a random character, although it cannot be considered as statistically representative for the surveyed population. The study, in which 400 people participated, was carried out in retail outlets in Silesia region. In order to bring closer the structure of the respondents, the characteristics of the sample group was made in terms of gender, age, education and place of residence – Table 1.

Table 1.
Characteristics of the sample group

Gender					
Women			Men		
246			154		
Age in years					
18-30	30-40	40-50	50-60	60-70	70 <
60	95	87	73	48	37
Level of education					
Basic	Vocational		Secondary		Higher
8	55		178		159
Place of residence					
Village ~ 5 000	Small town up to 50 000		Average city 50 000-250 000		Large city ~ 500 000
81	126		188		5

Source: own elaboration.

Evaluating the 4P tools aimed at sustainable development it should be emphasized that the most important instrument is the product. Thus, the questionnaire starts with the question: *what qualities should meet sustainable product?* Result of this study presents Figure 1.

Analysis of the product in terms of sustainable development included the issue of incentives that induce consumers to buy a particular good. Consumers have certain criteria, that determine the purchase of the product. Figure 2 presents the factors affecting consumers' purchasing decisions.

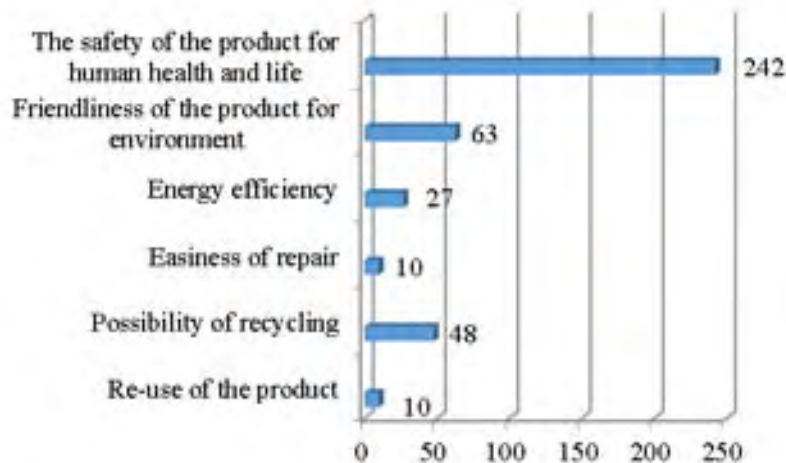


Figure 1. Features of sustainable product according to the opinion of respondents. Source: own elaboration.

Another tool of 4P that supports sustainable development is the price. This tool does not generate costs for the company, as in the case of other instruments of the marketing mix, but provides profit for organization.

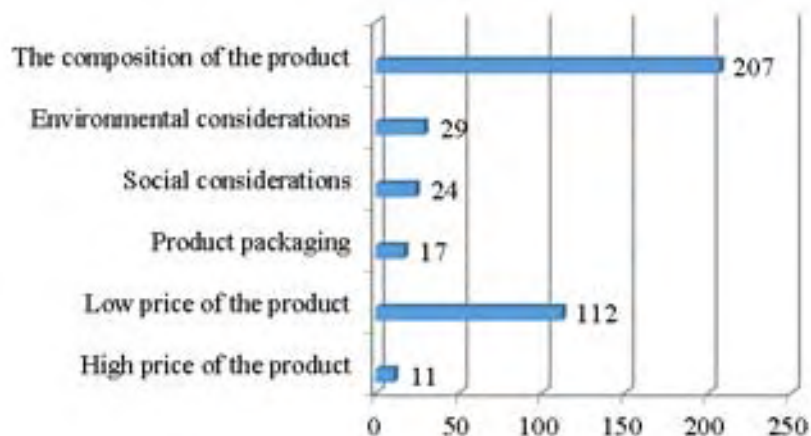


Figure 2. Preferences of a product purchase according to the respondents. Source: own elaboration.

Changing marketing environment of the company requires formulation of new pricing strategies, targeted at the idea of sustainable development. Creating pricing policy considering the principles of sustainable development, should take into account the opinions of consumers on the prices of sustainable products. When determining the price of the product, in addition to the cost of production, prices of competitors and the size of demand, the consumer preferences regarding payment for a sustainable product should also be taken into consideration. The results of the research in this regard are presented in Figure 3.



Figure 3. Pricing preferences of consumers. Source: own elaboration.

Distribution of products is the third component of 4P oriented towards sustainable development. In the case of the distribution there are broad opportunities to implement the concept of sustainable distribution including the selection of such means of transport that have minimal impact on the environment. Figure 4 presents the results of research on the type of transport used by the company, which has the most negative impact on the natural environment and society.

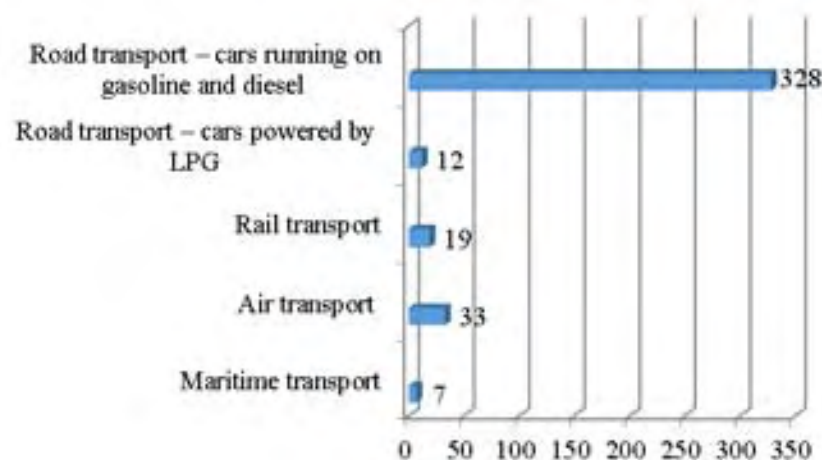


Figure 4. Means of transport and its negative impact on environment and society according to the opinion of respondents. Source: own elaboration.

In the carried out research on the means of products transport, factors that harm our nature and people are determined. Respondents indicated the main negative factors affecting the surrounding environment. Results of the studies in this regard are provided in Figure 5.

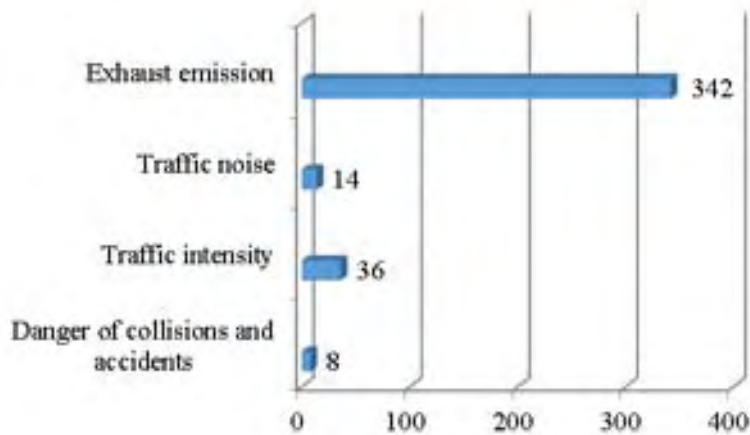


Figure 5. Negative factors related to the use of means of transport. Source: own elaboration.

A supplement of the analysis of the 4P instruments supporting sustainable development is the mix promotion focused on the concepts of sustainability. The research questionnaire included the following question: *which of the instruments of promotion mix encourages you to buy the product?* Results of this inquiry are presented in Figure 6.

Another question concerned the negative impact of the promotion mix instruments on the environment. Figure 7 shows the results of the research.

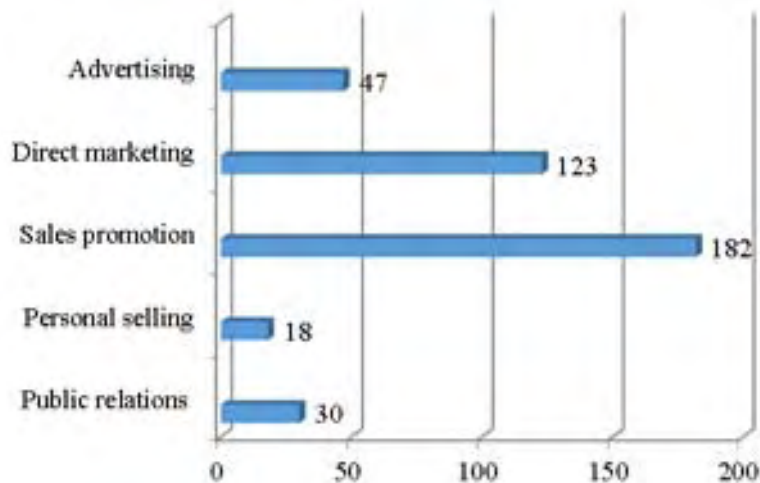


Figure 6. Promotion mix instruments encouraging to product purchase. Source: own elaboration.

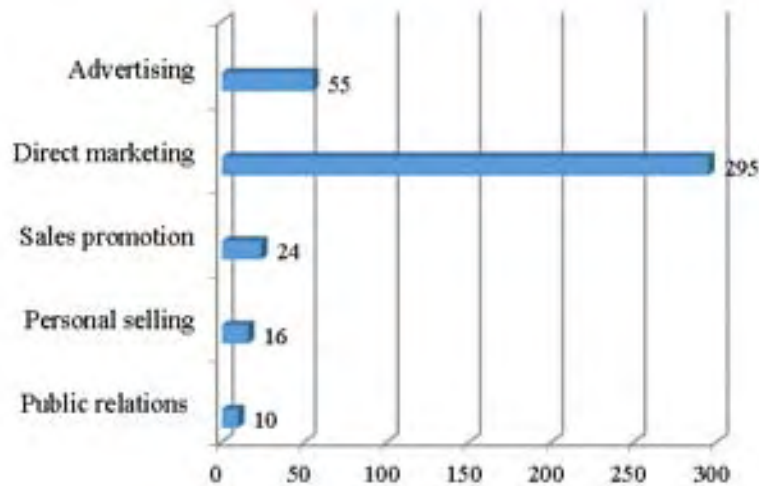


Figure 7. Negative impact of promotion mix instruments on the environment. Source: own elaboration.

Advertising messages used by businesses also contribute significantly to the state of society. Using the forms and means of promoting the organization can create positive or negative role models. The authors also conducted research on the negative impact of promotional activities on society – Figure 8.



Figure 8. Negative influence of promotion mix instruments on the society. Source: own elaboration.

Advertising is the most harmful mix promotion tool for society. Yes answer was showed by 173 researched respondents. In the second place was the actions in the field of public relations. Other promotional tools, and so direct marketing, sales promotion and personal selling are indicated respectively by 11, 17, and 9 people participating in the survey as a tool with negative impact on society. It should be emphasised that as many as 162 people cannot see the negative impact of the promotion mix activities on society, which is a state different in the case of the negative impact of measures to promote the environment, where all respondents confirmed the negative impact of the different mix promotion tools on the state of nature.

The conducted research in the sphere of using promotion mix instruments by companies were also designed to obtain information on the use of environmentally and social-friendly promotional projects. According to the respondents promotional messages addressed to consumers are not inviting to respect the environment and to counteract social problems. Such view present 265 people, while the remainder of the respondents – 135 people think that promotional messages are subject to the principles of sustainable development.

4. Discussion

The changing business environment, the emergence of new trends and developments especially in the context of environmental and social issues requires enterprises to change their current activity in the market of goods and services (Kemper et al., 2019; de Koeijer et al., 2017). The pressure exerted on the market participants – mainly consumers, on manufacturing and trading companies, forces the economic entities to modify the business objectives and marketing tools to be oriented to sustainable programs supporting sustainable consumption (Jianu et al., 2015; Solér 2012; García-Arca et al., 2017). Modification should focus on the 4P instruments through which the company directly affects the consumer. Making the decision to purchase the product increasingly depends on the active involvement of companies in the environment and pro-social actions (Diez-Martin et al., 2019; Masiello et al., 2018; Selby et al., 2009).

The results of the study presented in Table 2 indicate that the most important feature that a sustainable product should have is being harmless for human health and life. This feature is indicated by 242 respondents out of 400 surveyed. Another important characteristics is the product friendliness to the environment – 63 answers. Third place in the hierarchy of sustainable features of the product takes place the product recycling possibility – 48 answers. Other features of sustainable product indicated by respondents include energy efficiency, easy repair and possibility of the product reusing. The most important factor inducing customers to purchase goods is the composition of the product i.e. its raw material – Table 3. The vast majority of respondents indicated this criterion as the most important. An important incentive to buy a product is its low price. In the third place of shopping preferences are environmental reasons, just behind this factor, respondents indicated social aspects connected with a product. The packaging of the product and its high price were considered less important.

Analyzing consumer price preferences it can be agreed that buyers value more the environment and social problems than the low prices of products. Customers are willing to pay a higher price for a product that has been manufactured in a way that respects the environment and social aspects. Such desire was expressed by 276 individuals. Overwhelming majority of respondents also indicated that they are prepared to pay a higher price for the product where

part of the price will be used to improve the condition of the environment and social problems – 349 individuals. Low price of the product is not the main reason why consumers buy more. Results of this study indicate that only 25% of respondents – 102 individuals, are willing to buy more products than they usually need at a lower price. The other respondents – 298 individuals make shopping at a stable level and low prices do not influence them to increase their purchases. The increase of price does not reduce the amount of purchased products. Almost half of the respondents – 186 individuals indicated that high prices are not the reason for limiting the purchased goods.

Distribution of products is the third component of marketing mix oriented towards sustainable development. In the case of the distribution there are broad opportunities to implement the concept of sustainable distribution including the selection of such means of transport that have minimal impact on the environment (Ertz and Sarigöllü, 2019). Vehicles with hybrid or electric engine are not a serious threat to the environment, and their negative impact on the ecosystem is negligible. The use of other means of transport, not only by road, should also be considered (Jacyna et al., 2018). For larger quantities of distributed goods, a rail transport can be used, which apart from the noise, has a very limited impact on the environment (García-Arca et al., 2017; de Koeijer et al., 2017). With regard to the social aspects, sustainable distribution can be demonstrated, among others, in the choice of routes, which will shorten the delivery time, reduce the amount of consumed fuel, and thus will reduce the cost of delivery of products and purchase prices of the product in store. Another example would be the selecting brokers that are socially and environmentally sensitive, limiting the number of participants in the distribution channel, which will translate favorably on the final price of the product at the point of sale, and support charity actions. These examples and methods constitute the essence of sustainable distribution and demonstrate the commitment of distribution, logistics companies in creating equal opportunities for the development of future generations (Kemper et al., 2019).

The most onerous means of transport for the environment and society is road transport powered by combustion. This mode of transport was indicated by 328 respondents of the survey. Other means of transport have little impact on nature and people. Indications of respondents were at the level of 33 responses in the case of air transport and 19 and 12 responses in the case of rail and road transport powered by LPG. The least onerous transport is the maritime transport. This answer was indicated only by 7 people participating in the study. Exhaust emission is the most troublesome and harmful factor for humans and the environment. This response showed 342 respondents. Another negative factor associated with the use of transport is the traffic intensity – 36 answers. Traffic noise ranks third among the respondents – 14 people. Least noticeable negative factor is the risk of transport collisions and accidents. This answer indicated only 8 individuals.

Mix promotion instruments by means of which the organization communicates with potential buyers of goods and services include advertising, direct marketing, sales promotion, personal selling and public relations (Khan et al., 2019; Solér, 2012; Selby et al., 2009). The conducted research in this area of marketing raise the problem of the negative impact of the indicated instruments on the environment and society. Enterprises activities of promotion mix aims at drawing the attention of customers, generating interest, raising the desire to buy and leading to action – the Attention, Interest, Desire and Action model, commonly known as AIDA (Kotler et al., 2002). The most effective promotion tool inducing the purchase of the product is sales promotion – 182 responses and direct marketing – 123 answers. In the next place, respondents indicated advertising – 47 answers, public relations – 30 and personal selling – 18 responses. Instrument of promotion mix that has the most negative impact on the environment is direct marketing – 295 respondents indicated that instrument. Radio, press and television advertising has been identified as the second promotion tool adversely affecting the natural environment – 55 respondents think that way. Instruments of promotion mix, which have the slightest negative impact on the environment are adequately PR – 10, the personal selling – 16 and sales promotion – 24 answers. Advertising is the most harmful mix promotion tool for society. Positive answer was showed by 173 researched respondents. In the second place was the actions in the field of public relations. Other promotional tools, and so direct marketing, sales promotion and personal selling are indicated as a tool with negative impact on society respectively by 11, 17, and 9 respondents participating in the survey. It should be emphasized that as many as 162 respondents cannot see the negative impact of the promotion mix activities on society, which is a state different in the case of the negative impact of measures to promote the environment, where all respondents confirmed the negative impact of the different mix promotion tools on the state of nature.

5. Conclusions

It can be concluded that sustainable 4P is a new and widely unrecognized area of knowledge. The review of the literature points to a small number of publications in this field. Due to the status quo, the knowledge of 4P instruments in relation to sustainable development should be broadened and deepened. Reliable identification of sustainable 4P issues entails the need for empirical research in the area, focused on both, consumers and manufacturing companies which use the tools of the sustainable management.

The essence of this article was to review the literature in the field of sustainable management (public and private), and to present the results of research carried out in a group of 400 consumers on their perception of instruments supporting sustainable development of enterprises. The results of the research presented in this paper contribute to the concept of the

sustainable development comprehending elements of new public management. Obviously, the issue requires further scientific evaluation and the quest for such environmental and social solutions, which will be perceived in the distant future as the far-seeing ones and fully responsible for the fate of the Earth and its inhabitants.

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ESG REPORTING FRAMEWORK IN POLAND – THE CURRENT STATE OF AFFAIRS AND PERSPECTIVES

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Purpose: The purpose of the article is to systematise and present – against a background of the essence of ESG accounting – the applicable and proposed legal framework for non-financial reporting in Poland.

Design/methodology/approach: The article uses qualitative research methods: the method of studying literature and legal acts, the method of analysis and synthesis, as well as the descriptive method and deductive inference.

Findings: The results of the literature studies make it possible to conclude that the topic of ESG reporting is not new, but it is gaining importance, and this process will most probably continue. The growing demand and pressure for companies to be more environmentally and socially responsible are accompanied by the efforts that they make to present the best possible information in this area. To some extent, these activities are voluntary, but they are increasingly enforced by legal regulations. Non-financial information is gaining importance for various stakeholder groups, who are increasingly aware and sensitive to environmental, social and corporate governance issues. It, therefore, seems obvious that the disclosure of ESG information – in part voluntary and influencing marketing – is becoming increasingly regulated and necessary. This is evidenced by further EU regulations and their transposition into domestic legislation. Analysis of the regulations already in force and the draft CSRD Directive cited in the article clearly indicates that the European Commission has been increasing the obligations related to ESG reporting in recent years, and they will be further increased in the future.

Originality/value: The value of the article is the analysis, synthesis and systematics of issues related to the essence and framework of non-financial reporting (sustainable development) in Poland, including issues related to the currently applicable and proposed European Union legislation.

Keywords: ESG reporting, non-financial reporting.

Category of the paper: General review.

1. Introduction

The purpose of enterprises is their continuous development, expressed, among other things, through profit maximisation. At the same time, there is a widespread view in the literature, as well as in the practice of economic life, that enterprises cannot focus only on business goals. It does not require much effort to identify a range of enterprises, initiatives, individuals and organisations which are involved in social issues and have a responsible approach to the issues of ecology and environmental protection. However, it also seems that there is some ground for the belief that capitalism, as it exists today, causes more harm than good in the world (Edelman, 2020). ESG issues such as climate change and poverty – amplified by the effects of the Covid-19 crisis (Wood, 2020) – are at the root of the above-mentioned harm. There is, therefore, a growing need for and pressure on companies to be more environmentally and socially responsible. These expectations come from various stakeholder groups, including shareholders, creditors, customers, "regulators" (both domestic and EU), employees, suppliers, social and environmental activist groups, and the media (Sajjad et al., 2020; Camilleri, 2015; Hoang, 2018).

To meet the growing demands of their stakeholders and the challenges posed by the environment, uncertain external conditions and uncertain business, enterprises are increasingly often making efforts to improve both their business models and reporting systems (Arif et al., 2021). Such actions are partly enforced by law and partly voluntary. In the latter case, it is an approach that especially characterises entities belonging to environmentally sensitive industries, such as the coal, oil or gas industry. Analysis of the subject literature shows that entities operating in these types of industries try to present better ESG information more often than other entities, mainly in order to legitimise their activities and neutralise the stigma of poisoners (Dhaliwal et al., 2011).

2. ESG and ESG Accounting – Fundamental Assumptions

ESG is an increasingly popular concept integrating three elements: the environment, social responsibility and corporate governance (Domańska-Szaruga, 2011; Boffo and Patalano, 2020). This abbreviation is an agglomeration of concepts related to sustainable development, also in the corporate environment. Sustainable development is such development that meets the needs of the current generation without compromising the ability of future generations to satisfy their needs. When analysing individual ESG components, it should be noted that (E) environmental responsibility focuses on maintaining the state of the environment. It refers to the responsible utilisation of natural resources in a way that minimises environmental damage while ensuring

that these resources will remain available for future generations (Mgbame et al., 2021). (S) The social element of the ESG framework is referred to as the concept of corporate social responsibility. Social responsibility perceives an organization as a corporate citizen who should give back to society, even if it benefits from society. This responsibility is the obligation of entrepreneurs to implement such a policy, make such decisions and set such directions for their business that will be consistent with the objectives and values of the society (Żychlewicz, 2015; Stecko, 2012; Abad-Segura et al., 2019). On the other hand, (G) corporate governance includes the structure and activities related to managing and controlling organisational matters, to reconcile the interests of various parties. It is a mechanism that drives all the other ESG framework factors so that the company can earn stakeholders' trust. It includes such actions as governing the organisation, objectives and strategies, monitoring strategy implementation, directing and controlling the overall business, and reporting to shareholders on operations and management. It is therefore an attempt to find the so-called golden mean – a solution that would reconcile the financial aspirations of economic entities with the expectations of the stakeholders directly involved in its operation while maintaining the good of the entire society (Mgbame et al., 2021; Wierzbicka, 2018; Tylżanowski and Leoński, 2018).

The origins of ESG date back to the 1970s, when corporations such as General Motors, Ford and Cummins Engine began to share information about their philanthropic activity and involvement in the community (Wilburn, and Wilburn, 2013). Reporting needs have increased due to the occurrence of environmental disasters. Events of this kind are among the factors that contributed to the creation of special requirements concerning reporting in the ESG area. However, the prepared reports did not include a comprehensive overview of the companies' operations, they only contained a relatively random set of indicators. The situation has been changing in recent years. Corporations are disclosing a broader range of ESG data, mainly due to the emergence of global initiatives such as the UN Global Compact (UNGC), or the Global Reporting Initiative (Mgbame et al., 2021). At the same time, ESG accounting also began to be included in company accounting, as a result of the fact that stakeholders were concerned about the impact of companies on the environment and society, as well as how company management helps to solve this problem (Ackers and Eccles, 2015). Investors and other stakeholders have lost confidence in traditional financial reporting, especially after the 2008 crisis. It was then that the need arose for companies to adopt ESG accounting, containing ESG information in the form of additional reports, which are intended to increase the efficiency of information use (Maroun, 2018; Abhayawansa et al., 2019). What, then, is ESG accounting? First, it is considered a new direction in the field of accounting, complementing financial accounting data (Ismail and El-Shaib, 2012; Thomson, 2015). It is an accounting practice that takes into consideration the relationship between the company and the environment (Esch et al., 2019). ESG accounting is also interpreted as providing information on how a company's activity affects the environment, society and the management structure established in order to achieve the company's strategic objectives. These definitions indicate that ESG accounting is

strategic communication of the company's goals and business activity, as well as its impact on the environment and the society (Eccles et al., 2015; Casonato et al., 2019). Therefore, ESG reporting is a way for companies to inform stakeholders about the actions they are undertaking towards sustainability, as well as their business-related actions – other than the traditional assessment of financial results (Lament, 2017; Erkens et al., 2015).

3. Directive 2014/95/EU as the Beginning of Mandatory Non-Financial Reporting

At the European Union level, the first attempts to introduce mandatory non-financial disclosures date back to the late 1990s. In terms of regulations related to accounting, these samples were reflected in the Accounts Modernisation Directive (2003), according to which the information presented in the activity report should not be limited to financial aspects. Under the provisions of the foregoing Directive, the scope of disclosures should be increased with regard to social and environmental aspects, which was to allow for a better understanding of the development of the company and its financial situation. As pointed out by D. Kinderman (describing in detail the process of the creation of and struggle for the Directive 2014/95/EU on mandatory non-financial disclosures) (Kinderman, 2015), EU actions aimed at expanding the scope of mandatory ESG disclosures were blocked by large and influential enterprises (German ones in particular), which postulated voluntariness in this area. The change of approach to these issues was forced, as already mentioned, by the 2008 crisis, as well as environmental and construction disasters (e.g. the explosion on the BP Deepwater Horizon oil platform in 2010 and the collapse of the building at the Rana Plaza complex in Bangladesh in 2013) (Fijałkowska et al., 2019). The institutional response to such events was the initiative of the European Parliament that culminated on 25 November 2014 with the issue of Directive 2014/95/EU (Directive 2014/95/EU) regarding disclosure of non-financial information. Member States were given time to implement it until 6 December 2016, and its provisions entered into force on 1 January 2017 (Fijałkowska, 2016). However, it should be emphasised that already in 2011, the European Commission issued a Communication in which it indicated that enterprises should have a mechanism for integrating social, environmental, ethical and human rights issues, as well as consumer problems, with their activity and basic strategy (Commission Communication, 2011). Directive 2014/95/EU confirmed that position. It introduced the requirement for large public-interest entities to disclose, in an activity report or in the form of a separate report, a minimum amount of relevant information on environmental, employee-related and social issues, the protection of human rights and the fight against corruption and bribery (so-called corporate social responsibility reporting). In addition, the provisions of the Directive introduced the obligation of new disclosures in the field of

diversity policy, the composition of the company's administrative, management and supervisory bodies, the objectives of diversity policy, the methods of its implementation, its results, as well as risks and risk management in non-financial matters. Entities covered by the aforementioned regulations are obliged to apply the "comply or explain" principle, which means that when an entity does not conduct a policy regarding one or more issues specified in the Directive, it is obliged to disclose this fact and state the reasons behind such a situation (Directive 2014/95 EU); Fijałkowska, 2016).

The transposition of Directive 2014/95/EU into Polish law entailed the need to amend the Accounting Act. Pursuant to it, an additional article was introduced (Art. 49b), regulating the obligation to include a statement on non-financial information in the activity report. If an entity prepares a separate report on the non-financial information required for the statement together with the activity report and publishes it on its website within six months of the balance sheet date, it will no longer be obliged to prepare a separate statement on non-financial information. (Act of 15 December 2016; Tylec, 2018). In addition to the amendment to the Accounting Act, the National Accounting Standard No. 9 "Activity Report" was also updated (National Accounting Standard, 2017). Due to the introduced changes, the category of entities subject to the non-financial reporting obligation now includes public-interest entities (independently exceeding the thresholds, or being parent entities of capital groups) listed in art. 3 sec. 1 e items 1-6 of the Act, being a capital company, a limited joint-stock partnership or such a registered partnership or a limited partnership in which all partners that bear unlimited liability are capital companies, limited joint-stock partnerships or companies from other countries with a similar legal form to the foregoing companies and partnerships. Examples of these include banks, insurance companies, investment funds, issuers, pension funds and domestic payment institutions. The entities listed in the Act are obliged to prepare a statement on non-financial information if in the financial year for which they are preparing their financial statement and in the preceding year they exceeded the following values: average annual employment (in full-time equivalents) – 500 people and the total balance sheet assets at the end of the financial year – 85 million PLN or 170 million PLN – in the case of net revenues from the sale of goods and products (Chluska, 2017; Act of 15 December 2016; Act of 29 September 1994; Tylec, 2020). According to the Accounting Act, as amended in connection with the transposition of the Directive, the areas of ESG reporting include:

- a description of the entity's business model,
- performance indicators,
- a description of the policies carried out by the entity in relation to social, employee, environmental, human rights and anti-corruption issues, as well as a description of the results of the application of these policies,
- a description of due diligence procedures – if the entity applies them,

- a description of significant risks related to the activity of the entity that may have an adverse impact on social, employee, environmental, human rights and anti-corruption issues, including risks related to the entity's products or its relations with the external environment, including contractors, as well as a description of the management of these risks (Act of 15 December 2016; Lorenc and Kustras, 2017).

4. EC Communications: Guidelines on non-financial reporting (2017) and Supplement on reporting climate-related information (2019)

Despite the provisions of Directive 2014/95/EU, the lack of methodology, standards and a precise set of ESG information to be disclosed in the reports has become a serious challenge for the ESG reporting practice. Support in this area was to be provided by a supplement to this Directive, introduced by the Communication from the European Commission: Guidelines on non-financial reporting (methodology for reporting non-financial information). The Communication identifies several frameworks on which companies can base their reporting process. However, it should be emphasised that these were non-binding and non-mandatory guidelines aimed at persuading companies to disclose high-quality, relevant, useful, consistent and comparable non-financial information (environmental, social and management-related) (Santos et al., 2021; Communication from the Commission, 2017; Tylec, 2020).

The 2017 guidelines were extended in 2019 with a supplement on reporting climate information. These additional non-binding guidelines are aimed at providing the entities covered by the Directive with practical tips on how to better report their impact on climate as well as the impact of climate change on their activity. In the 2019 Guidelines, the EC postulates the disclosure of climate-related information concerning each of the five reporting areas specified in the Directive, i.e.: business model, policies and due diligence, the outcome of these policies, the main risk factors and risk management, and key performance indicators. At the same time, the Supplement indicates that practices in the field of climate-related reporting are undergoing dynamic changes, and the content of the related information to be disclosed may vary between enterprises depending on such factors as the sector of activity, geographical location, as well as the nature and scale of climate-related risks and opportunities. The Supplement also stresses that it is not intended to encourage companies to issue separate reports regarding climate. Instead, climate-related information should be included in reports on other financial and non-financial information and made readily available to end-users. At the same time, the EC calls for methodological flexibility and an innovative approach in this respect, going beyond the framework of the proposed guidelines (Communication from the Commission, 2019).

5. Regulation 2019/2088 (SFDR) and Regulation 2020/852 (Taxonomy) as EU Regulations on Sustainable Investments/Finance

On 10 March 2021, the Regulation 2019/2088 (SFDR) on sustainability- related disclosures in the financial services sector entered into force. It obliges financial market participants¹ and financial advisors who provide investment or insurance advisory services (concerning insurance investment products) to publish, in writing, a strategy for introducing risks to sustainable development into the business activity and to ensure transparency of such introduction into the activity. The following were indicated as the objectives of the Regulation:

- an increase in the protection of final investors and broadening of the scope of information disclosed to them,
- the achievement of greater transparency concerning how financial market participants and financial advisors introduce sustainability risks into business activity,
- a reduction of the information asymmetry in relations between the ordering party and the contractor regarding the introduction of risks to sustainable development into the activity, taking into account adverse effects on sustainable development, promoting the environmental or social aspect and sustainable investments, by requiring financial market participants and financial advisors to disclose relevant information to final investors before the conclusion of a contract, and then on an ongoing basis when they act as contractors for those final investors (ordering parties) (Regulation 2019/2088).

The scope of disclosures to which the SFDR Regulation obliges financial market participants and financial advisors includes in particular: information on the adopted strategy regarding the risk to sustainable development when making investment decisions, information on the negative impact of the investment decisions that were made on sustainable development factors and disclosures regarding the remuneration policy, in terms of including information on how to ensure its consistency with the introduction of risks for sustainable development into the activity. The indicated disclosures should be presented on the websites of entities covered by the SFDR Regulation.

The provisions of the SFDR Regulation were amended and supplemented by the Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on establishing a framework facilitating sustainable investments, on the establishment of a framework to facilitate sustainable investment and amending Regulation (EU) 2019/2088 – Taxonomy (Regulation 2020/852; Krappe, 2021).

The taxonomy is recognised as a new EU tool to support the achievement of sustainable development goals. The Taxonomy has established criteria (precisely defined goals) to determine whether a given business activity qualifies as environmentally sustainable, i.e.:

¹ including banks, insurance companies providing insurance-based investment products and investment companies providing portfolio management services.

- mitigation of climate change,
- adaptation to climate change,
- the sustainable use and conservation of water and marine resources,
- transition to a circular economy,
- pollution prevention and control,
- protection and restoration of biodiversity and ecosystems.

According to the provisions of the Taxonomy, business activity will be qualified as environmentally sustainable if it fulfils at least one of the above-mentioned goals and at the same time does not cause serious damage to any of the environmental goals, is conducted in accordance with minimum guarantees, and meets the technical qualification criteria characterised in Regulation 2020/852 (Regulation 2020/852; Krappe, 2021).

6. CSRD – The Future of ESG Accounting

In April 2021, the European Commission published a draft of the Corporate Sustainable Reporting Directive, which will replace the existing NFRD (Non-Financial Reporting Directive). The objective of the CSRD is to improve reporting in the area of sustainability at the lowest possible cost to better exploit the potential of the European single market so as to contribute to the transition to a fully sustainable and socially inclusive economic and financial system, in line with the European Green Deal and the UN Sustainable Development Goals. It is worth noting that the names of the requirements imposed by the CSRD were changed from "non-financial" to "sustainable" (Proposal, 2021; Baumüller and Grbenic, 2021).

In particular, the following were identified as new elements of the Directive:

- an extension of reporting requirements to more companies, including all large and listed companies (except listed micro-enterprises),
- a requirement for attestation of information on sustainable development,
- a more detailed definition of the information that companies should provide and an obligation for companies to submit reports under mandatory EU standards for sustainability reporting,
- a provision ensuring that all information will be published in the business reports and disclosed in digital format (Proposal, 2021).

When comparing the proposed CSRD to the NFRD, it should be noted that the current NFRD covered four pillars, four basic thematic aspects in the scope of which non-financial information was expected to be disclosed. These were: environment, social responsibility and employees, human rights, as well as anti-corruption and anti-bribery measures. In the methodological aspect, the Directive was supported by non-binding guidelines.

The draft Directive indicates three main areas: environment, social policy (social responsibility) and corporate governance. The information that companies will be required to disclose in the field of environmental protection corresponds with the above-mentioned six goals of the Taxonomy. Compulsory disclosures in the field of corporate social responsibility are to cover three main issues:

- equal opportunities (including gender equality, wage equality, equal opportunities for employment and inclusion of people with disabilities),
- working conditions (wages, social dialogue, collective agreements, employee involvement, work-life balance, health, safety and work environment adaptation issues,
- respect for human rights (the fundamental rights of freedom, respect for international standards) (Proposal, 2021).

The information that companies will be required to disclose in the field of corporate governance includes: management and supervisory bodies (including their composition and role), business ethics, corporate culture, anti-corruption policy, political engagement, including lobbying, relations with business partners, including payment practices, internal control systems and risk management, including risk management for reporting processes. At the same time, works are ongoing on the future standards for the presentation of this information. These will no longer be non-binding guidelines, but probably the so-called sustainable development standards, referring to other standards, e.g. GRI, IFRS, and SASB (Proposal, 2021).

In conclusion, the CSRD will not only impose more obligations concerning reporting, but above all, it will expand the list of entities and areas covered by it. A significant change will be the extension of the reporting obligation so that it will cover all the large companies (not only listed companies) that meet certain financial and employment criteria. Importantly, plans also include the introduction of a uniform European standard for reporting on sustainable development issues – the draft Directive assumes the adoption of a first set of reporting standards by 31 October 2022. The new Directive, after having been adopted by the Member States and implemented into national legislation, will come into force in 2024, and it will first apply to data reporting for the year 2023 (Krappe, 2021). It is expected that the solutions introduced by the CSRD Directive will be a big step forward in the field of corporate transparency. This development will entail high administrative costs for enterprises (Baumüller and Grbenic, 2021).

7. Conclusions

Even though the first attempts to introduce mandatory non-financial disclosures in the European Union date back to the late 1990s, the introduction of Directive 2014/95/EU is considered to be the beginning of mandatory reporting. Despite the introduction of the Directive, a challenge for the ESG reporting practice was, and to some extent still is, the lack of a methodology, standards and a set of ESG information required to be disclosed in reports. Such a state of affairs has necessitated making further efforts to develop a methodology, indicators and a precise set of information to be presented. As a result of the search for methodological solutions for ensuring the comparability of data, the issue of non-financial reporting was increasingly regulated (e.g. by Regulation 2019/2088), which was justified by the EU's striving for the transition to a low-emission, more sustainable and resource-efficient circular economy, consistent with the sustainable development goals. Following the regulations of Directive 2014/95/EU (NFRD), further provisions were prepared, including guidelines and regulations, which addressed the issues of ESG reporting in various aspects. These regulations include in particular: Guidelines on non-financial reporting (2017), Supplement on reporting climate-related information (2019), Regulation 2019/2088 (SFDR) and Regulation 2020/852 (Taxonomy).

It can be presumed that a special role in ESG reporting will be played by the CSRD, currently being reviewed in the EU, which is to introduce a uniform European standard for reporting on sustainable development issues. It will include the obligation of non-financial reporting, defined as reporting of sustainable development, for not only large enterprises but also medium-sized and smaller ones. Thus, the disclosure of ESG information will become even more regulated, more broadly mandatory and necessary for different stakeholder groups, who are increasingly aware of and sensitive to environmental, social and corporate governance issues.

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NEW CONCEPT OF GAS MIXTURES FOR WELDING HIGH-STRENGTH STEEL S960 MC

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Purpose: Checking the quality of a joint made with a newly developed method.

Design/methodology/approach: A new welding method has been developed in order to obtain a high-quality joint. The properties of the joint were checked by NDT (Non Destructive test) tests and the strength and fatigue strength were tested.

Findings: Now, adding to the shielding gas mixture can improve the quality and properties of the weld.

Research limitations/implications: In the future, it can be suggested to investigate the effect of nitrogen in other gaseous shielding mixtures of the MAG welding process.

Practical implications: The proposed innovation will not cause problems in the production process. Only the shielding gas will be modified without affecting the technological process, management and economic aspects.

Social implications: Modifying the welding method will not affect the environment and production management methods.

Originality/value: What is new is to propose a new solution with its scientific justification. The article is addressed to manufacturers of structures made of HSS and AHSS steels.

Keywords: welding process, S960 MC steel, means of transport, shielding gas mixtures.

1. Introduction

The article presents the results of tests leading to the selection of the correct MAG welding parameters of a thin-walled structure made of S960 MC fine-grained steel. These steels are increasingly used in the construction of means of transport due to their high strength and acceptable relative elongation at the level of 8% (Jaewson et al., 2011; Darabi and Ekula, 2016). The most recognized high-strength steels are the fine-grained steel S 700 MC. The weldability of this steel is quite well recognized (Golański et al., 2018; Skowrońska et al., 2017).

The dominant martensitic structure of the steel is not conducive to good weldability. In order to obtain a proper and high-quality joint, it is necessary to very precisely determine all welding parameters: current, arc voltage, welding speed, beveling method, type of electrode wires and gas mixtures (Silva et al., 2019; Krupicz et al., 2020). Welding of 960 MC steel is even more complicated compared to 700 MC steel due to the higher carbon and titanium content to strengthen the parent material. However, it is related to the possibility of the formation of additional non-metallic inclusions in the weld, mainly titanium nitrides and carbonitrides (Shwachko, 2000; Mazur and Grela, 2002). Additionally, when welding high-strength steels, as in classic unalloyed steels, the hydrogen content should be controlled (Łabanowski and Fydrych, 2008). When welding HSS steels, cracks often occur both in the weld and in the Heat Affected Zone (HAZ). The reasons for these cracks are usually:

- dominant martensitic structure,
- welding stresses,
- hydrogen interaction.

In order to reduce welding stresses, it is recommended to limit the linear energy during welding to the level of 4.4 kJ/cm, while in order to reduce the hydrogen content in the weld, it is recommended to use preheating.

2. Research materials

For MAG welding of S960 MC steel with a thickness of 1.8 mm, the UNION X90 wire (EN ISO 16834-AG 89 6 M21 Mn4Ni2CrMo) was used and a mixture of 90% Ar-18% CO₂, which was modified by additionally introducing nitrogen with 1% and 2%. In the welding process, it was decided to check the need for drying preheating to a temperature of 80°C.

Table 1 shows the mechanical properties of the S960 MC steel used in the construction of various means of transport.

Table 1.

Tensile strenght of steel S960 MC

YS MPa	UTS, MPa	A5, %
950	1250	8.1

In addition to high strength and yield point, the yield point is considered to be the acceptable value of the relative elongation at the level of 8%. The high temporary tensile strength is related to the higher content of carbon and titanium compared to unalloyed constructional ones, which favors the formation of titanium nitrides and carbonitrides of the TiN, Ti (C, N) type. In unalloyed steels, the content of Ti is introduced at the maximum level of 0.0035%, and in HSS steels, the content of titanium is twenty times greater (Table 2).

Table 2.*Chemical composition of S960 MC*

C, %	Si, %	Mn, %	P, %	S, %	Al, %	Nb, %	V, %	Ti, %	Ni, %
0.12	0.25	1.3	0.02	0.01	0.015	0.1	0.05	0.07	1.7

Source: Łabanowski, Fydrych, 2008.

Chemical composition of steel is similar with electrode wire composition (tab. 3).

Table 3.*Wire UNION X90 – chemical composition*

UNION	C%	Si%	Mn%	P%	Cr%	Mo%	Ni%	Ti%
X90	0.10	0.8	1.8	0.010	0.35	0.6	2.3	0.005

Source: Skowrońska, Szulc, Chmielewski, Golański, 2017, pp. 104-111.

Before starting to make joints from sheets with a thickness of $t = 1.8$ mm. no chamfering was performed. The distance between the sheets and the threshold was 0.5 mm.

The welding parameters were as follows:

- diameter of the electrode wire: 1 mm,
- arc voltage: 19 V,
- welding current: 113 A,
- welding speed: was 315 mm/min,
- shielding gas flow: 14 l/min,
- the nature of the weld: single-pass.

The joints were made with a drying pre-heating to the temperature of 80°C and without pre-heating.

3. Methodology

After MAG welding. standard non-destructive testing (NDT) of the joints was carried out:

- VT – visual examination with an eye armed with a magnifying glass at $3 \times$ magnification – the tests were carried out in accordance with the requirements of PN-EN ISO 17638, evaluation criteria according to EN ISO 5817.
- MT- magnetic particle testing – the tests were carried out in accordance with the PN-EN ISO 17638 standard. the tests were assessed in accordance with EN ISO 5817, with a magnetic flaw detector test device type REM-230.

The analysis of the obtained results of non-destructive tests allowed to select joints for destructive tests, which consisted of the temporary tensile strength and fatigue strength tests. The samples were also structurally examined using a light microscope (LM). The tests were carried out in accordance with the PN-EN ISO 9016:2021 standard. It was decided to check the content of diffusible hydrogen and nitrogen in the tested joints. Tests on the content of H in the

weld were carried out according to the illustrative glycerin method described in the standard "Determination of the total amount of hydrogen in the weld metal of steel electrodes with acid, rutile or alkaline coating. BN-64/4130 "(BN-64/4130, 2013).

4. Research results and their analysis

Joints were made with the use of three shielding mixtures with different nitrogen content. The joints were made without preheating and with preheating. The results of macroscopic visual tests carried out with the naked eye and the magnetic-powder tests of the resulting connections with the use of various shielding mixtures are presented in Table 4.

Table 4.

Results of non-destructive research

Type of shielding mixture	Welding without preheating	Welding with preheating to 80°C
Ar + 18% CO ₂	Cracks in the weld.	No cracks
Ar +18% CO ₂ + 1% N ₂	No cracks	No cracks
Ar + 18% CO ₂ + 2% N ₂	Cracks in the weld and in the HAZ	No cracks

It has been found that for proper welding of 2 mm thick sheets of S960 MC steel. preheating prior to welding is recommended. The preheating temperature of 80°C was found to be sufficient as no cracks were observed in these joints in all three tested cases. It was additionally noted that the shielding gas mixture Ar + 18% CO₂ + 1% N₂ allows for obtaining the correct joint also without the use of preheating.

The next stage of the research was to estimate the content of diffusible hydrogen in the weld. Immediately after welding, the content of diffusible hydrogen in the weld was checked. The test results are presented in Table 5.

Table 5.

Diffusing hydrogen content [ml / 100 g of weld metal]

Type of shielding mixture	Welding without preheating	Welding with preheating to 80°C
Ar + 18% CO ₂	6.3	4.2
Ar +18% CO ₂ + 1% N ₂	6.2	4.1
Ar + 18% CO ₂ + 2% N ₂	6.3	4.2

Based on the results of the tests presented in Table 6 it was found that hydrogen is at the recommended level of 3-5 ml/100 g of the weld metal only when preheating is used. For further destructive tests (structure and mechanical properties) only joints made with preheating at 80°C were taken into account. The dominant structure was martensite and ferrite and carbides, mainly (Ti, Nb) C, carbonitrides (mainly Ti (C, N) and nitrides (mainly TiN). The presence of small amounts of bainite was also found. It should be noted, that the crystal lattice of TiN nitride is

identical to the crystal lattice of alpha ferrite, which favours ferrite nucleation during the rapid transformation of austenite under welding conditions. The dominant martensitic structure with ferrite is observed. the average size of ferrite is at a different level. The average size of ferrite grain in the weld for the tested shielding gas mixtures is presented in Table 6.

Table 6.

Average size of ferrite grain in the joint [μm]

Type of shielding mixture during the welding process with preheating to 80°C	Average size of ferrite grain
Ar + 18% CO ₂	19
Ar +18% CO ₂ + 1% N ₂	17
Ar + 18% CO ₂ + 2% N ₂	21

It was found that the most advantageous mixture is Ar + 18% CO₂ + 1% N₂. It has the greatest influence on ferrite grain refinement which influences the plastic properties of the joint. The next stage of the research was to check the mechanical properties. Table 7 shows the immediate tensile strength of joints made in various sheathing mixtures.

Table 7.

The results of strength tests of a joint made with the use of various shielding gas mixtures

Shielding gas	R _e [MPa]	R _m [MPa]	A ₅ [%]
Ar + 18% CO ₂	429	678	4.9
Ar +18% CO ₂ + 1% N ₂	434	703	5.1
Ar + 18% CO ₂ + 2% N ₂	410	654	4.7

The table data shows that it is possible to obtain high tensile strength of the joint (at the level of 700 MPa) with an acceptable relative elongation (at the level of 5%). This result was obtained only in one case when 1% N₂ was added to the Ar-CO₂ mixture. The strength of joints made in the cover of the remaining mixed gas mixtures (Ar + 18% CO₂, Ar + 18% CO₂ + 2% N₂) is significantly lower and the relative elongation is below 5%. It has been found that a mixture containing 1% nitrogen is the most favourable, justify the fact that nitrogen has a high affinity for titanium and forms nitrides TiN and carbonitrides Ti (N, C), the size and distribution of which is strongly related to the nitrogen content in the weld metal and has an impact on the strengthening of the weld metal, nitrogen in weld metal shielded from three different tested mixtures (Table 8).

Table 8.

The content of nitrogen in the weld metal in the weld metal depending on the type of the shielding mixture used

Shielding gas	Nitrogen content in the weld. ppm
Ar + 18% CO ₂	50
Ar +18% CO ₂ + 1% N ₂	55
Ar + 18% CO ₂ + 2% N ₂	65

The table data confirmed that the addition of nitrogen to the gas mixture influenced the nitrogen content in the weld. Analysing the results of non-destructive and destructive tests to date, it can be concluded that the nitrogen content in the weld metal should be about 55 ppm. Then, the bending test of all tested joints was carried out. Three measurements were made in the joint bending test from the side of the ridge and from the side of the face (Table 9).

Table 9.

Bend test results for a joint made with various shielding gas mixtures

Shielding gas	Face side	Ridge side
Ar + 18% CO ₂	No cracks	No cracks
Ar + 18% CO ₂ + 1% N ₂	No cracks	No cracks
Ar + 18% CO ₂ + 2% N ₂	No cracks.	Cracks in the weld

There were no cracks in the weld and in the HAZ, both from the side of the ridge and the face, only in the first two tested cases (mixture without nitrogen and mixture with 1% nitrogen). Cracks in the weld were observed only for the joint made in a gas mixture shielding with 2% nitrogen.

5. Conclusion

In the article, it was decided to check the effect of nitrogen added to the shielding mixture in the MAG process when welding high-strength steel S960 MC. For this purpose, joints were made in the Ar + 18% CO₂ shield with the addition of 1% N₂ and 2% N₂, respectively. At the same time, the influence of the use of preheating at the level of 80°C was tested. The hydrogen content in all the test joints was analysed. The results of non-destructive tests and tests for the assessment of hydrogen content in the welds clearly showed that the use of preheating gives better results. In further tests, joints made only with the use of preheating were checked. The tensile strength test and the bending test were performed and the nitrogen content in the tested welds was assessed. Based on all the tests performed, it can be concluded that the gas mixture Ar + 18% CO₂ + 1% N₂ is the most appropriate for the welding of 960 MC steel in the MAG process.

In the tested welds, it was observed that the dominant phase is martensite, which is not conducive to good weldability:

1. Preheating (80°C) is recommended prior to MAG welding of S960 MC.
2. It is possible to obtain the tensile strength of a joint made of 960 MC steel at the level of 700 MPa.

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THE PROTECTIVE MEASURES AGAINST SARS-COV-2 INFECTION IN THE SEAFOOD COMPANY FROM THE PERSPECTIVE OF THE EMPLOYEES

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Purpose: To identify and discuss the protective measures implemented to prevent SARS-CoV-2 infection among employees.

Design/methodology/approach: The four-stage course of research. Case study and structured interviews with all employees, directly and indirectly, involved in food processing. Research questions: (R1) What measures have been taken to prevent the risk of infection among employees? (R2) What activities and responsibilities were the most difficult and easiest for employees to follow when implementing these measures?

Findings: Administrative protective measures dominate in the organization. Wearing additional protective equipment, keeping distance, and following new hygienic procedures are the most difficult issues. Temperature self-measurement and signing of health declarations are not a problem for employees. It is a need to listen to employees about the protective measures.

Research limitations/implications: The results refer to one unique case and should not be generalized. However, it is clear that protective measures and their implementation seem to make employees more aware of potential hazards. Therefore, the questions included in our interview can be recommended for use in other organizations, not only in food companies.

Originality/value: The article fills in the research gap. According to the authors' knowledge, this is the first study in Poland that is based on the experience of a food company.

Keywords: COVID-19, human resources, safety, protective measures.

Category of the paper: Research paper.

1. Introduction

Coronavirus SARS-CoV-2 (causing COVID-19) was first reported in December 2019 in China. On 11 March 2020, WHO (World Health Organization) recognized it as a pandemic (Shahbaz et al., 2020; Poudel et al., 2020). SARS-CoV-2 was probably initiated in a seafood market in Wuhan, Hubei. The disease spread from human to human, initiating infections between family members and healthcare personnel attending victims (Han et al., 2020; Aday and Aday, 2020). The pandemic has caused irreparable losses to people and the global economy (Chaudhary et al., 2020). To reduce infection rates, both private and public sector organisations have been shut down/reorganized. ‘Stay-at-home’ policies and restrictions have affected different industries, including the food sectors (Peterson and Thankom, 2020; Bouey, 2020). According to Rezoua et al. (2020), the COVID-19 pandemic has generated a new era. The food supply chain (FSC) is no exception, because COVID-19 has affected the whole logistics process from ‘farm to table’ (Aday and Aday, 2020; Poudel et al., 2020). As Nakat and Bou-Mitri (2021) present, food is considered part of a nation's critical infrastructure along with healthcare, energy, communication sector, among others; therefore, normal operations should be maintained to feed the people during the pandemic. During the global pandemic, this sector continues to combat new challenges, from supply chain disruption and its consequences on food systems, to meeting the high market demand, to protecting its workforce, absenteeism, while maintaining a high level of food safety and consumer trust.

Safety at work, both physical and psychological, plays a central in human resources management and for the organization during the ongoing outbreak of COVID-19 (Falco et al., 2021). It can be defined as a set of conditions that must be maintained in the workplace so that employees can perform their tasks safely and without harming health (Studenski, 2000). As Ambarwati et al. (2022) convince every operating company to prevent COVID-19 from spreading to employees and the surrounding community through various activities and completing the necessary facilities and infrastructure, such as providing masks, hand washing facilities, hand sanitizers, gloves, and face shield, etc. These COVID-19 protocols need to be implemented in various work programs. The gradual transition to the post-pandemic period requires the maintenance of many preventive measures in this regard. It should be emphasized that each organization, especially the one whose functioning has an impact on food security, becomes a resilient organization. Ensuring resilience and business continuity depends on the type of employee protection measures, as well as whether they are followed by employees.

The purpose of the paper is to identify and discuss the protective measures implemented to prevent SARS-CoV-2 infection among employees. An organization operating in the seafood supply chain was selected as the research subject.

The research questions are as following: (R1) What measures have been taken to prevent the risk of infection among the employees? (R2) What activities and responsibilities were the most difficult and easiest for employees to follow when implementing these measures?

According to the authors' knowledge, this is the first article in Poland on this subject, and based on the experience of a food company. Regardless of the sector, to date there is too little work on this issue. Among these few, one can indicate, e.g. the article written by Józefowicz et al. (2020). The research aimed to determine how enterprises operating in the production and service sector react to the pandemic, and four aspects were taken into consideration: employment, remuneration, working time, and work mode. Although one of the companies analyzed was a dairy enterprise, the issue of protection measures was treated by the authors very generally, without their detailed identification. For this reason, the results presented by us fill the research gap in this area.

2. Theoretical and contextual background

Organisations such as the FAO (Food Agricultural Organization), WHO, Centers for Disease Control and the Prevention, and European Food Safety Authority argue that “so far there is no evidence that food is a source of COVID-19” (COVID-19 and food safety..., 2020; <https://www.cdc.gov...>, 2019; <https://www.efsa.europa.eu...>, 2020). It is assumed that SARS-CoV-2 transmission is mainly from person to person, through direct contact and through respiratory droplets that infected people sneeze, cough, or exhale (<https://www.efsa.europa.eu...>, 2020; <https://www.ecdc.europa.eu...>, 2019).

According to WHO (COVID-19 and food safety. Guidance..., 2020), the food industry should have Food Safety Management Systems (FSMS) based on Hazard Analysis and Critical Control Point (HACCP) principles, including Good Manufacturing Practice (GMP) and Good Hygienic Practice (GHP), to reduce the risk of SARS-CoV-2 transmission (Galanakis, 2020; Olaimat et al., 2020; Rahman et al., 2020). The emergence of SARS-COV-2 is said to be caused by a lack of FSMS implementation (Quality & standards..., 2020). The WHO makes it clear that to eliminate or reduce the risk of contamination, it is critical to ensure compliance with measures to protect human resources from contracting COVID-19. There is a need to prevent exposure to or transmission of the virus; strengthen food hygiene, sanitation practices, and personal hygiene measures; provide refresher training on food hygiene principles; introduce physical distancing and hygienic behaviour at each stage of food processing (COVID-19 and food safety. Guidance..., 2020). Moreover, bearing in mind the need to maintain business continuity, such a difficult situation requires reallocation of human resources to different tasks and related new training (Seoki and Sunny, 2021).

Focusing on ensuring continuity of operations helps build supply chain resilience (Liu and Lee, 2018). This pro-resilience orientation should now be a new paradigm of operational excellence that goes beyond simple compliance to measures (The QEHS Guide ..., 2017). Food supply chain (FSC) is composed of a wide diversity of products and companies operating in different markets involving a long process of production, processing, distribution, storage, and handling, from primary production to consumption (Christopher and Peck, 2004; Bukeviciute et al., 2009). Each stage of the FSC is susceptible to disruption and there are different hazards associated with that problem. Furthermore, as already mentioned, maintaining business continuity is threatened by the emergence of SARS-CoV-2 infection among employees (How is COVID-19..., 2020). Food industry personnel do not have the opportunity to work from home and are required to continue working in their usual workplaces. Keeping all workers in food production and supply chains healthy and safe is critical to surviving the current pandemic. Maintaining food movement along the food chain is an essential function to which all stakeholders along the food chain must contribute. This is also required to maintain trust and consumer confidence in the safety and availability of food (COVID-19 and food safety Guidance..., 2020). Some recent studies argue that while COVID-19 is a catalyst for companies to review their existing business continuity plans, short-term actions can be implemented to respond to or mitigate the spread of the COVID-19 pandemic outbreak and ensure business continuity. Companies must educate their employees on the symptoms of COVID-19, educate their staff to minimize the risk of workers' health, and impose strict screening protocols (Rizou et al., 2020; Butt, 2022). It is also important to take care of the mental condition of employees (Butt, 2022; Honarmand et al., 2022), to introduce additional insurance systems (Côté et al., 2021), and to allow free vaccinations (Zhang et al., 2021). Researchers also emphasize the importance of proper nutrition to strengthen the immune system (Maffoni et al., 2021). This means that the company can promote the consumption of meals of appropriate quality. Such an approach contributes to the improvement of the well-being of employees who, in the situation of introduced restrictions, are exposed to additional stress (Usman et al., 2021), considered one of the most important challenges of human resources management, not only during the COVID-19 pandemic (Wong et al., 2021). Employee well-being refers to the idea that the quality of life is improving through the health, happiness, comfort, and tranquility that employees feel while working. A study on employee well-being showed that increasing employee well-being awareness has a positive effect on mental health, job satisfaction, organizational commitment, and work-life balance (Sirgy and Lee, 2016; Edgar et al., 2017; Yu et al., 2021).

The general requirements for the protection of food companies' human resources have been strictly defined in the FAO and WHO documents (e.g., COVID-19 and food safety. Guidance..., 2020). In addition, several guidance documents and resources have been developed on the local, national, and international levels, both in the private and public sectors; to support the food industry during this unprecedented time, and are being continuously updated

in the light of new knowledge (Nakat and Bou-Mitri, 2021). The same can be said about the seafood industry (How is COVID-19 outbreak..., 2020). The scientific literature also provides many reviews of knowledge and good practices in this field, allowing for the selection of appropriate protection measures (Ceylan et al., 2020; Nakat and Bou-Mitri, 2021; Ambarwati et al., 2022; Honarmand et al., 2022). According to experts, there is a hierarchy of actions taken into account to protect employees (Nakat and Bou-Mitri, 2021) (see Figure 1).

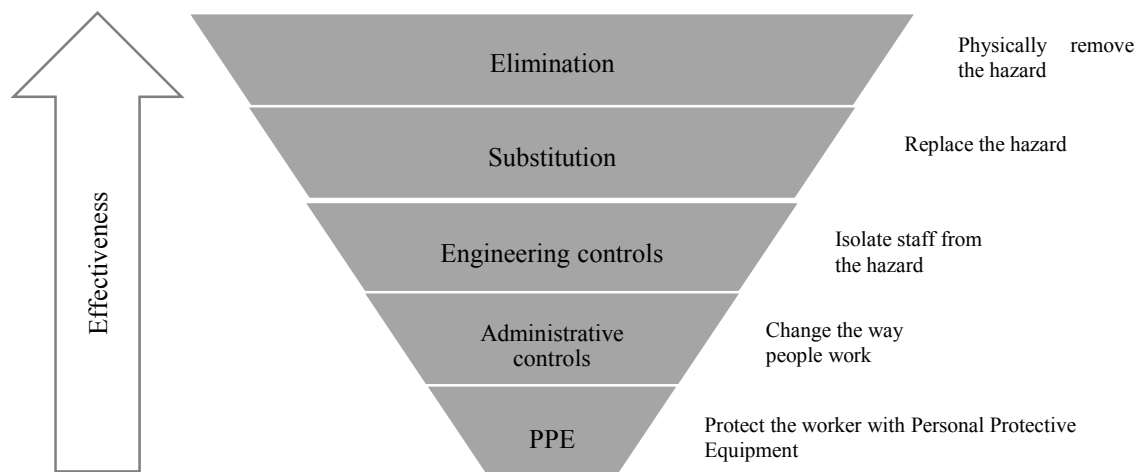


Figure 1. Protective measures against COVID-19 infection. Source: own elaboration based on Nakat and Bou-Mitri (2021).

As can be seen, the hierarchy is arranged by starting with the most effective measures and moving to the least effective. According to Figure 1, while it may not be currently possible to eliminate or substitute the COVID-19 hazard, the most effective protection measures are engineering and administrative controls and the use of personal protective equipment (Nakat and Bou-Mitri, 2021). Engineering controls involve isolating employees from work-related hazards, for example, installing a physical barrier (such as strip curtains or plexiglass), increasing ventilation and air exchange, adding more hand washing stations and hand sanitizers, and separating employees 1 to 2 m (depending on the reference). Administrative controls require action by the worker or the employer, and typically, administrative controls are changes in work policy or procedures to reduce or minimize exposure to a hazard (e.g. stay-at-home procedures, updating the cleaning schedule, minimizing contact among workers by staggering the shifts, and introducing training and education tools). The above controls may also apply to improving the well-being of employees. Food industry-related PPEs can include face masks, face shields, gloves, clean uniforms (worn on-site and laundered daily), hair nets, closed non-slip work shoes, etc. (OSHA, 2020; Trmčić et al., 2021; Yu et al., 2021; Nakat and Bou-Mitri, 2021).

3. Research methodology

3.1. Respondents and research steps

The research was carried out in a small seafood company. The study covered all company staff (13 people) directly and indirectly involved in food handling. Respondents consisted of seven food handlers (FH), three members of the HACCP Team (HT), and three members of the Crisis Management Team (CT). To ensure objectivity, the Management Representative for Quality & Food Safety Assurance (RQFSA) was excluded from this research. As a result, 100% completed structured interview questionnaires were received. The questionnaires (two A4 sheets) were distributed after a short explanation of the purpose of the study by the authors of the article. Employees were informed that participation in the survey were optional and anonymous. The stages and concept of the research are presented in Table 1.

Table 1.

Research steps and the concept of the research

No	Stage	Methods used	Research questions/Interview questions
1	Contact with the company and preparation of its plans Characteristics	Secondary data analysis, Case study	-
2	Identification of preventive measures introduced by the company to protect employees against SARS-CoV-2 infection	Secondary data analysis, Case study	(R1) What measures have been taken to prevent the risk of infection among employees?
3	Conducting interviews and identification the most difficult and most easy responsibilities in terms of preventive measures and getting answers to questions about staff expectations and experiences	Structured interview method	(R2) What activities and responsibilities were the most difficult and easiest for employees to follow when implementing these measures? Q1: Which actions and responsibilities are the most difficult for you to meet in relation to the measures taken against SARS-CoV-2 infection (indicate the appropriate answer/answers)? Q2: Which actions and responsibilities are the easiest for you to meet in relation to the measures taken against SARS-CoV-2 infection (indicate the appropriate answer/answers)? Q3: Which activities and responsibilities, in your opinion, require further improvement and more attention (indicate appropriate answers/answers)? Q4: Has management encouraged you to report such improvements so far? Q5: Do you think that management will take into account your proposed improvements?
4	Drawing conclusions	Synthesis and logical reasoning	-

Source: own elaboration.

3.2. General characteristics of the company

The organisation analysed is an important link in the global supply chain of frozen seafood products. Their core activity is providing high-quality logistics services; handling and storage of packed frozen food products, cross-docking, documentation flow, value-added logistics services, etc. The company operates in the north of Poland and is located in the middle of the FSC between the main producers of raw materials and food processors. It is not involved in the production or sale of finished products. The company has implemented the following universal management systems: ISO 9001, ISO 14001 and ISO 45001, and complies with the sector systems and practices like: HACCP (Hazard Analysis and Critical Control Point), GMP (Good Manufacturing Practice), GHP (Good Hygienic Practice), IFS Logistics, BRC Storage & Distribution, and MSC Chain of Custody. Additionally, the company has introduced the 4-pillar SMETA norm requirements (the Sedex Members Ethical Trade Audit). Although official bodies such as the Food Agricultural Organization (FAO), World Health Organization (WHO), Centers for Disease Control and Prevention, or European Food Safety Authority argue that 'so far there is no evidence that food is a source of COVID-19' (COVID-19 and food safety. Guidance..., 2020; <https://www.cdc.gov...>, 2019; <https://www.efsa.europa.eu...>, 2020), the company in its HACCP system also took into account the hazards connected to SARS-COV-2. This is related to the requirements set by different recipients in the food supply chain. The company employs 21 staff and has seven divisions responsible for operational, tactical, and strategical aspects. There are three groups of bodies directly engaged in ensuring compliance with different standards and regulations: Management Representative for Quality & Food Safety Assurance; Crisis Management Team responsible for preventive and corrective measures related to unexpected and incidental events; and Interdisciplinary HACCP team representatives from Quality Assurance, Technical, and Food Handling divisions. Food traceability process is supported by IT software, Warehouse Management System (WMS).

3.3. Methods

The research was qualitative and was carried out using case study analysis, supported with a structured interview method. Case studies generally cover the 'how' and 'why' questions and focus on real-life context (Rahim et al., 2015). Data for the case study were received from RQFSA. The structured interview questionnaire included one metrics part, three groups of multiple-choice questions, and two groups of open questions. The aim was to ensure that each interview was identical with the same fixed questions in a similar order (Rashidi et al., 2014). A structured interview is a conversation aimed both at gaining detailed knowledge about the interlocutor, an assessment of his attitudes and behaviours, as well as a conversation based on the rules of everyday communication and interpersonal interaction, in which the interlocutors strive to understand each other and share their own experiences (Schaefer and Presser, 2003). The interview questionnaire was verified and accepted by the RQFSA, Quality Assurance

division, and Crisis Management Team representatives. The first three questions were (see Table 1): Q1: Which actions and responsibilities are the most difficult for you to meet in relation to the measures taken against SARS-CoV-2 infection (indicate the appropriate answer/answers)? Q2: Which actions and responsibilities are easiest for you to meet in relation to the measures taken against SARS-CoV-2 infection (indicate appropriate answer/answers)? Q3: Which activities and responsibilities, in your opinion, require further improvement and more attention (indicate appropriate answers/answers)? The answer options were identical:

- a. Obligation to perform self-measurements of body temperature.
- b. Necessity to submit daily health declarations.
- c. Necessity to inform about the potential risk of infection in my immediate environment.
- d. Necessity to read and follow additional guidelines, procedures, and instructions implemented in the enterprise.
- e. Maintain a regime of physical distance between employees at work.
- f. Maintaining a regime of physical distance and limiting the possibility of use of common areas at the same time (locker room, toilets, dining rooms).
- g. Reorganization of work time (shift work).
- h. Necessity to wear additional equipment (disposable face masks/gloves, etc.).
- i. Necessity to comply with additional hygiene requirements.
- j. Others.

The next two questions were (see Table 1): Q4: Has management encouraged you to report such improvements so far? Q5: Do you think that management will take into account your proposed improvements? Here, respondents had a choice of one of the following three answers: a) Yes; b) No; c) Don't know.

4. Results and discussion

4.1. Identifying protective measures in the industry (research question R1)

As shown by the analysis of the documentation, protective measures were introduced at all stages and areas of the organization's operation, covering the following and main processes: 1) cargo delivery; 2) Cargo intake and unloading; 3) Palletizing, foiling, labelling; 4) Cargo transport & location of storage chambers; 5) Cargo storage; 6) Completion for dispatch; 7) Cargo dispatch. Additionally, the following supportive processes are taken into account: 8) Communication & Training; 9) Crisis Management; 10) Human Capital Management & Leadership.

Taking into account the hierarchy and the most effective preventive measures: engineering (E), administrative control (A), and personal protective equipment (P) presented in Figure 1, the authors of the article identified them and subordinated into three categories (see Table 2).

Table 2.

Protective measures identified in the company

No.	Processes	Protective measures description	E	A	P
1	Cargo delivery control	Manual temperature control scheme		v	v
		Following GHP rules and procedures		v	
		Handling of cargo only with disposal protective equipment (masks, gloves).		v	v
		Increased number of disinfection points and activities focused on handling equipment and areas.	v		v
		Declaration of precaution measures taken by the cargo owner and/or supplier		v	
2	Cargo intake and unloading	Visual assessment		v	
		Following GMP & GHP rules		v	
		Procedures of waste disposal		v	
		Proper hygiene and disinfection points and activities	v	v	v
		Cleaning and disinfection of tables, door handles, handrails		v	
		Airflow and UV-C lamps in social areas and open-space offices	v		
		Ozoning offices and social spaces after working hours	v		
3	Palletizing, foiling, labelling	Proper labelling of the unloaded cargo batches		v	
		Procedures for handling complaints		v	
		Instructions of cargo intake		v	
		Following GMP rules		v	
		Procedures of waste disposal		v	
		Procedures of cleaning & disinfection		v	
4	Cargo transport & location at storage chambers	Temperature monitoring		v	v
		Instructions for cargo storage, control measures, cleaning & disinfection		v	
		Following GMP rules		v	
5	Cargo storage	Hygienic lock for office visitors	v	v	
		External visits are minimised to an absolutely needed level		v	
		Document flow without direct contact through hygienic locks with remote audio contact		v	
		Each visitor declares any potential risk related to direct & indirect contact with SARS-CoV-2, current health condition, and allows the measurement of their body temperature		v	
		The visitor wears masks/face covers		v	v
		Not allowed to walk around the office		v	
		Contact with team members is very limited, only when needed.		v	
		All operations and cooperation with external personnel are conducted in a highly hygienic manner (min. 2m. social distance, facemask/shields, gloves) and with the demand of min. document/paper flow		v	v
6	Completion for dispatch	Proper labelling of the unloaded cargo batches		v	
		Instructions of cargo handling		v	

Cont. table 2

7	Cargo dispatch	Inspection of the means of transport prior to loading		v	
		Arrangements with the cargo carrier	v	v	
		Instructions of cargo handling		v	
		Document flow without direct contact through hygienic locks with remote audio contact		v	
		Hygienic lock implemented in the facility for operational visitors/drivers	v	v	
		External visits are minimised		v	
		Each visitor declares any potential risk related to direct & indirect contact with SARS-CoV-2, current health condition, and allows the measurement of their body temperature		v	
		The visitor wears masks/face covers. Not allowed to walk around the office		v	v
		Contact with team members is limited, only when needed		v	
8	Communication & Training	Rules regarding the continual use of Personal Protective Equipment (PPE)		v	
		Additional warnings, pictogram signs, leaflets, and communication materials distributed among personnel and throughout the organisation		v	
		Additional hygienic & epidemiological trainings		v	
		Additional occupational health instructions and risk assessment		v	
9	Crisis Management	Procedure for crisis management in case of identified risk of SARS-CoV-2 at the facility		v	
		First aid respiratory equipment			v
		Information and attention materials (printouts, information signs, etc.) placed around the facility		v	
		External & internal training dedicated to SARS-CoV-2 protection and prevention		v	
		Access to a private healthcare system provided and maintained		v	
		Private life insurance with COVID-19 risk coverage ensured.		v	
		An additional pension saving program is implemented for interested personnel		v	
		Sports equipment is ensured at the facility to encourage a healthy lifestyle model		v	
		Twice a week fresh fruits are delivered to the organization to support healthy food habits		v	
10	Human Capital Management & Leadership	Each employee declares any potential risk related to direct & indirect contact with SARS-CoV-2		v	
		Temperature self-test and a logbook of measurements, health condition, and SARS-CoV-2 exposure declaration of each employee		v	
		Employees are encouraged to report, without consequence, every suspicion regarding their health condition		v	
		Home office work option (where applicable)		v	
		Private healthcare provider		v	
		SARS-CoV-2 RT PCR tests in case of a high risk of virus infection and/or before returning to direct work at the facility		v	v
		Rotation working system implemented; operational employees working on shifts with zero contact between shifts (separate social facilities, etc.)		v	
		Physical distance requirements		v	
		Limits of persons per rooms		v	
		Each employee equipped with additional (more than GMP/GHP): PPE – face shields, disposal masks, gloves, and Personal Disinfection Dispensers			v
		Handling of supply materials in a highly hygienic manner and disposal of unnecessary outer packaging before entering the office		v	
		Min. 24h quarantine (in room temp.) before usage (proper disinfection conducted)	v	v	

Source: own studies.

The analysis of the documentation made it possible to identify many different preventive measures, implemented both in terms of the protection of employees and external stakeholders. Furthermore, the analysis revealed various safeguards related to SARS-CoV-2 as recommended by recognized agencies (COVID-19 and food safety. Guidance..., 2020; COVID-19 and food safety. Questions..., 2020; Guidance for the Food Industry..., 2020). Individual measures based on GHP and GMP rules to prevent the risk of SARS-CoV-2 contamination and infection) are washing hands, wearing protective clothes, masks, gloves. Other more serious measures are collecting declarations of precautionary measures by cargo owners and/or suppliers with each delivery (e.g. process 1); increasing of disinfection activities (e.g. processes 1 and 2); ozoning premises (e.g. process 2), following the rules of quarantine (e.g. process 3), of distance (both in the workplace and in social spaces – e.g. process 5) or confirming good health (e.g. process 1); additional rules related to the hygienic handling of documents (e.g. process 5). Rules for new visitors (e.g., process 7) auditors, veterinary inspectors, customs supervision services, customer representatives, and technical service companies are also crucial. For example, visitors must declare any direct and indirect contact with SARS-CoV-2, their current health condition, and measure body temperatures. Visitors must wear masks/face covers and gloves. Walking around the premises and contact with employees is limited. The importance of these measures is clear (e.g., Safefood, 2020; COVID-19 and food safety. Guidance..., 2020).

SARS-CoV-2 infection disrupts supportive processes, affecting both the safety of employees and continuity of operations (Staniforth, 2020; COVID-19 and food safety. Guidance..., 2020). Protection of physical and mental health is related to the implementation of processes 8, 9, and 10. Key additional measures implemented to promote physical health are training on hygiene & epidemiological rules; crisis management instructions; warning signs, pictograms, and other educational materials. Workers have access to first-aid respiratory equipment and private health care. Measures to protect mental health and well-being include private insurance covering COVID-19, additional pension savings programs, and on-site sports equipment. Measures also implemented are obligations to submit health declarations, self-monitoring of body temperatures, reporting of any suspicious situations, maintenance of physical distance in the workplace, and more restrictive rules of hygiene. Important to employees is the possibility of SARS-CoV-2 testing, additional protective equipment (face shields, disposal masks, gloves), and rotating working systems to ensure zero contact between shifts.

In summary, our research shows that some of the identified measures fall into two or three categories. This is due to the fact that their implementation involves activities of a different nature, e.g. at the engineering and/or administrative and/or operational level. It also turned out that administrative measures predominate in the organization as protective measures. In addition, attention should be paid to numerous measures to protect workers against possible transmission of the virus from the surface of the packaging. According to Han et al. (2020), evidence of virus transmission was disclosed in China early July 2020 by detection of SARS-CoV-2 in packaging materials and storage environments, with two re-emergent outbreaks linked to contaminated food sources.

4.2. The results of structured interviews (research question R2)

The results of the research carried out at this stage are presented in Table 3.

Table 3.

Summary of responses from the structured interviews

Question	Total number of indication FH1-FH7	% of indication FH1-FH7	Total number of indication HT1-HT3	% of indication HT1-HT3	Total number of indication CT1-CT3	% of indication CT1-CT3	Total number of all indications	% of all indications
Q1								
a	2	28.57	0	0.00	1	33.33	3	23.08
b	3	42.86	0	0.00	1	33.33	4	30.77
c	2	28.57	1	33.33	0	0.00	3	23.08
d	6	85.71	0	0.00	1	33.33	7	53.85
e	7	100.00	2	66.67	1	33.33	10	76.92
f	6	85.71	2	66.67	1	33.33	9	69.23
g	3	42.86	2	66.67	1	33.33	6	46.15
h	6	85.71	0	0.00	2	66.67	8	61.54
i	0	0.00	0	0.00	0	0.00	0	0.00
j	No others reported							
Q2								
a	4	57.14	3	100.00	1	33.33	8	61.54
b	2	28.57	3	100.00	1	33.33	6	46.15
c	2	28.57	1	33.33	1	33.33	4	30.77
d	0	0.00	1	33.33	1	33.33	2	15.38
e	0	0.00	0	0.00	1	33.33	1	7.69
f	1	14.29	0	0.00	1	33.33	2	15.38
g	1	14.29	1	33.33	1	33.33	3	23.08
h	0	0.00	2	66.67	0	0.00	2	15.38
i	3	42.86	2	66.67	1	33.33%	6	46.15
j	No others reported							
Q3								
a	0	0.00	0	0.00	0	0.00	0	0.00
b	0	0.00	0	0.00	0	0.00	0	0.00
c	1	14.29	0	0.00	0	0.00	1	7.69
d	0	0.00	1	33.33	0	0.00	1	7.69
e	0	0.00	1	33.33	1	33.33	2	15.38
f	0	0.00	1	33.33	0	0.00	1	7.69
g	1	14.29	0	0.00	0	0.00	1	7.69
h	0	0.00	0	0.00	0	0.00	0	0.00
i	0	0.00	0	0.00	0	0.00	0	0.00
j	Some postulates formulated							
Q4								
a	2	28.57	3	100	2	66.67	7	53.85
b	1	14.29	0	0	0	0.00	1	7.69
c	3	42.86	0	0	1	33.33	4	30.77
Q5								
a	1	14.29	3	100	2	66.67	6	46.15
b	0	0.00	0	0	0	0.00	0	0.00
c	5	71.43	0	0	1	33.33	6	46.15

Source: own studies.

The answers related to Q1 showed that for all groups of respondents, although mainly noted by FH and HT, the most difficult is to maintain a regime of physical distance between employees. This is an important requirement, as emphasized in several guidelines (COVID-19 and food safety. Guidance..., 2020; Guidance for the Food Industry..., 2020; Recommendations for food producers..., 2020). For FH, also difficult is following additional guidelines, procedures/instructions, as well as the necessity to wear additional protective equipment. The latter obligation was also important for all the employees surveyed. Q2 showed that the easiest measures were self-examination of body temperature, particularly for HT, submission of daily health declarations, and additional hygiene-related activities. This may demonstrate the effectiveness of training and educational campaigns crucial to implementing FSMS and enforcing hygiene rules (Rahman et al., 2020). Q3 shows that the vast majority of respondents agree that they currently do not see the need to improve existing protective measures. However, from the CT point of view, more attention could be paid to following new guidelines and implementing procedures. The responses of the HT group agree and additionally emphasize 'paying more attention to maintaining a regime of physical distance in social areas'. According to two people from the FH group, 'better reorganization of working hours and information on the potential risk of infection could be considered', as recommended (COVID-19 and food safety, Guidance..., 2020). It should be noted that the surveyed group of people also includes employees who, for example, do not perceive any difficulties, nor do they consider any of them to be particularly easy. The same can be said about the willingness to express an opinion on improvements (e.g., see CT1, CT2, FH3, FH4, FH5). The survey also provided the opportunity to provide answers other than those included in the questionnaire. Only two people (from the HT and CT groups) used this possibility. In Q3, both of these people indicated that, to improve on existing protective measures, monitoring of international and legal requirements, guidelines, and recommendations could be necessary ('procedures should definitely be updated, if necessary'; 'following the law is imperative in our industry'). In our opinion, the Q4 and Q5 relating to management are essential. More than half of the respondents admitted that management encourages them to give their opinions on improving existing protective measures. However, up to one-third of employees indicated that they 'did not know that this form of encouragement from their superiors exists'. This problem mainly affects FH. Employees responded quite similarly when asked about feedback and management responses to any proposed potential changes. Again, the most doubts were expressed in the FH group, their responses mean they certainly require more support from management, as well as more direct involvement in fulfilling the requirements of standards, e.g. ISO 9001, BRC or IFS (e.g. 'Some day-to-day support would be useful to me'; 'I would like to take advantage of such help', 'I don't know if my opinion will count'). According to scholars, this type of management support and listening to their staff strengthens productivity, employees' trust, morale, and motivation (Do, 2018; Glikson and Woolley, 2020; Kluger and Itzchakov, 2022).

5. Conclusions

This case study, supported by structured interviews, obtained answers to research questions on measures to protect workers from SARS-CoV-2 infection on the workplace. It appeared that the protective measures implemented were primarily associated with the need to follow the fundamental requirements of GHP and GMP, but they also comply with the official sector recommendations regarding SARS-CoV-2.

Based on the study results, one can conclude that:

- Administrative protective measures, such as hygiene procedures or protocols, are those that dominate in the organization.
- Administrative measures are effectively supported using different PPEs.
- Some PPEs are difficult to implement for specific groups of employees, particularly food handlers.
- Wearing additional protective equipment makes work more difficult.
- Keeping distance in everyday work, due to its specificity and the need to maintain the fluency and effectiveness of activities, is a difficult issue, as is following new hygienic guidelines or procedures.
- Self-measurement of body temperature or signing health declarations are not a problem for employees, although it requires extra time and attention.
- All adopted measures require continuous improvement, as well as the guidelines and regulations themselves.
- Ongoing supervision of compliance and monitoring of new procedures and restrictions is necessary.
- Management must be more committed to listening to the needs and proposals of employees, and feedback in this regard will foster trust and increase productivity and staff safety.

As authors, we are aware of the limitations of the study. These results refer to one unique case and should not be generalized. However, it is clear that protective measures and their implementation seem to make employees more aware of potential hazards. In turn, measures such as additional insurance, management care for the quality of nutrition or easy access to first-aid respiratory equipment, strengthen the sense of security and overall well-being of employees.

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JUST CULTURE MATURITY QUESTIONNAIRE VALIDATION IN A POLISH HOSPITAL

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Purpose: (To present the results of the statistical validation of just culture maturity questionnaire (JCMQ), used to recognize the maturity level of JC among nurses in the hospital in Poland.

Methodology: (The case study and 5-stage research with the use of a 5-point Likert scale questionnaire with 28 statements, distributed among nurses. The results were statistically processed with Statistica 13.1 software.

Findings: We confirmed the reliability of JCMQ what helped to recognize the level of JC maturity as “wisdom”. The improvement actions were proposed. The priority in this respect seems to be education and constant, undistorted communication and knowledge exchange.

Originality: To the best knowledge of the authors, this is the first article in Central Europe and Eastern Countries referring to JC maturity assessment in a hospital setting, and addressed to nurses. The results allow indicating the level of JC maturity concerning Ph. Crosby maturity grid.

Keywords: just culture assessment; patient safety, nurses.

Category of the paper: Research paper.

Introduction

The discussion on the essential and necessary characteristics of the quality of healthcare services has been systematically evolving over the years (Fatima, Humayun, Iqbal, Shafiq, 2019). Quality in healthcare is a comprehensive concept and prioritized by individual countries as well as by aspiring medical institutions. According to The Institute of Medicine (IOM), quality of care is the degree to which health services for individuals and populations increase

the likelihood of desired health outcomes and are consistent with current professional knowledge (Busse, Panteli, Quentin, 2019). World Health Organization (WHO) in its “Handbook for national quality policy and strategy” (2018a) points out that quality health services across the world most of all should be: (1) effective: providing evidence-based health care services to those who need them; (2) safe: avoiding harm to people for whom the care is intended; and (3) people-centered: providing care that responds to individual preferences, needs, and values. Besides, according to the Handbook (WHO, 2018a), to strengthen the value of quality in health care, health services must be: timely, equitable, integrated, and efficient.

The critical component of healthcare quality (HQ) is patient safety (PS), defined as the “absence of preventable harm to a patient during the process of healthcare” (WHO, 2018b). It is recognized as fundamental to all aspects of health care services (Maher et al., 2019), whereas a patient safety culture (PSC) is perceived as a key element of any activities and efforts were undertaken to improve patient safety and to provide a relevant level of medical care (Edwards, 2018). For this reason in healthcare organizations focused on continuous improvement the patient safety culture plays a very important role in everyday practice (Bishop & Cregan, 2015). It seems to be a peculiar and irreplaceable potential of a medical organization, contributing to appropriate behaviors, attitudes, and beliefs toward perceiving patient safety as one of their highest priorities. This article focuses on just culture (JC), the specific component of patient safety culture, reflecting the behavior in the situation of medical error and helping people to distinguish between responsible and irresponsible activities (Marx, 2019). Improvement in this area requires knowledge about the level of just culture maturity in the work environment. This can be obtained, among others, by systematically measuring just culture maturity. Therefore the purpose of the manuscript is to present the results of the statistical validation of just culture maturity questionnaire (JCMQ), used to recognize the maturity level of JC among nurses in the hospital in Poland. The research questions are as follows: (1) Is the developed JCMQ reliable and can it be used to assess JC maturity? (2) What is the level of JC's maturity among nurses in the studied hospital? (3) Which of the analyzed aspects can be considered the strongest? (4) Which of the analyzed aspects should be refined?

We tackled this topic because of its poor recognition among practitioners and researchers dealing with healthcare quality in Central Europe and Eastern Countries (CEECs). A review of the literature available in the PubMed (Medline) database published during the period 1998-2020 confirms the research gap in this regard. After entering the phrase “just culture” only 117 publications referring to this topic directly (by keywords) or indirectly were identified (state as of May 2020) and none of them came from the researchers affiliated in this region.

The idea of just culture

Any organization, including a medical one, has its own organizational culture, which represents the shared ways of thinking, feeling, and behaving in healthcare organization) and it is supported by different and specific subcultures. According to Mannion and Davies, (2018), healthcare organizations have specific characteristics, often consistent with those of other cultures, which make up the picture of the organization. They are like connected vessels feeding the overall OC and those specific components intensify each other and allow managers to look more holistically at OC in healthcare organization (HCO) while seeking quality improvement.

Bearing in mind the need to improve the quality of medical services, the quality culture (QC) in HCO appears as a part of OC focused on the quality of healthcare services and its continuous improvement. Creating QC is a challenging but necessary prerequisite for eliminating medical errors and ensuring patient safety (Edwards, 2018), therefore a patient safety culture (PSC) will always be an important part of it. PSC as the element of QC is the component of OC and is a set of values, beliefs, attitudes, and standards regarding what is important in HCO in terms of patient safety. Developing a quality and safety culture is crucial for the patient and staff welfare. It is perceived as one of the key factors in improving patient safety in healthcare and preventing medical errors (Santa, Borrero, Ferrer, Gherissi, 2018). Moreover, the vital component of PSC is just culture (Saber, Jamshidi, Rajabi, Seydali, Bairami, 2017; Armstrong, 2019), which can be defined as the element of OC, and in parallel, the part of PSC, that helps healthcare organizations to move away from responding to errors and near misses with “shame and blame” and encourages and rewards people for speaking up freely about safety-related concerns (Barnsteiner & Disch, 2017). PSC as an idea comes from the concept of safety culture and gained significance after the explosion of the Chernobyl nuclear reactor in 1986 (Wiśniewska, 2018). Since the publication of the famous report “To Err is Human” in 2000, this phenomenon has become more and more noticeable in the medical area. For the authors of this article, the opinion on PSC presented by AHRQ (American Healthcare Research and Quality) seems to be the most appropriate: “the patient’s safety culture is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization’s health and safety management” (<https://psnet.ahrq.gov>). It was James Reason who for the first time introduced the concept of JC into the practice, however, this phenomenon was first applied to healthcare by David Marx (Edwards, 2018), the American risk management specialist who describes JC in healthcare as follows: “Within healthcare, the just culture is model of workplace justice intended to create fairness for providers and create a better outcome for patients. It is about creating a common language to evaluate provider conduct. A just culture helps create an open reporting culture. To create better patient safety outcomes, a just culture shifts the focus from errors and outcomes to system design and the facilitation of good

behavioral choices” (Marx, 2019). As the authors, we identify ourselves with the definition proposed by AHRQ, according to which JC is a culture that “...recognizes that competent professionals make mistakes and acknowledges that even competent professionals will develop unhealthy norms (shortcuts, “routine rule violations”), but has zero-tolerance for reckless behavior” (<https://psnet.ahrq.gov>). AHRQ agrees that the goal of JC in healthcare is to promote the attitude of reporting errors by those who made them, but also in a situation when a given medical staff representative notices the error or violation made by other healthcare employees. Patient safety depends on the existence of a quality culture (QC), a culture of patient safety (PSC), and just culture (JC) in the organization (see Fig. 1). This has been argued by many researchers and institutions (e.g.: Barnsteiner & Disch, 2017; Saberi et al., 2017; Edwards, 2018; Santa et al., 2018; Marx 2019; Armstrong, 2019).

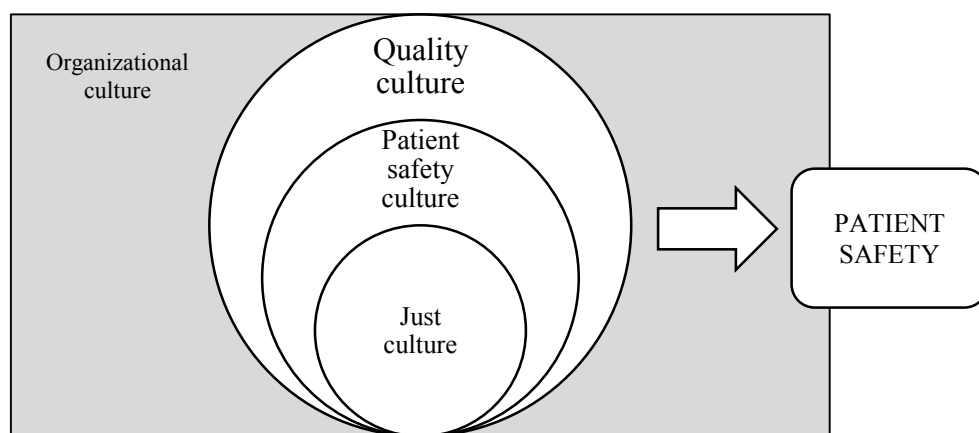


Figure 1. QC, PSC, and JC and their influence on PS. Source: own elaboration.

Having in mind the research problems and the aim of the article, it should be noted that in JC the purpose is not only to identify responsibility for a particular medical error but first of all to solve the problem and to find its roots. Based on the literature one can conclude that many problems may result from the lack of: the relevant reporting system (Ramirez et al., 2018), the management commitment and support (Alzahrani, Jones, Rizwan, AbdelLatif, 2019); the relevant and fair management behavior when mistakes appear (Boysen, 2013); the necessary equipment and materials (Bahreini, Doshmangir, Imani, 2018); an effective and fast communication with the superiors (Norouzinia, Aghabarari, Shiri, Karimi, Samami, 2016) as well as an effective feedbacks to resolve conflicts constructively (Hardavella, Aamli-Gaagnat, Saad, Rousalova, Sreter, 2017); the sufficient professional training (Armstrong, 2019); the knowledge on the causes of potential threats (Hooker, Etman, Westra, van der Kam, 2019); trust among the employees (Paradiso & Swenney, 2017); time (Stergiopoulos, Brown, Felix, Grampp, Getz, 2016); the relevant management behavior when an error occurs (A complimentary publication..., 2017); learning from mistakes (A complimentary publication..., 2017); paying attention on cause-and-effect analysis (Hooker et al., 2019), teamwork (Rosen et al., 2018). The very important seems to be the fear of punishment and of being denounced by other employees (Stergiopoulos, 2016; Vozir & Yurtkoru, 2017). Therefore persons reporting errors have to be protected against any action brought against them

by the employer, except the cases of intentional gross negligence (Paradiso & Sweeney, 2017, 2019; Browne & Haysom, 2019).

To sum up, JC is a culture that creates a balance between blame and blamelessness and between punishment and non-punishment. It creates conditions for trust, for open and fair discussion to facilitate the responsible reporting of errors.

An important way to recognize whether these conditions are met is to conduct systematic research in this area. Assessment of attitudes and behaviors is a reliable measure for evaluating the efficacy of patient safety programs (Saber, Jamshidi, Rajabi, Seydali, Bairami, 2017). However, so far there are still too few tools to measure JC. Probably the first model was presented by von Thaden and Hoppes (2005). In 2011 Barger *et al.* proposed the tool for gap assessment of hospital adoption of JC principles, but the most popular seems to be a model developed by Petschonek *et al.* (2013). The first model consists of twenty statements divided into four criteria: “Reporting Systems”, “Response and Feedback”, “Accountability” and “Basic Safety” arranged into a 7-point Likert scale questionnaire, from 1 - “strongly disagree” through 7 - “strongly agree” (von Thaden & Hoppes, 2005). The second tool comprises two parts. Part 1 measures organizational culture through 13 questions about organizational policies, adverse event investigations, and human resources actions. This section is completed by the patient safety officer after reviewing a representative sample of documents related to these three areas. Part 2 measures the perceptions of leaders about the organization’s culture through 20 questions about critical behavioral indicators, such as system design, coaching, reporting, responses to human error, responses to reckless behavior, severity bias, equity, and transparency. For each statement, response categories were presented on a 5-point Likert scale ranging from “strongly disagree” (-2) to “strongly agree” (2) with a neutral value (0) for “neither etcagree nor disagree” (Barger, Marella, Charney, 2011). The third model is the 27-item questionnaire, categorized into six dimensions: “Balance”, “Trust”, “Openness in Communication”, “Quality of the Event Reporting Process”, “Feedback and Communication About Events” and “Overall Goal of Continuous Improvement”. Also in this case the seven-point Likert scale was used (Petschonek *et al.*, 2013). To some extent, the following models, recognized by the European Patients’ Forum as the tools for PSC assessment and potentially suitable for use during accreditation, may also be recommended to measure JC: Hospital Survey on Patient Safety Culture (HSOPSC), Manchester Patient Safety Framework (MaPSaF), Safety Attitudes Questionnaire (SAQ), because among the items that make up these tools, there is a possibility to exclude those with a direct relationship to JC. For example, in HSOPSC, developed by AHRQ, within the United States Department of Health & Human Services, in the last version 2.0 published in 2019, such items can be found mainly in four out of six sections, like A: Your Unit/Work Area; B: Your Supervisor, Manager, or Clinical Leader; C: Communication; D: Reporting Patient Safety Events. Significant in this regard is section C, entirely related to JC (<https://www.ahrq.gov/sites/...>). Bearing the above in mind, a given HCO can choose a ready-to-use JC assessment model and adapt it to itself, it can also modify existing PSC measurement tools or to implement its own, validated solutions, adequate to its needs.

Methods

The case study to validate the questionnaire used to assess JC maturity was carried out in one of the medium-sized public hospitals in the Pomeranian Voivodship, in Poland, with the following departments: general surgery, trauma, and orthopedic surgery, internal medicine, urology, neurological rehabilitation, intensive care, pediatric, cardiological, and emergency surgery. Due to the sensitivity of the results, the condition for conducting the study, imposed by the hospital management, was confidentiality and concealing the name of the hospital and its exact location. The study was divided into 5 general stages (see Table 1), however, the whole research was inspired and based on W.E. Deming's four-step PDCA cycle (Patel & Deshpande, 2017): (1) P (plan) – planning and developing the questionnaire, (2) Do (do) – contacting with the hospital and questionnaire administration, (3) C (check) – the validation of JCMQ and JC maturity assessment, and (4) A (act) – conclusions and recommendations preparation. To assess the level of JC's maturity, a maturity grid developed by Ph. Crosby was used, as recommended for hospitals by Nwabueze (1995).

Table 1.
The stages of the research

PDCA cycle	Stage No.	Description	Methods
Plan	1	Developing a questionnaire	Conceptual work method
	2	Contacting with a hospital quality representative (HQR) and explaining the purpose and principles of the study	N/A
Do	3	Administration the questionnaire, with the help of HQR; conducting the research	Questionnaire survey method
Check	4	The validation of the questionnaire; JC maturity assessment Discussion and analysis of the collected results, with the presence of HQR	Method of statistical analysis Method of analysis and synthesis
Act	5	Preparation of conclusions, with the presence of HQR	Method of synthesis and logical reasoning

Source: own elaboration.

The questionnaire (see Table 2) consists of 28 items (one A4 sheet). Having in mind the tools and scales established by von Thaden and Hoppes (2005), Barger et al. (2011), and Petschonek et al. (2013), the following aspects of the just culture idea were proposed: GEN – general rules (questions 1-7), REP – reporting (questions 8-14), RES – responsibility (questions 16-20) and REA – reaction (questions 21-28). They were assisted by a 5-point Likert scale. The JCMQs were distributed in individual hospital departments among all nurses, after a short explanation of the purpose of the study by superiors suitably instructed by HQR. The employees were informed that participation in the survey is optional and anonymous. They were asked to leave the questionnaires in a box prepared for this purpose. As a result, 73 completed questionnaires were received (5 of which did not contain opinions on all statements). Thus, the number of questionnaires used to validate the measurement scale and develop the test results was 68 (35 % of respondents). The calculations were carried out using the appropriate procedure of the STATISTICA 13.1 package.

Table 2.
JCMQ (before validation)

1. Medical staff underwent the necessary training to do the work in a safe way for the patient	1 2 3 4 5
2. Patient safety is a priority regardless of costs	1 2 3 4 5
3. Medical staff receives the necessary equipment, auxiliary materials, to perform work in a safe way for the patient	1 2 3 4 5
4. Medical staff receives the necessary help from supervisors if they have doubts about the safety rules	1 2 3 4 5
5. Improvements to patient safety are systematically introduced	1 2 3 4 5
6. When there are incidents that can affect/affect the patient's safety, this is mainly due to system or technological reasons (R)	1 2 3 4 5
7. When incidents occur that can affect/affect patient safety, they usually result from human error (R)	1 2 3 4 5
8. Medical personnel can report comfortably for themselves mistakes/incidents that threaten the patient's safety, committed by others	1 2 3 4 5
9. Medical personnel can report comfortably for themselves mistakes/incidents threatening the patient's safety, committed by themselves	1 2 3 4 5
10. Medical personnel can report comfortably for themselves any deviations that may lead to mistakes/incidents, even if no harm has been done to the patient	1 2 3 4 5
11. Staff do not have enough time to report the above-mentioned errors/incidents (R)	1 2 3 4 5
12. The main obstacle in reporting the above mistakes/incidents is fear of punishment (R)	1 2 3 4 5
13. The main obstacle in reporting the above mistakes/incidents is a fear of accusing others of informing (R)	1 2 3 4 5
14. Medical staff discourage each other from reporting errors / incidents (R)	1 2 3 4 5
15. If the medical personnel violates the procedures, the rules contributing to the threat to the patient's safety they are immediately disciplined by the superiors	1 2 3 4 5
16. If the medical personnel violates the procedures, safety rules, it is immediately disciplined by the superiors, even when it does not have a direct impact on the patient	1 2 3 4 5
17. If the medical personnel violates the procedures, rules, contributing to the threat to the patient's safety, it is immediately disciplined by other personnel	1 2 3 4 5
18. Disciplining personnel by supervisors does little to improve the violation of procedures and security rules (R)	1 2 3 4 5
19. Disciplining personnel by other personnel does little to improve the violation of procedures and security rules (R)	1 2 3 4 5
20. If an incident occurs, first of all, the supervisor is looking for a guilty one (R)	1 2 3 4 5
21. The medical staff immediately reacts to problems concerning the patient's safety	1 2 3 4 5
22. If the medical staff reports problems related to patient safety, appropriate decisions and actions are taken	1 2 3 4 5
23. If there is an error/incident, both the superiors and the employees take this very seriously	1 2 3 4 5
24. If an error/incident occurs in our branch, the explanatory team looks at each step in the process to determine how they could have occurred	1 2 3 4 5
25. Positive conclusions are drawn from errors	1 2 3 4 5
26. I am convinced that the reaction of our superiors to a given problem is always fair to a given employee	1 2 3 4 5
27. Supervisors discuss with us all the problems that arose concerning the patient's safety	1 2 3 4 5
28. We know nothing about the errors/incidents and their consequences (R)	1 2 3 4 5

1 – strongly disagree, 2 – disagree, 3 – not disagree and not agree, 4 – agree, 5 – strongly agree, R – reverse question.

Source: own elaboration based on study results.

The results of the JCMQ validation

For the purpose to assess the quality of the scale used in JCMQ there was a need to assess its reliability. The criterion validity was analyzed employing multivariate analysis within each item framework. Principal Component Analysis (PCA) was applied to determine convergence validity and to assess the redundancy of the questionnaire. The cumulative variability of each principal component was analyzed (see Table 3).

Table 3.

Cumulative variability of principal components within each item framework of the questionnaire

General rules (questions 1-7)									
Principal component	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Cummulative variability [%]	37.74	53.44	68.99	80.69	89.54	95.29	100	-	-
Reporting (questions 8-14)									
Principal component	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Cummulative variability [%]	39,89	68,39	80,63	87,84	94,33	97,78	100,00	-	-
Responsibility (questions 16-20)									
Principal component	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Cummulative variability [%]	60,32	82,70	92,15	96,95	100,00	-	-	-	-
Reactions (questions 20-28)									
Principal component	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Cummulative variability [%]	38,31	53,72	67,57	77,32	86,18	93,13	96,65	100,00	-

Source: own elaboration based on study results.

The results presented in Table 3 confirm the low redundancy of the data collected with this questionnaire. Each of the questions brings additional, new information. The reliability refers to a measurement that supplies consistent results with equal values (Taherdoost, 2016) and it measures consistency, precision, repeatability, and trustworthiness of research. Formally, reliability is defined as the proportion of the variance of true results to the variance of results obtained. The measurement is reliable if the results obtained on a given scale in the subsequent measurements are the same or very similar. The most frequently mentioned methods of assessing reliability are the method of repeating the measurement (test-retest) and the method of determining the internal consistency (homogeneity) of the scale using the α -Cronbach coefficient. The first one is based on the estimation of the inter-period compliance of results. The method of determining internal consistency using the α -Cronbach coefficient allows to determine the degree to which the elements forming the scale (JC aspects) are correlated and coherent with the measurement of the concept they represent (Taber, 2018). The α -Cronbach coefficient is calculated according to the formula (1) (Cronbach, 1951):

$$\alpha = \left(\frac{k}{k-1} \right) \left(1 - \frac{\sum_{i=1}^k \sigma_i^2}{\sigma_s^2} \right) \quad (1)$$

where:

k – number of scale items (here 28 items),

σ_i^2 – variance of the i- position,

σ_s^2 – total scale variance.

This coefficient takes values from 0 to 1. The high reliability of the scale is indicated by the α values greater than 0.7 (Taber, 2018). The statistical analysis of survey data on the 28 questions forming the JCMQ construct to assess the reliability of this scale was done. To determine the values of the α -Cronbach coefficient, all 28 statements were treated as elements of one scale - without separating the subscales marking specific sub-areas within this scale.

The obtained value of the α coefficient for the adopted scale consisting of 28 positions (variables P1-P28) of the research tool was 0.613. In the “Alpha if deleted” column of the table, the values of the α -Cronbach coefficient for individual scale positions are calculated following the principle – “will the α coefficient for the scale increase if one of the elements with the weakest correlation with the scale is eliminated?” (Taber, 2018). It can be stated that item P15 does not meet the condition of consistency concerning other items of the scale. After removing position number 15, the α -Cronbach coefficient will increase to an acceptable value of 0.714. Therefore, further analysis and conclusions obtained as a result of the research presented in this article will be based on 27 positions of the just culture scale, i.e. statements 1-14 and 16-28.

The results of JC maturity assessment in the studied hospital and discussion

To identify the JC maturity level the average value from the answers of all respondents was calculated for each question. Then the average of these values was calculated. The answers to the reverse questions (P6, P7, P11, P12, P13, P14, P18, P19, P20, and P28) were adequately recalculated to obtain JC maturity value on a scale of 1-5. JC maturity value of the studied organization is 3.40 ($\sigma = 0.92$), which corresponds to 68% of the maximum expected value (see Table 4).

Table 4.
Just culture maturity value

Question No.	Average (reverse questions included)	Σ	Just culture value (average of averages) (1-5 scale) within the category	JC value [%] within the category	Just culture value (average of averages) (1-5 scale) in total	JC value [%] in total
1	4.35	0.48	GEN 3.25	65	3.40	68
2	3.99	0.64				
3	4.04	0.54				
4	4.21	0.41				
6	2.83	0.65				
7	3.32	0.69				
8	4.00	0.59				
9	4.15	0.52	REP 2.94	59		
10	4.06	0.82				
11	1.92	0.87				
12	2.01	0.99				
13	2.13	1.21				
14	2.33	1.32				
16	3.93	1.13				
17	3.54	1.24	RES 3.05	61		
18	3.21	1.21				
19	2.39	1.16				
20	2.20	1.14				
21	1.72	0.45				
22	4.17	0.50				
23	4.42	0.52				
24	4.21	0.53	REA 4.17	83		
25	4.06	0.60				
26	4.08	0.44				
27	4.24	0.43				
28	2.32	1.16				

Source: own elaboration based on study results.

The fact and the nature of the validation of the proposed JCMQ made it possible to indicate the overall level of JC maturity in the examined hospital, in the context of nursing personnel behavior. Bearing in mind Ph. Crosby maturity grid (Nwabueze, 1995), by analogy, it can be stated that the level 68% corresponds to “wisdom”, assuming that 1%-20% corresponds to “uncertainty”, 21%-40% - to “awakening”, 41%-60% - to “enlightenment”, 61%-80% - to “wisdom”, and 81%-100% - to “certainty”. Given the above, it is also possible to evaluate JC maturity within each category as follows: GEN – “wisdom”, REP – “enlightenment”, RES – “wisdom”, REA – reaction “certainty”. The data obtained also allowed to gather knowledge about certain beliefs and behaviors, from the perspective of individual statements. Having in mind the research questions, it was possible to identify the most positive reactions and behaviors in the hospital in terms of JC criteria included in JCMQ. According to the results, it turned out that all nurses (100%) agree and strongly agree that they have the necessary and important professional training (Armstrong, 2019) on how to work in a safe way (P1) and receive the relevant help and support from the superiors in case of doubts as to the safety rules (P4). Nurses in 100% confirm (P27) that the superiors discuss with them the arising

problems. One can note that in the situation of any uncertainty, it is necessary to provide effective and fast communication with the superiors (Norouzinia et al., 2016). An equally positive (99%, P23) is the fact that both employees and supervisors treat all errors very seriously, and that the reaction of the superiors to a given problem is always fair (94%, P26). In the studied hospital there is a possibility of comfortable reporting of mistakes made by the staff (P9, 96% of respondents agree and strongly agree). Nurses admitted that they could easily report any deficiencies that may lead to errors, even if they did not cause any harm to the patient (P10, 92% of respondents agree and strongly agree). Moreover, in the event of such an error, the appointed team explains its origin and cause (P24, 94% of respondents agree and strongly agree). In our opinion, there is evidence of an atmosphere of trust in the hospital, as well as a very positive response to P8-P10. Paradiso and Swenney (2017) confirmed a strong positive correlation between trust and JC alignment, and the results of research conducted by Stergiopoulos (2016) indicate that lack of time and fear of punishment are some of the major obstacles in this regard. 89% of respondents agree and strongly agree (P8) they can easily report errors affecting PS committed by others. Appropriately 84% (P11) and 79% (P12) nurses disagree and strongly disagree that these factors constitute any barriers. Slightly more cautious, however, the nurses referred to informing (P13) because only 71% agree and strongly agree that the main obstacle to reporting errors could be fear of being denounced by co-workers. Nurses declared strongly and very strongly that in the case of irregularities, appropriate decisions and actions are taken (97%, P22) and that they receive the necessary equipment and materials to work for patients in a safe way (P3, 90%). Fairly high consistency of responses was observed in the case of a similar issue included in the P5 statement, as 87% of respondents reacted positively that the hospital uses facilities that improve the patient's safety. Improving the condition and number of facilities is an important element of healthcare, regardless of its specificity. They are essential for modern healthcare delivery (Bahreini et al., 2018). Most of the nurses agree and strongly agree (P2 – 87%) that PS is a priority, regardless of costs.

Other areas of concern should be looked at a little more critically, and in our opinion, they should be refined. Regarding P6 and P7, more than half of the respondents have no opinion on whether incidents affecting PS stem from systemic or technological reasons (63%) or human error (55%). This situation can be considered as worrying, as it may indicate a lack of sufficient knowledge on the causes of potential threats, or that no cause-and-effect analysis is considered as a basic tool to reduce or minimize the occurrence of adverse events of different origins (Hooker et al., 2019). Only 58% of respondents disagree and strongly disagree that the personnel is discouraged from reporting errors or incidents of a negative nature (P14), and as many as 21% admit that such a situation happens. This is a serious problem and for this reason, the management should be aware that when medical staff decide reporting non-conformities and errors, they may face dilemmas about who and how to report their comments and claims. Moreover, the lack of sense of safety and a fear of retaliation, and the lack of feedback may affect the quality and completeness of the report (Vozir & Yurtkoru, 2017,

Hardavella et al., 2017). Not very positive impression comes from the fact that only 88% of respondents (P16) agree and strongly agree that violating safety rules is immediately disciplined by superiors, which means there are cases of lack of management commitment and response, whereas managers' response in this respect is regarded as an important determinant of PSC (Alzahrani et al., 2019). The same can be said about concluding the mistakes (P25, 85%). There is evidence that talking about errors and teamwork in this regard influence reducing errors and improving the quality of patient care (e.g. Boysen, 2013; Rosen et al., 2018). However nearly 70% (P20) of nurses denied that when the mistake occurred, first of all, the supervisor is looking for a guilty one, and all respondents admitted that the personnel immediately responded to problems concerning PS (P21), 18% (P28) of nurses admitted that their knowledge of errors occurring in the hospital is unsatisfactory. This means it would be necessary to pay more attention to feedback, which in the case of JC and in general – P SC, is not only an important element of education but also a motivational factor. A similar situation occurs when there is a need for mutual disciplining by the staff (P17). Nurses with such experience are only 20% and as many as 33% of respondents agree and strongly agree that disciplining does not translate into improved performance (P18). This may mean that management does not conduct adequate and systematic supervision in this regard, is inconsistent, or has no authority among a certain group of staff. Because an important element of JC is proper management and staff behavior when an error occurs (Boysen, 2013), the response to the P19 statement was to allow to recognize the role of personnel in the mutual discipline. Although 60% of respondents felt that it was effective, the fact that 22% of respondents said that it contributed little to improving safety behavior, is not satisfactory.

It can also be noted that the category reaction (REA) was the best, however, the weakness of the existing approach is undoubtedly reporting (RES). The above means that following the observed willingness to act quickly in the event of non-compliance, appropriate actions should be taken to document them within the framework of a system that everyone trusts (Ramirez et al., 2018).

After analyzing the results of the study in the presence of HQR, she agrees that the conducted research and the collected results have indicated the stronger and weaker aspects of existing patient safety practices in terms of PSC and JC. However, we are aware of some limitations associated with the study. The first one can be a small number of respondents, which means that the obtained results can't be generalized and they have meaning within the sample obtained (voluntary participation). Besides, respondents were asked to spoke about this subject for the first time. Although the study was anonymous and discretion was provided, there was probably some concern among nurses about expressing an opinion on such a sensitive matter. Secondly, the study was only quantitative, so HQR agree that in the future it should be carried out in parallel with other methods, especially qualitative, e.g.: observations at the workplace, direct interviews with nurses, focus group interviews, or mystery shopping. A combination of such methods and their systematic use might help to better recognize hidden

motives, different nuances, real and potential problems, and difficulties, and to confirm whether the desired rules and requirements are followed and respected by employees (Wiśniewska, 2018), which in the case of JC and PSC is certainly crucial.

Implications of research

The theoretical implication related to the research and the considerations contained in the article is to draw attention to the role of just culture in ensuring patient safety and emphasize its relationship with the culture of patient safety and, more broadly, the culture of quality. The practical implication of the research is to extending the set of tools to measure the level of JC maturity, and thus indicate its possibilities and limitations in the context of wider application.

Conclusions

JCMQ presented in this article has been validated in terms of the reliability of the measurement. After removing one of the items of the pre-proposed diagnostic scale (P15), the coefficient of internal consistency (α -Cronbach) has an acceptable value in the light of the views presented in the scientific literature. Taking into consideration the results of the research and the level of JC maturity recognized as “wisdom”, there is a need to indicate some strong and some weak aspects of just culture in the studied hospital. The fact that the staff undergoes various appropriate training and can count on the support of superiors if they have doubts about compliance with the PS rules, can be considered very positive. Certainly, a very important issue is the fact that in the surveyed institution there is a climate conducive to reporting errors, which proves trust in the management. The next is the fact that every such mistake is taken seriously, and that PS is a priority. However, there are still many areas for improvement. First of all, HQR agrees that it seems necessary to broaden the subject of training to include issues such as cause and effect analysis of errors and their consequences. Next, it is important to conduct a series of training with a specialist in psychology on the subject of error reporting and mutual disciplining of employees, during which the problem of whistleblowing codex seems to be necessary to discuss. Important is also the problem of insufficient consistency and reaction of the superiors in situations of emerging exceptions, as well as the need for effective information sharing. According to HQR, in this case, a good idea seems to be to introduce systematic and ongoing management meetings with the staff regarding patient safety problems, as well as to create an internal, anonymous knowledge exchange platform. The education and constant, undistorted communication is a pre-requisite for the success of any change, including changes

in beliefs and behaviors constituting just culture. Last, but not least, JC maturity measurement should be repeated systematically. It shouldn't be treated as a one-time action. Only then it will be valuable and useful, both for the hospital and the patient. Just culture is more than policy (Paradiso & Sweeney, 2019), it is an obligation. Therefore, this instrument may be recommended and used for further research e.g. to compare attitudes in different groups of medical staff in the same hospital or to compare JC maturity in two different organizations that provide medical services. We believe that JCMQ applied in the study may become a model for other researchers, both scientists and practitioners, also from outside Poland, especially for researchers from CEECs, but not only. Before JCMQ implementing this approach, the following guidelines can be taken into account. First of all the questionnaire should be validated in terms of use, regarding the relevant national language limitations. Next, with the mobility of staff (hiring medical personnel from abroad) in mind, one can also consider the cultural factor. Therefore it will be necessary to select an appropriate sample for the study to draw generalized conclusions. As the questions concern very sensitive issues that may affect the willingness and openness of answers, the condition for conducting the study is to organize a short training session and explain how important the study is to the healthcare facility, especially for the patient's well-being. In this case, both immediate supervisors and representatives of quality management should play a very important role. Last but not least, in our opinion, the use of JCMQ should be additionally supported by the use of qualitative assessment methods, such as systematic audits, observations of employees in the workplace, or mystery shopping.

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MANAGEMENT OF ENGINEERING TEAMS

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Purpose: The aim of the paper is to analyze the methods of management in the case of engineering teams.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: The considerations presented in the publication made it possible to analyse the most important aspects of managing engineering teams. The publication draws attention to the specificity of managing engineering teams and the features that distinguish it from management in other types of organizations. In particular, it points out how to develop engineering teams in subsequent stages. The paper presents soft skills that should characterize people managing engineering teams, such as: dependability, work ethic, communication skills, community and teamwork, time management skills, goal setting, mental ability and takes direction well. The paper has a special focus on the best practices that should be followed to effectively manage engineering teams. Especially nowadays, in the era of Industry 4.0, there is a need for team management in industrial companies as well as more and more cooperation between people and machines. This kind of approach requires careful planning and management of engineering teams. The best practices presented in the publication can provide assistance to engineering teams in today's industrial enterprises wherever teamwork is necessary.

Originality/value: Detailed analysis of all subjects related to the problems connected with management of engineering teams.

Keywords: teams, management, motivation, organization, human resource management, Industry 4.0.

Category of the paper: literature review.

1. Introduction

It is not easy to give a process definition of term management. Different authors have different approaches to this concept. Every specialist put attention on another part of the management concept (Gębczyńska and Wolniak, 2018; Grabowska et al., 2019; 2020; 2021; Wolniak and Skotnicka, 2011; Wolniak and Skotnicka-Zasadzień, 2008). Examples of useful definitions of the term management are (Geffen, 2020):

Management is the art of getting things done through and with people in formally organized groups.

Management is a disconnect process consisting of planning organizing activating and controlling performed to determine and accomplish the objectives by the use of people and resources. Management is the art and science of decision making and leadership (Hąbek and Wolniak, 2013; 2016; Hys and Wolniak, 2018).

Good Management, or scientific management, achieves a social objective with the best use of human and material energy and time, and with satisfaction for the participants and the public (Wolniak and Skotnicka-Zasadzień, 2010; 2018; 2022; Wolniak et al., 2019; Wolniak and Sułkowski, 2016).

To manage is to forecast, to plan, to organize, to command, to coordinate, and to control.

Management is a social and technical process which utilizes, resources, influences, human action and facilitates changes in order to accomplish organizational goals.

The aim of the paper is to analyze the methods of management in the case of engineering teams.

2. Classic functions of management

The need for management in business world normally arises when group of people come together to tackle a task that is too large or too complex for any individual to cope with (Humphrey et al., 2009). In industrial organization it's normal that we are faced with such situation (Gajdzik and Wolniak, 2021). In this situation we need to break tasks or problems down into key elements traditionally involved key management practices for example: planning, organizing, staffing, directing, coordinating, reporting and budgeting (Thomas, 2007). We described the main managerial activities in the table 1.

Table 1.
Classic functions of management

Function	Characteristic
Planning	Planning involves establishing the main objectives or outcomes of the work. It entails detailing the tasks that need to be achieved and the methods for accomplishing them. Planning provides a strong focus and framework for any project or task.
Organizing	This function involves establishing formal structures of authority so that tasks and activities can be defined and co-ordinated amongst the people involved. Organizing also includes the selection and training of staff to deliver the objectives.
Directing	Making effective decisions in a timely and appropriate manner. Creating a shared understanding of the key goals and objectives through the use of appropriate communications channels.
Forecasting	Estimating future needs and requirements. For example, market growth, market share, customer demand, profit and revenue streams, return on investment etc.
Establishing objectives	Establishing the results that have to be achieved.
Scheduling	Establishing the priorities and sequence of actions needed to achieve the stated objectives. What is the order in which tasks and initiatives need to happen?
Budgeting	Allocating the necessary resources to deliver the objectives and outcomes – people, equipment and finance.
Establishing procedures	Developing and applying standardized methods and processes for executing the work.
Selecting the team	Identifying the right people with the right skills for the tasks and roles to be performed.
Delegating	Allocating the appropriate levels of responsibility and accountability to people.
Motivating people	Energizing people on a collective basis and leading them to deliver high levels of performance even when faced with setbacks and obstacles.
Developing people	Advising team members on how they can fully develop their skills and capabilities to increase their value and realize their full potential.
Leading	Involves working with and through people to accomplish organizational goals. Leading involves the social and informal sources of influence that you use to inspire action taken by others. If managers are effective leaders, their subordinates will be enthusiastic about exerting effort to attain organizational objectives. The behavioral sciences have made many contributions to understanding this function of management. Personality research and studies of job attitudes provide important information as to how managers can most effectively lead subordinates.
Controlling	This function involves monitoring any work in progress so as to ensure results are ultimately delivered. It entails inspecting projects and work plans and driving any financial planning, accounting or controlling procedures. The function also involves advising and reporting to senior managers on progress.

Source: own work based on: (Thomas, 2007; Mustafa, 2022).

Today the high level of competition lead to emphasis on highly performed organization and highly performed managers (Gajdzik and Wolniak, 2022). They may be summarized by following points (Miller, 2022):

- High acceptance of responsibility for business performance at every level.
- High information access and sharing.
- Regular and rigorous process measurement and analysis.
- High contact with customers and focus on their requirements.
- Flexibility and adaptability to changing markets and technology.
- High teamwork at every level of the organization.

A team can be defined as a unified group of people with a common goal or purpose and identity (Jonek-Kowalska and Wolniak, 2021; 2022; Jonek-Kowalska et al., 2022). Each team member is committed to working together and has their own areas and responsibility and accountability (Bang, 2017). In effect they need each other in order to succeed (Barakat, 2011). Any industrial engineer manager in today fast changing business environment needs to be able to form teams quickly and create an atmosphere of strong and productive working relationships (Drozd and Wolniak, 2021; Kordel and Wolniak, 2021; Kwiotkowska et al., 2021; 2022; Orzeł and Wolniak, 2022; Ponomarenko et al., 2016). To help a team to function properly and effectively the leader needs to provide the following points (Thomas, 2007):

- Clear objectives and roles for the team and individual members.
- An informal but effective working atmosphere.
- Time-lines and control processes for guiding the team.
- Regular assessments of both team and individual performance.
- Rewards for performance – both for the team as a whole and individuals.
- Development and coaching to continually raise performance standards.

The model of forming engineering team invented by Tuckman is based on four sequential stages of developing all teams experience (Thomas, 2007; Jones, 2019):

- forming stage,
- storming stage,
- norming stage,
- performing stage.

Table 2.

The four stages of developing an engineering team

	Forming stage	Storming stage	Norming Stage	Performing stage
General observations	Uncertainty about roles, looking outside for guidance.	Growing confidence in team, rejecting outside authority.	Concern about being different, wanting to be part of team.	Concern with getting the job done.
Content issues	Some attempt to define the job to be done.	Team members resist the task demands.	There is an open exchange of views about the team's problems.	Resources are allocated efficiently; processes are in place to ensure that the final objective is achieved.
Process issues	Team members look outside for guidance and direction.	Team members deny the task and look for the reasons not to do it.	The team starts to set up the procedures to deal with the task.	The team is able to solve problems.
Feeling issues	People feel anxious and are unsure of their roles. Most look to a leader or coordinator for guidance.	People still feel uncertain and try to express their individuality. Concerns arise about the team hierarchy.	People ignore individual differences and team members are more accepting of one another.	People share a common focus, communicate effectively and become more efficient and flexible as a result.

Cont. table 2

<p>Behavioral characteristics</p>	<ul style="list-style-type: none"> • Politeness. • Superficiality, reserved. • Avoiding controversy. • Suspense – what’s going to happen to me? • Withholding of information. • Watchful of other members – guarded position. • Relatively low levels of involvement and participation. • Fear, anxiety, nervousness. 	<ul style="list-style-type: none"> • Feeling stuck: “What are we supposed to be doing here?” • I’m fed up with this” feelings being expressed. • Opting out of proceedings. • Resistance to requests for help and co-operation. • Competitive behavior between team members. • Sub-groups developing. • Jockeying for position – who’s in charge here? • Differences being expressed openly. 	<ul style="list-style-type: none"> • Give and take amongst team members. • Acceptance and agreement on roles and responsibilities. • Procedures and processes understood by all. • Ground rules for meetings are set and adhered to. • Working together. • Group decision-making is generated by quality discussions. • Increased levels of active listening occur. 	<ul style="list-style-type: none"> • High performance and productivity through problem solving • Strategies. • Strong mutual support and co-operation. • Giving and receiving feedback. • Lots of emotional and task support evident in team working. • Follow through with regard to commitments and action plans. • Strong team identity, spirit, pride and cohesion. • All team members contribute. • Flexibility in outlook and approach. • Compliance of the norming stage is replaced by commitment.
<p>Strategies to help a team move through this phase</p>	<ul style="list-style-type: none"> • Establish a clear sense of direction and performance goals. • Identify the resources available to the team. • Effect introductions – ‘break the ice’ and get people co-operating. • Build a supportive and open atmosphere. • Identify relevant parties and stakeholders outside the team. • Clarify individual roles, expectations and objectives. • Get the team doing things together. 	<ul style="list-style-type: none"> • Allow the dispute to continue for a while – the team need to vent – it is OK! • Re-establish and confirm the team’s mission and objectives – why we are here. • Clarify the leadership role. • Clarify roles, responsibilities and expectations. • Promote real listening amongst the team. • Establish required team procedures and processes. • Provide positive feedback. • Manage the conflict constructively – identify the issues. 	<ul style="list-style-type: none"> • Demonstrate ‘give and take’ amongst team members. • Discuss team processes and dynamics. • Ask for input versus ‘telling’. • Focus on team goals and objectives when conflicts arise. • Demonstrate openness to feedback. • Re-establish roles and responsibilities. • Confront issues. 	<ul style="list-style-type: none"> • Delegate, coach and develop team members. • Enhance openness. • Promote supportive and creative confrontation of ideas. • Seek out feedback. • Let go!

Cont. table 2

		<ul style="list-style-type: none"> • Stay relaxed and calm – see this stage as natural and positive. • Move the team from ‘testing and proving’ to a ‘problem solving mentality’. 		
The team leadership issues	<ul style="list-style-type: none"> • Dependence on the leader to get things moving. • Providing direction: moving the team from the comfort of non-threatening topics to encountering the risk of disagreement and potential conflict. 	<ul style="list-style-type: none"> • Feelings of loss of control. • People opt out or drop out. • Loss of momentum and impetus. • Challenging the leader. • Resistance to move things on. 	<ul style="list-style-type: none"> • Inter-dependence between members and the leader. • Sharing and completing work together. • Shaping the team as an effective unit. 	<ul style="list-style-type: none"> • Inter-dependence of the team and leader. • Role of the leader – redundancy?! • Need to stand back – delegate and empower.

Source: Own work based on: (Thomas, 2007; Bruce, 2022; Rickard and Moger, 2000; Bonebright, 2010).

Every manager should have proper managerial skills which are indispensable if he wants to achieve his goals and be successful (Stawiarska et al., 2020; 2021; Sułkowski and Wolniak, 2016; 2018; Wolniak and Sułkowski, 2015). Every manager should focus on three dimension in his work (Jitesh, 2022; Jones, 2019):

- technical – an understanding of proficiency in engineering and science,
- human – the ability to build a collaborative effort within a group,
- conceptual - he ability to apply analytical thought to the management process and to enterprise as total system.

3. Soft skills for engineers managing teams

Engineering managing teams should have not only technical skills but also it very important he have also so called soft skills (Wolniak and Skotnicka-Zasadzień, 2014; Wolniak, 2011; 2013; 2014; 2016). We described in the table 3 the most important soft skills needed by engineers when they manage teams.

Table 3.
Soft skills for engineers managing teams

Skill	Characteristic
Dependability	Can you be depended on to be where you need to be, to do what needs to be done, to do what you say you will? Your boss must be able to depend on you or you will not get ahead. It is equally important that your peers and your subordinates believe they can depend on you too. Without that, they will not give you the support you need if you are going to be successful.
Work ethic	You were hired to do a job. Do you do it or do you sit back and watch others work? Are you the hardest working person in your group? If not, you ought to be. We described the problem connected to engineering ethic in the chapter 4 of this book.
Communication skills	How well do you communicate with your boss, your peers, your subordinates? Are you able to communicate as well in writing as you are verbally? If you have any weakness in this area you need to work to improve or to eliminate it.
Community and teamwork	A lot has been written about the need to demonstrate your ability to work well with the other members of your team. It is a skill that is becoming more important as we move toward more cross-functional teams. But it is also important that a manager build community. Don't just be part of your team, but understand how it fits in the larger organization and work to strengthen those connections.
Time management skills	The one resource a manager will never have enough of is time. To succeed as a manager, it is vitally important that you develop, and continually improve your skill, in time management. In addition to the ability to prioritize and to delegate, which reduce the number of things you have to do, you have to be able to maximize what you do get done in the time you have
Goal setting	Good managers are able to determine what needs to be done and to set goals to get there. Don't just drift through the day dealing with what lands on your plate. Prioritize. Figure out what needs to be done and set specific goals for yourself and for your team
Mental ability	When hiring, one always look for the candidate who is one step ahead of other in the interview because that person will be the same way when hired. These people catch on quick. They understand business in general and their industry in particular. They are critical thinkers and problem solvers.
Takes direction well	As much as manager are valued for their ability to figure out what needs to be done and get after it, there are still times when they need to be told to do something. Whether it is a change in strategic direction or coaching regarding their performance a good manager has to be able to not only accept the directions, but to do so with a positive attitude, and learn from them.

Source: own work based on: (Jitesh, 2022).

Structuring an organization into teams should be seen as a strategic initiative to achieve operational effectiveness (Geffen, 2020). Participating in a team is not voluntary any more than other management practice (Wolniak, 2017; 2018; 2019; 2020; Wolniak and Sułkowski, 2018; Wolniak and Grebski, 2018). Team management is not merely involvement, it is empowerment. Teams are assigned authority and responsibility for a specific process and for specific performance. The high performance engineering team should meet following points (Miller, 2022; Vacchani, 2016):

- A team with clear responsibility for business performance.
- A team that knows its customers, suppliers and has a documented process known to all members.
- A team with a balanced scorecard linked to organization performance.

- A team with built in flexibility and adaptability through multi-skilled members who share functions.
- A team that has demonstrated competence at problem solving by improving their work processes.

Teams should be empowered to make decision concerning their portion of the business rather than merely making recommendation to higher level of authority (Wang et al., 2021). While team structure may change in industrial organization, and people will serve on several teams, it should be seen as a permanent fixture in the organization, not a temporary answer to a business crisis or a particular problem (Wolniak et al., 2019; Wolniak and Hąbek, 2015; 2016; Wolniak and Jonek-Kowalska, 2021; 2022; Wolniak et al., 2020). We can distinguish some main steps in the engineering team management process. We described them in the table 4. While each team will respond to their own work process and priorities, they almost always should de described points in following order.

Table 4.
Steep of engineering team management process

Steep	Characteristic
Define Team Principles	All groups, whether families, athletic teams or work teams function well when they have common understanding priorities and principles. Define your team's principles around your organization's vision and how you want to work as a team. Principles may include things such as the agreement to conduct discussions with absolute frankness and honesty; to agree to adhere t decision in unity as if they were your own; to listen to all input with respect; and to maintain a constant focus on the requirements of customers.
Clarify Roles and Responsibilities	One of the most common misunderstandings of team management is that teams reduce responsibility and result in the chaos unclear roles. If one had never seen a basketball game and walked into the arena it might appear to be chaos with players running every which way in apparent disorder. However, the more one under-stands the sport, the more one understands that there are very clear roles and responsibilities, designed plays and discipline. The same is true with management and work teams. Roles may include facilitation, data collection and presentation, customer and supplier communication, training, and responsibility for specific process steps.
Define Key Customers and Requirements	Reports that "quality is dead" are premature. Without a doubt one of the most useful concepts to come out of the quality movement is the focus on customers and their requirements. The team management process institutionalizes this focus as a routine responsibility of every employee on every team. Each team will decide how best to define their customers and how to gather data on requirements. They may interview their customers, gather survey or telephone information, and will seek to develop ongoing customer feedback on their performance. They will also define their suppliers and share their requirements with their suppliers.
Develop a Balanced Scorecard	The purpose of the team management process is to improve business performance. Each and every team should know their data. They should define measures that reflect the output of their work process as well as measures of customer satisfaction. Measures typically include productivity, quality, costs and cycle time. It is generally the practice to develop a visual scoreboard so that every team member can see the graphs moving toward their goal and experience the emotional impact of improved (or the reverse!) performance. Scorecards are generally reviewed at each team meeting and form the basis for ongoing problem solving and performance improvement efforts.

Cont. table 4

Analyze the Work Processes	Teams are formed around responsibility for specific work processes. The processes may be assembling a certain product in a manufacturing environment, servicing a group of customers, selling to a defined market group, or for a senior management team, developing business strategy. Each team should be expert in those processes for which it is responsible. To be expert in a work process that process must be de-fined, its course mapped, its cycle time measured and alternatives considered. A requirement of ISO 9001 is that definition and management of processes. This is also a requirement of the team process. It is from this analysis and knowledge that is formed the basis for continuous improvement.
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Source: own work based on: (Miller, 2022).

4. Best practices of team management in engineering

On the basis of the experiences connected with team-management in industrial organization there is in the literature description of many practices that should be used by engineers to successfully manage their teams. In the table 5 there is an characterization of main best practices of leading teams of engineers.

Table 5.
Best practices of team management in engineering

Practice	Characteristic
Understand your team	When you take on a leadership role, you need to get to know your team members. These are the people on whom you will rely to complete a project effectively and on time. They are not mere cogs in a machine; they are individuals, and each has his or her own strengths and weaknesses. A person may be suited well for one part of the process, but flounder in another area. Part of your job is to direct the right people to the right work in order to best advance a project to completion. Leading engineers requires you to advance beyond the mechanics of a product or the processes of assessing quality and functionality.
Understand project details	Your engineering knowledge should remain your base. Before you can lead, your team members need to know that you understand their jobs. Good engineers are detail-oriented; you need to master the details to earn their respect. As their leader, you not only need to know everyone’s area of expertise, but also know how each one contributes to the overall picture. Be ready to ask the right questions of team members and to answer questions on the finer points of the project. If team questions appear to be taking someone in a different direction than you need, be ready to bring them back on target.
Have confidence not to micromanage	The flip-side of knowing details is to trust your team to navigate those details. This is one of the most difficult aspects of moving into a position of leadership: moving away from doing everything and moving into managing the processes and workflows. When you delegate tasks, you give a sense of ownership to your team members. If you try to control every aspect of what they do, you set yourself up for failure. Engineering projects require collaboration and coordination; trying to keep your fingers in everything defeats the purpose. A true leader will develop reporting for the team and check in periodically, while giving team members the freedom to work independently. They will be more effective for it, and you can focus on the overall goals rather than each minute detail. To lead teams effectively, learn to put your engineers in a position to succeed--and then get out of their way.

Cont. table 5

Be flexible	A good leader manages change well. Your greatest value comes not in the planning itself, but in helping a project succeed when things do not go according to plan. Build in time for contingencies, and be ready to shift resources to ensure your timeline and end product remain feasible in the face of disruption
Keep an eye on the big picture	Engineers often do task-oriented work. As a leader, you need to see how each task affects the overall project, and how the project fits into your company's overall goals. When team members' work moves in the wrong direction, it is up to you to bring it back. You will experience hiccups and delays along the way; focusing on the end goal helps you move past those to right the ship and lead your team to success.
Communicate well	When you lead an engineering team, you need to communicate clearly. Your team members need to know what you expect of them. Company management also must understand what you are doing and why. You will deliver oral instructions and written reports, and must learn to clearly and concisely deliver the information everyone in your organization needs to know. People are generally able to adjust to almost anything. To do so, though, they must understand and appreciate what is happening and why. Your effective communication serves your team and everyone in your organization.
Manage up, down and through the finish	Understanding how to succeed begins with defining what outcomes represent success for your project. You need to set reasonable expectations for your managers to hold, and then identify those expectations for your team. Each engineer focuses on individual tasks, but to lead them through to the project's conclusion, you need them to understand not only what each task entails, but for what they are working.
Reward problem-solving	Technical people love to solve problems and build stuff. Trying to figure out what incentives can foster this fundamental characteristic can be tough. Try organizationally elevating the importance of your company's desire and ability to build great products. Products are important to your business, so you're not paying lip service. Rather, you are paying attention. Instill pride in engineers' efforts through all-hands meetings, group messages, or blogs. Another thing you can do is compensate technical staff appropriately. It's rare that technical people will complain about their pay or demand more compensation. It's far more common, especially in the Bay Area, that they'll leave for a job with better salary and more recognition.
Trust your engineers	Instead, set clear objectives and timelines, from the project level (daily, weekly, monthly) to the team level (sprints, product deadlines, market milestones). Then let them work through how to define and organize the work to meet the objectives. You'll get more energized, enthusiastic teams and better work as a result.
Share customer feedback	Technical people respond well to data. Give your team feedback on how their work is being used. But don't get stuck on the raw data, such as number of users; let them know how their work benefits customers. Spend lots of cycles talking to customers and your customer support team to gather this information. Make sure the functional teams (engineering, product, support, sales, etc.) share the feedback.
Don't overcompensate management	Create a system where technical staff don't have to become managers to grow their careers. Most companies pay management the most, on the assumption that managers should have significantly higher salaries than their staff. This greatly overvalues the contribution of managers.
Foster a sense of team and mission	Building strong, inclusive teams with cohesive social bonds takes a massive amount of forethought and work. But that forethought and work is an integral part of leading a team, because having strong teams is paramount to our success as a company. Evidence has shown time and time again that teams who work well together are happier, more productive, and retain better. Leaders should be able to instill a strong sense of mission in their teams, and those missions should be feasible and compelling. A team's mission is like a north star — it can keep that team moving in the same direction, together.

Source: own work based on: [7 best, 2022; 5 secrets, 2022; Sorenson, 2022].

5. Conclusion

The considerations presented in the publication made it possible to analyse the most important aspects of managing engineering teams. The publication draws attention to the specificity of managing engineering teams and the features that distinguish it from management in other types of organizations. In particular, it points out how to develop engineering teams in subsequent stages. The paper presents soft skills that should characterize people managing engineering teams, such as: dependability, work ethic, communication skills, community and teamwork, time management skills, goal setting, mental ability and takes direction well. The paper has a special focus on the best practices that should be followed to effectively manage engineering teams.

Especially nowadays, in the era of Industry 4.0, there is a need for team management in industrial companies as well as more and more cooperation between people and machines. This kind of approach requires careful planning and management of engineering teams. The best practices presented in the publication can provide assistance to engineering teams in today's industrial enterprises wherever teamwork is necessary.

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PROJECT MANAGEMENT IN ENGEENERING

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Purpose: The aim of the paper is to analyze the methods of management in the case of project management of engineering teams.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: The considerations presented in the publication made it possible to analyses the most important aspects of project management. The paper concentrate on the analysis of basic principles of project management especially in the condition of Industry 4.0. In the analysis we were concentrated on industrial organization and tried to characterize main benefits of using the project approach in those enterprises. We distinguished the main benefits of using project management in industrial enterprise in Industry 4.0 conditions. It is especially important to use this approach to handle complex, costly and risky projects which are not easy to manage in traditional way. In Industry 4.0 we can spot many those type indyscyplinary projects linking the technical and social knowledge. In those situation using of project management approach can lead to the success of organization activities.

Originality/value: Detailed analysis of all subjects related to the problems connected with project management in engineering organizations.

Keywords: project management, industrial management, management, project, Industry 4.0.

Category of the paper: literature review.

1. Introduction

We could to define project for example according to definition prepared by Project Management Institute. They said (Project Management Institute, 2013) that project is a temporary endeavor focused on producing a unique operational entity (product, service, result differing obtained in prior projects). Juran one of founders of quality management thought a project is ad problem scheduled for solution (Juran, 1992; Harris et al., 2020). We should mention that problem in this definition not should imply negatives. The outcomes of problem solution can create a positive effects.

The activities connected with project management are especially important in the conditions of Industry 4.0 (Drozd and Wolniak, 2021a; Gajdzik and Wolniak, 2021; 2022; Gębczyńska and Wolniak, 2018; Grabowska et al., 2021; Grabowska, 2019). A series of activities and actions precedes the initiation of the project. One of them is a project plan. It encompasses several components that collectively culminate in a realistic and well-planned sequence of actions and processes. The project plan should go beyond a general project scope and should include all the detail necessary to make a meaningful and value-based addition to work unit or an entire system (Harris et al., 2020). Tuthill thinks that project plan should include a budget, a work and activity breakdown and schedule, an overall project schedule and any other supporting documents (Tuthill, 2014). Billow point out that in every project should be scope definition, risk identification, team resource requirements and decomposing individual task (Billows, 2014). Kerzner thinks that a project is any series of activities and tasks that have a specific objective to be completed within certain specifications; have a defined start and end date; have funding limits; consume money, people and equipment; and are multifunctional (Kerzner, 2015). In 10006 standard project is defined as a unique process, consist of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time cost and resource (ISO 10006:2018; ISO 21500:2020; ISO 21504:2015).

The aim of the paper is to analyze the methods of management in the case of project management of engineering teams.

2. Benefits of project management

The project management itself can be defined as application of knowledge, skills, tools and techniques to project activities to meet project requirements (Hąbek and Wolniak, 2016a; Hąbek and Wolniak, 2016b; Hys and Wolniak, 2018; Jonek-Kowalska and Wolniak, 2021; Jonek-Kowalska and Wolniak, 2022; Jonek-Kowalska et al., 2022; Kordel and Wolniak, 2021; Kwiotkowska et al., 2021; Kwiotkowska et al., 2022). Project management is accomplished through the application and integration of the project management process of initiating, planning, executing, monitoring, controlling and closing (Project Management Institute, 2013; Bakator et al., 2017). Project management entails a combination of tools, people and systems, Tools may include computers, software packages and daily planners. People include organizations and projects teams who engage in processes geared toward goal accomplishment within system. Management of people may present as challenge in this endeavor, and leaders and communicators must use multiple skills to coach and mentor individuals towards achieving the common goal (Lewis, 2011). According to ISO 10006 project management means planning,

organizing, monitoring, controlling and reporting of all aspects of a project and the motivation of all those involved in it to achieve the project objectives (ISO 10006:2018).

Project management can be also seen as a professional discipline with its own body of knowledge and skills. Project management expertise can benefit any in-depth feasibility projects and analysis upfront in order to create an appropriate project strategy, governance and delivery structure (Gorod et al., 2020). Following the project management approach, detailed work breakdown structures, resource plans and delivery timeline schedules will be covered with the proposed methodology (Orzeł and Wolniak, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020; Stawiarska et al., 2021; Sułkowska and Wolniak, 2016; 2018; Wolniak and Sułkowski, 2015; Wolniak and Skotnicka-Zasadzień, 2014; Wolniak, 2011; 2013; 2014; 2016; 2017; 2018; 2019; 2020). Without a project management methods, all project actors will have different ideas about how things should be organized and when the different aspects of the project will be completed (Hyttinen, 2017).

There are following benefits of using project management concept within industrial organization (Introduction, 2021):

- Project management approach will help in handling complex, costly and risky assignments by providing interdisciplinary approach in handling the assignments. Example: R&D organizations.
- Project management approaches help in handling assignments in a specified time frame with definite start and completion points. Example handling customer orders by Industries involved in production of capital goods.
- Project management approaches provide task orientation to personnel in an Organization in handling assignments. Example: Organizations in IT sector handling software development assignments for clients.

3. Project management life cycle

We can identify four phases of project lifecycle (Tuthil, 2014; Kerzner, 2109):

1. Initiating the project (including identifying customer-driven factors and obtaining leadership approval and support).
2. Planning (including human and physical resources).
3. Executive (monitors, control, and cycle of efforts).
4. Project closure (training, operations, and support).

Other authors mentioned five step approach to project life cycle (Figure 1) (Hyttinen, 2017; Martinelli and Milosevic, 2016):

1. Initiating.
2. Planning.

3. Execution.
4. Monitoring and Controlling.
5. Closing.

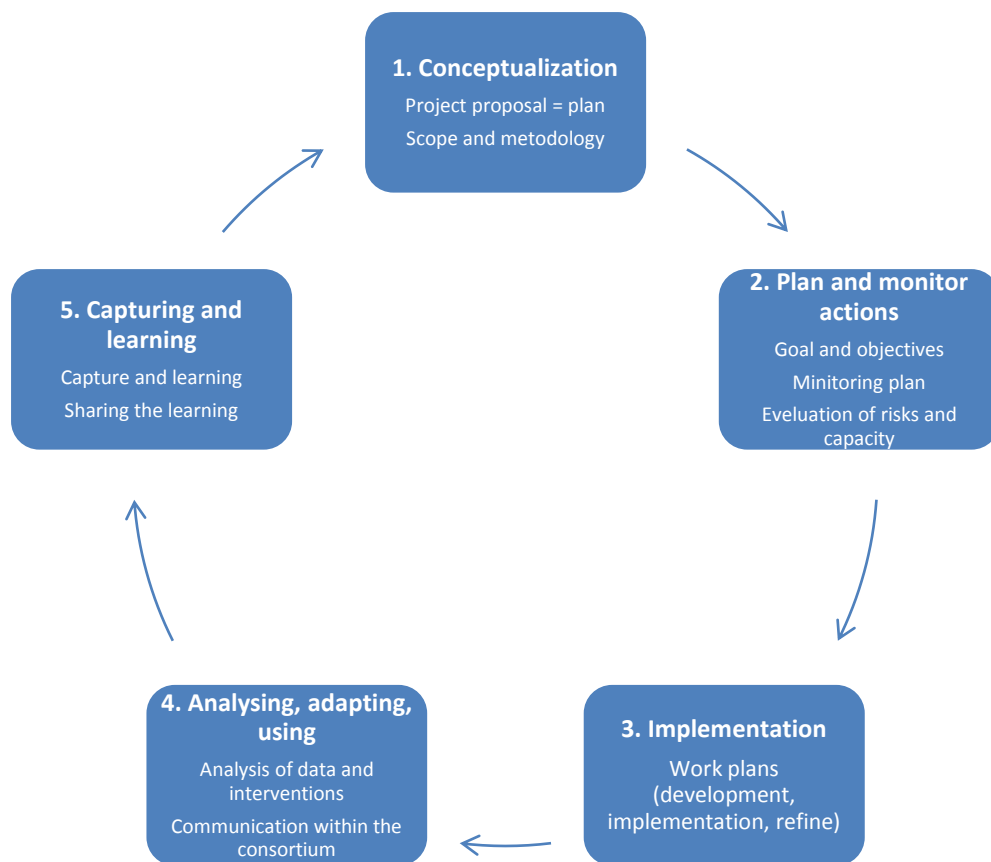


Figure 1. Project management life cycle. Source: (Hyttinen, 2017).

At the beginning of the project, the basic idea needs to be well explored and elaborated (Wolniak and Grebski, 2018; Wolniak et al., 2019; Wolniak and Hąbek, 2015; 2016; Wolniak and Jonek-Kowalska, 2021; 2022; Wolniak et al., 2020; Wolniak and Skotnicka, 2011; Wolniak and Skotnicka-Zasadzień, 2008; 2010; 2018). Initial phase includes also goals of the project, decision concerning the partners and parties to carry through the project implementation and the plan of the project (Smart, 2021; Campbell, 2020).

The project management plan should (ISO 10006:2018):

- refer to the customer's and other interested parties' documented requirements and the project objectives; the input source for each requirement should also be documented to allow traceability;
- identify and document the project processes and their purposes,
- identify organizational interfaces, giving particular attention to:
 - the project organization's connection and reporting lines with the various functions of the originating organization,
 - interfaces between functions within the project organization,

- integrate plans resulting from the planning carried out in other project processes, review these plans for consistency and resolve any discrepancies; these plans include:
 - quality plan,
 - work breakdown structure,
 - project schedule,
 - project budget,
 - communication plan,
 - risk management plan,
 - procurement plan,
- identify, include or reference the product/service characteristics and how they should be measured and assessed,
- provide a baseline for progress measurement and control, to provide for planning the remaining work; plans for reviews and progress evaluations should be prepared and scheduled,
- define performance indicators and how to measure them, and make provision for regular assessment in order to monitor progress; these assessments should:
 - facilitate preventive and corrective actions,
 - confirm that the project objectives remain valid in a changing project environment,
- provide for reviews of the project required by the contract to ensure the fulfilment of the requirements of the contract,
- be reviewed regularly and also when significant changes occur.

To evaluate project management it is necessary to define the key measure or key indicators (Denise, 2019; Wolniak and Skotnicka-Zasadzień, 2022; Wolniak, et al., 2019; Wolniak and Sułkowski, 2016). To achieve successful functioning of the project we should include five activities like: conceptualization, plan and monitor actions, implementation, analyzing, adapting and using, capturing and learning, which are described in table 1.

Table 1.

Main project activities

Activity	Characteristic
Conceptualization	The elaboration of project scope and methodology shall be defined during this first project phase. This phase includes expanding and encompassing the project concept to relevant elements such as current understanding and study fields. As a result, this phase provided a project plan at the beginning of the project.
Plan and monitor actions	In order for the project to meet the end users' needs, this phase shall redefine the goals and objectives for work package execution. The overall project plan is the stable foundation for the detailed plans. The risks and capacities must be updated and evaluated
Implementation	If the earlier phases have been effectively conducted, project execution and implementation are fluent processes. The activities in a CSA project vary and they can include desk-based studies, field studies, active data collection, organizing panel discussions, presentations, end user events, dissemination, gathering and analysing needs and feedback, providing publications, making research studies more available for public audiences, and utilising and exploiting relevant data for political decision-makers and/or other end users.

Cont. table 1

Analysing, adapting and using	Successful execution and implementation of the project or work package provides information and results to be analysed, adapted and used in relevant areas and fields. Depending on the objectives, the relevant bodies for this phase/process can be project consortium organisations, external end users (e.g. political decision-makers, industry, academics, technologies) or the general public. The use of change management processes, dissemination strategy, communications and exploitation is necessary during this phase.
Capturing and learning	At the end of the project or work package, one purpose is to gain more knowledge and skills at all levels: individual, group (consortium), organisational and public. Failures also provide platforms for the learning process. By sharing one's own experiences, the learning can happen in a wider framework (e.g. higher education). This phase aims to integrate the project findings to broader conceptualisation levels.

Source: own work based on: (Hytinen, 2017).

When we think about good project management in industrial enterprise we should stick to many principles and activities (Zwikael and Smyrk, 2019; Stecuła and Wolniak, 2022; Czerwińska-Lubszczyk, 2022; Gajdzik and Wolniak, 2022; Jonek-Kowalska et al., 2022). The challenge of project management is not only to deliver the project successfully, but also to deliver the result at an optimal balance cost, time, scope and quality, stakeholder satisfaction and achieving short and long term objectives at an acceptable risk. In the table 2 there is an characteristic of main project management principles.

Table 2.*Project management principles characteristic*

Principle	Characteristic
Focus on performances and results	Projects are specific endeavors with one or more explicit purpose and desired outcomes. Project managers are the main drivers toward achieving those goals and objectives. Where possible, leverage lessons learned from past projects to enhance the likelihood of achieving results.
Minimize surprises	Project professionals, especially project managers, should look ahead when possible and plan the execution of a project. Irrespective of the project management approach, project manager's primary responsibility is to navigate the situation, establish and manage the processes, and drive toward results. Even positive surprises, or opportunities, can be perceived as poor project management if they occur unexpectedly as the project cannot take more advantage of the opportunity.
Manage responsibility	The challenge of project management is to do more with less. By being as effectively and efficiently as possible, effective projects management should deliver results at lower costs and with greater satisfaction. Project managers should also find the optimized method for implementing projects, such as selecting between the spectrum of approaches from the predictive to the adaptive.
Optimize approach	Project management is an optimization exercise, performing the art of possibility by dealing with competing priorities and needs with factors such as availability of time and resources. Effective project management strives to find the optimal balance between good planning with overthinking and make difficult trade-off decisions, risk taking, speedy execution with thoroughness, focusing on exceptions while maintaining solid control over execution progress and managing change versus adopting change, and trust but verify. Combined with Manage Responsibly, project managers need to adopt the optimal method that works best for the project and the sponsoring organization.
Empower people	This is especially important on large projects involving many people. Organizations should provide an environment in which individuals can thrive and encourage their project managers to foster trust and independence in which people can contribute.

Cont. table 2

Communicate effectively	Communication has always been an important contributor of success. But in the era with a proliferation of technology tools such as social media, there may be a tendency toward too much information versus too little. Project professionals, especially the project managers, should concentrate on the most important messages and make sure they are delivered timely and appropriately.
Think and manage up	Most skilled project managers can manage both up and down one level effectively, but the truly experienced project managers can manage multiple levels up the organization chain. By developing the ability to think from the perspective of senior management, project managers can link their immediate project goals and deliverables with the broad goals and key performance indicators of executives multiple levels above their current standing. This is a sure way to ensure strategic alignment and continual support from the upper management.
Fact-based management	Complex projects, especially projects in a politically tense environment, can be intricate to manage. Project managers should always focus on the facts first and consider them first in their decision-making processes. Other sentiments, can be important, and even if some ultimate decisions are political, project managers should be aware that their decisions are based on extrinsic factors beyond mere facts.

Source: (We, 2020).

4. Conclusion

The considerations presented in the publication made it possible to analyse the most important aspects of project management. The paper concentrate on the analysis of basic principles of project management especially in the condition of Industry 4.0. In the analysis we were concentrated on industrial organization and tried to characterize main benefits of using the project approach in those enterprises. We distinguished the main benefits of using project management in industrial enterprise in Industry 4.0 conditions. It is especially important to use this approach to handle complex, costly and risky projects which are not easy to manage in traditional way. In Industry 4.0 we can spot many those type interdisciplinary projects linking the technical and social knowledge. In those situation using of project management approach can lead to the success of organization activities.

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SUSTAINABLE PROJECT MANAGEMENT CONCEPT DEVELOPMENT AND RESEARCH DIRECTIONS REVIEW

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Purpose: The dynamic economic changes in recent years have made the principles of sustainable development gain more and more importance and there is a great need to maintain a balance in the social, environmental, and economic dimensions. This has also been observed in project management, whereby the concept of sustainable project management plays an important role in both practice and science. In recent years, there has been a significant increase in scientific publications on the concept of sustainable project management. The article presents the assumptions of sustainability in a project and the identification of research directions in this area. The study aims to present the results of the literature review and answer the two research questions: which research areas related to sustainable project management dominate the literature and what are the further research directions in the field of sustainable project management?

Design/methodology/approach: The study was conducted based on a literature review in the field of sustainable project management and sustainability in project management. Scientific articles indexed in the Scopus database, published before 2022, were used. A keyword analysis was carried out, on the basis of which subject areas related to sustainable project management were distinguished, and the most cited articles were reviewed to extract recommendations for the directions of future research.

Findings: The literature review, taking into account sustainable project management, show that project lifecycle, project success, and risk management are dominated research topic in the articles. Further research directions suggested in the literature indicate, inter alia, to extend the scope of research on sustainable project management to different countries and sectors.

Originality/value: The literature review is based on the most recent publications. Moreover, in addition to the traditional literature review, keywords were analyzed and other research directions were analyzed, which was rarely seen in publications that focused mainly on the synthesis of conclusions.

Keywords: sustainable project management, sustainability in project management, research directions.

Category of the paper: literature review.

1. Introduction

The consequence of the ongoing changes in the internal and external conditions of the functioning of modern organizations are dynamic changes in the existing management concepts and new management problems. Among the factors causing changes within the organization, one can distinguish the continuous improvement of management models and organizational structures, e.g. as a result of process automation. Changes in the external environment of the organization are more noticeable and result primarily from the development of technology, digitization, and their effects are also felt in the social, economic, and environmental spheres.

The above-mentioned phenomena are only examples of changes caused by the Fourth Industrial Revolution. According to Jarosz et al. (2020) Revolution 4.0 presupposes the changes connected with industry digitization, automation, robotization, data processing, and intelligent systems. On the other hand, Coşkun et al. (2019) distinguish specific technologies that allow us to understand the concept of the Fourth Industrial Revolution, e.g., Internet of Things, Internet of Services, or Industrial Internet.

In recent years, the development of technology and the Internet significantly influenced changes in the economy from a global perspective. Currently, especially during the Covid-19 pandemic, there has been a large increase in remote services, such as making purchases remotely from anywhere in the world. This, in turn, leads to increasing demand for services related to the storage and transport of goods. The given example is perfect for confirming that the changes resulting from Revolution 4.0 leave their mark on the social (changes in people's habits, social exclusion), economic (non-cash payments, changes in the labor market), and environmental (exhaust emissions and environmental pollution) spheres. These changes are very dynamic and cause an imbalance in the ecosystem of contemporary organizations, hence the interest in the concept of sustainable development has been growing in recent years.

Several important events contributed to the creation of the concept of sustainable development, e.g., the convening of the 1992 UN Conference in Rio de Janeiro, known as the Earth Summit. As a result of the conference, The Earth Charter or Agenda 21 were formulated. The first was a declaration of values and principles that were intended to “awaken in all people a new sense of global interdependence and shared responsibility for the welfare of the entire human family, greater community of life and future generations”. Agenda 21 presents economic and social problems as well as the roles and tasks of individual social groups in the management and protection of natural resources (Płachciak, 2021).

There are two approaches to the concept of sustainable development in the literature. The basic approach assumes the coexistence of social, economic, and ecological order, which is also called the triad of sustainable development. A system constructed in this way will become unbalanced, for example, in a situation where economic development is the result of overexploitation of the environment. A more extensive concept of sustainable development is

presented in terms of capital and orders. It focuses on the quality of life by managing human capital (social order), economic capital (economic order), natural capital (economic order), social capital (institutional order), and capital integrating all other capital groups (spatial order) (Adamowicz and Dresler, 2006; Trzepacz, 2012).

Over the years and as a result of numerous studies, the concept of sustainable development has been developed and is not only a starting point for environmental protection but has become, above all, a motivating factor for the creation of sustainable business models, which result in profitability and innovation of services (Carboni et al., 2018).

Contemporary organizations increasingly apply management by projects, i.e., targeted and unique activities, limited in terms of time and budget, and focused on creating business value (Kerzner, 2017). Over the years project management is still developed as a field of research studies and organizational approach (Turner et al., 2013). There is a growing interest in the discipline of project management in both education and business. Most universities currently educate students in this field, but also the profession of a project manager is becoming more and more needed in the labor market.

Organizations and managers are currently facing the challenge of maintaining order in the economic, social, and environmental spheres. The concept of sustainable project management seems to be a response to the needs resulting from the ongoing changes. A 2020 UK survey found that 83% of 200 UK business leaders describe sustainability as a business opportunity that should be seized. In addition, among the most important measures used to assess the return on investment from sustainable practices, respondents cited: the success of new, sustainable products and services (56%); cost reductions (42%), and profitability (42%) (Smurfit Kappa, 2020).

Bearing in mind the above foundations, the article aims to present the assumptions of sustainability in project management and to identify the dominant research areas and research directions due to the concept of sustainable project management, based on a literature review from Scopus. This review is aimed to answer two main research questions:

RQ1: Which research areas related to sustainable project management dominate the literature?

RQ2: What are the further research directions in the field of sustainable project management?

The remainder of this article is organized as follows. The following chapter presents the general concept of sustainable project management. Then, the method used in the literature review is described. The section entitled “Results” presents the analysis of the content of the research articles. Then, the section “Discussion” answers the research questions posed and shows them against the background of previous studies by scientists. The section entitled “Summary” presents the main conclusions of the literature review and further research directions.

2. Sustainable project management

Sustainable project management derives from the concept of sustainable development, which dates back to the 1950s (Waas et al., 2011). An important event for the development of the concept of sustainable project management was the 22nd World Congress of the International Project Management Association in 2008 organized in Italy. According to McKinlay (2008) speech during the congress, the future of project management depends on “taking responsibility for sustainability” by project managers (Silvius and Schipper, 2014). As noted in the introduction section, this concept began to play a significant role and more and more researchers developed it. The definitions of sustainable project management reported in the literature in 2009-2012 were presented by Silvius and Schipper (2014). Literature analysis shows that sustainable project management is often understood as Sustainability in Project Management or Project Sustainability Management (PSM). In addition, scientists also use the term Green Project Management (GPM). This article presents the chosen definitions that appeared in the literature during the last years (Table 1).

Table 1.
Sustainable project management definitions

Authors	SPM definition
Carboni, Duncan, Gonzalez, Milsom, Young (2018)	“the application of methods, tools, and techniques to achieve a stated objective while taking into account the project outcome’s entire lifecycle to ensure a net positive impact environmental, social, and economic impact”
Armenia, Dangelico, Nonino, Pompei (2019)	“the managerial practice aiming at pursuing project objectives by maximizing economic, social, and environmental benefits through the proactive involvement of stakeholders, the consideration of the extended life cycle of resources, processes, and effects, and continuous organizational learning”
Brzozowska, Pabian, Pabian (2021)	“an activity that consists in planning, organizing, leading, and controlling, carried out in accordance with the principles of sustainability, as a result of which the project team achieves project goals”

Source: own elaboration.

The idea of sustainable project management results directly from the assumptions of organizational balance. “Organizational balance consists in the mutual adjustment of relations within-organizational and between the organization and the environment” (Kozłowski, 1991). Sustainable project management is about managing change in policies, processes, resources, assets, or organizations, taking into account the six principles of sustainability in the project and its result (Silvius and Schipper, 2014). The principles present the following issues:

- Social balance, ecological and economic – in order to contribute to sustainable development, organizations should meet all "three" pillars of sustainable development: social, environmental, and economic;
- Short-term orientation and long-term – sustainable organizations should consider both the short-term and long-term consequences of their actions and not just focus on short-term gains;

- Local and global orientation – sustainable development must be coordinated action on several levels, from global to regional and local;
- Orientation on values and ethics – sustainable development supports organizational ethics and decision-making respecting universal principles by preventing negative impacts on society and the environment;
- Clarity and accountability – the organization is responsible for its policies, decisions, and actions and their impact on the environment and society;
- Economic prosperity – sustainable organizations should adhere to strategies that balance the needs of stakeholders, including the needs of today's society and future generations.

The adoption of the principles of the concept of sustainable development in business brings many benefits for enterprises. These include gaining market advantage and increasing trust in the brand, more effective resource management (e.g., reducing energy and material consumption), or increasing employee commitment and morale. In addition, sustainable management of the organization helps to improve relationships, among others with investors, suppliers, customers, and even government bodies (Carboni et al., 2018; Gasiński and Piskalski, 2009; ISO 26000). However, among the most tangible benefits of sustainable operation of the enterprise are growing profits, which are the result of investments of stakeholders who perceive the sustainable operational ability of the company and the development potential (Wang et al., 2020).

The importance of sustainability in project management is now emphasized in books and scientific articles, but standards and guidelines are becoming more and more common. The best-known today is the GPM P5 standard and PRiSM methodology described by Carboni et al. (2018). The P5 Ontology relates to sustainable development in project management while maintaining a balance between the five aspects: People, Planet, Prosperity, Process, and Products. It also supports the methodology of Projects integrating Sustainable Methods (PRiSM). Among key products of PRiSM methodology, the Business Case or Sustainability Management Plan can be distinguished. Maintaining the principles of sustainability in project management is also possible with the use of the IPMA Project Excellence Model, which assumes balance in three areas: people and goals, processes and resources, project results.

3. Methods

It is claimed that sustainable project management is a constantly developing field of research (Silvius et al., 2012). This is due to the constantly growing number of scientific publications in this field, but also practice shows a constantly growing demand for training and certification related to it (e.g. in Poland an increase in the number of Accredited Training Organization of Green Project Management has been observed).

In the article, the systematic literature review was used to select, analyze and synthesize (Tranfield et al., 2003). Data selection consisted in searching for articles related to the concept of sustainable project management. The Scopus database, which is one of the largest and best-known scientific databases in the world, was selected as the data source.

The terms “sustainable project management” or “sustainability in project management” were used as search strings. The search results for scientific publications were limited to articles published in scientific journals until 2021. The Scopus search key was as follows: (TITLE-ABS-KEY ("sustainable project management") OR TITLE-ABS-KEY ("sustainability in project management")) AND PUBYEAR < 2022 AND (LIMIT-TO (DOCTYPE, "ar")).

As of March 03, 2022, a search found 65 results (see Appendix) that match the above search command.

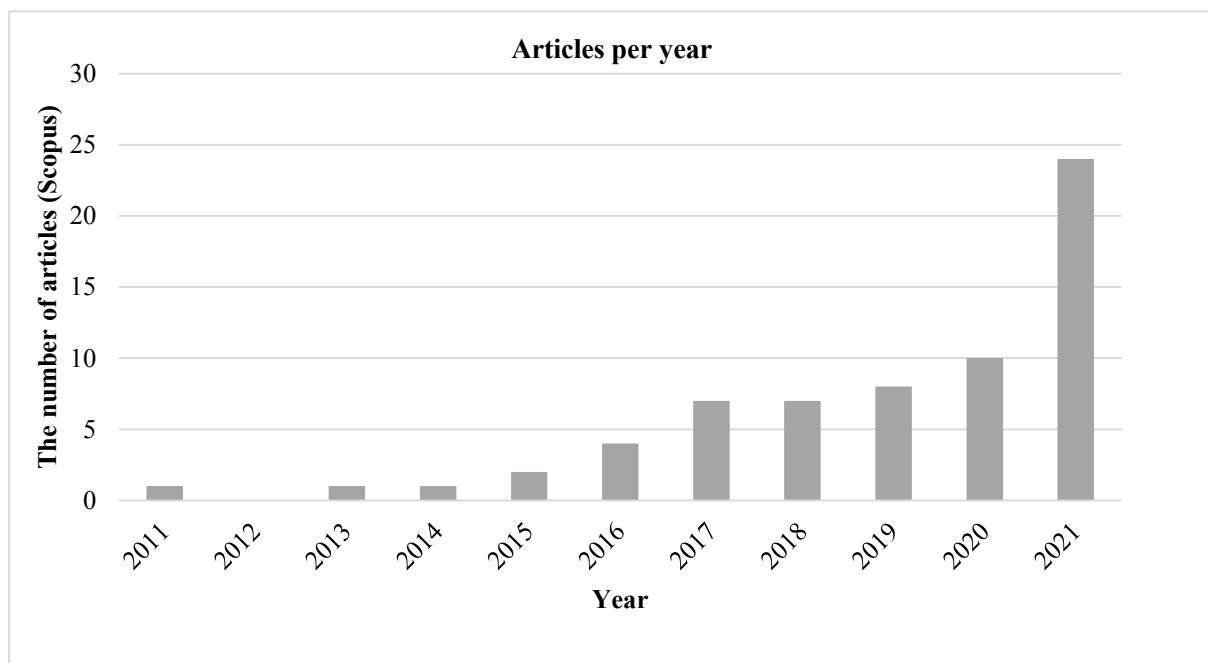


Figure 1. Overview of articles by year in the sample. Source: own elaboration.

The data presented in Figure 1 confirms that in recent years there has been a significant increase in the number of scientific articles on sustainable project management.

The analysis of the literature was carried out in two stages to be able to answer research questions: keywords analysis and deep qualitative analysis of the most cited articles.

The first step involved the author’s keywords analysis to identify key research areas described in the publications in the Scopus database. The analysis allowed to isolate 199 different keywords in the Scopus database based on the selected documents. The keywords analysis did not take into account “sustainable project management” and “sustainability in project management”, as they were the main criteria for the selection of the documents. Also, general keywords as “sustainability”, and “project management” were excluded. All analyzed keywords have been counted and presented in Figure 2.

project manager, risk management, developing countries, project, behavior, Q-methodology. Based on the analysis of abstracts, it is concluded that some keywords indicate the scope of the research (e.g., risk management) and some - the selection of methods used in the study (e.g. Q-methodology).

As a result of the analysis of keywords, Table 2 was developed, which presents thematic areas and the scope of research in the field of sustainable project management in the analyzed articles. Keywords were grouped into clusters with a similar thematic scope.

Table 2.
Keywords clusters

Cluster	Keywords sample
Environment and sustainability	ecodesign, environmental protection, environmental impact, environmental sustainability, green projects, sustainability, sustainable development, sustainability concepts, sustainability constructs, sustainability drivers, sustainability factors, sustainability governance, sustainability indicators, sustainability maturity assessments, sustainability practices, sustainability tools, sustainable tunnel
Project Management	project control, project definition, project delivery, project design, project leadership, project lifecycle, project management plan, project success, project planning and budgeting, project scheduling, project stakeholders, project value management, public project, social projects, vulnerability of the project, Agile Project Management, Green Project Management, collaboration, Corporate Social Responsibility, decision making, design cost estimation, indicators, management and evaluation, management of innovative project, optimization, risk management, risk assessment, value management, waste management
Project manager	attitude, behavior, competences, human, multitasking, skills, project manager, project owner, stimulus patterns
Industry	biogas, biotechnology, construction engineering project, construction industry, energy, IT project, digitalization, engineering big data, extractive industries
Research location	developing countries, Pakistan, Iran, Taiwan
Research methods	Analytic Hierarchy Process, Fuzzy AHP, Fuzzy ANP, Fuzzy DEMATEL, Correlation Network Analysis, PROMETHEE, Q-Methodology, Systematic Literature Review, Metaheuristic Algorithms, Stochastic Frontier Analysis, Structural Equation Modeling

Source: own elaboration.

After the analysis of titles and abstracts, as well as keywords presented in the word cloud (Figure 2) and clusters developed in Table 2, the following research areas were identified by the author as the most dominated: project lifecycle, project success, risk management. Below is an overview of recent research in the field of sustainable project management in terms of the identified thematic areas.

Project lifecycle. According to the keywords' clusters, Project Management is the most complex research area in terms of the number of keywords. Most of them relate to the processes present in project management and the project life cycle. The authors of the analyzed articles often raised issues related to the definition, planning, scheduling, financing, and delivery of projects. For instance, Chow et al. (2021) described that sustainable project management positively influences project planning. Furthermore, the topic of project lifecycle was studied in the context of construction management waste in Jordan. The authors of the study proved that the causes of waste generation are related to all phases of the project life cycle (Zighan and Abualqumboz, 2021).

Project success. In the context of sustainable project management, some of the analyzed scientific articles were devoted to the criteria and success factors of the project. Klaus-Rosińska and Iwko (2021) concluded that stakeholders management is one of the guidelines for sustainability based on the analysis of project success in small companies in the construction sector. Furthermore, project success is linked with value for stakeholders by a modern approach to managing projects (Mrzygłocka-Chojnacka et al., 2021). In their research, other authors dealt with the problem of exploring and validating the effects of megaprojects affecting sustainable project management. The survey data showed that the success of the project is influenced by factors such as environmental protection, international relations, and economic recovery (Xiaolong et al., 2021). Additionally, the studies based on the identification of key factors of sustainability in project management in the United Arab Emirates confirmed that there is a significant positive link between sustainable project management and project success (Wafsa et al., 2021).

Risk management. Risk analysis is a very important part of project management, especially taking into account the aspect of sustainability. One of the analyzed articles describes a model of sustainable risk management in IT projects based on expert research. The author presented inter alia the processes of risk management compared to the standard GMP P5 (Trzeciak, 2021). Risk factors and sustainable project management were also a topic of interest of Jang et al. (2021). The researchers proved that risk factors may be parameters from bidding documents of construction projects, which are the field for developing sustainability. As environmental impact is one of the pillars of sustainability, also in project management, scientists have attempted to evaluate risk techniques that can be used to assess accidents in the environmental impact process (Fuentes-Bargues et al., 2020).

Research directions

In-depth analysis of the most cited articles in the sample provides information about main research findings and researchers' recommendations for further research directions. Table 3 shows the analysis results.

Table 3.

Research directions in the field of sustainable project management

Authors	Citation count	Research findings	Research directions
Martens and Carvalho (2017)	160	Using the systematic literature review method and survey of project managers, the authors identified key factors of sustainability in project management: Sustainable Innovation Business Model, Stakeholders Management, Economic and Competitive Advantage, and Environmental Politics and Resources Saving.	The authors suggested to use of the variables disclosed in the study in other sectors for parameterization in project management as an assessment tool; performing the validation and structuring of sustainable development variables (TBL); incorporation of the concept of resilience to develop a model combining themes, persistence, and resilience in project management.

Cont. table 3

Kivilä et al. (2017)	138	The authors proved that sustainable project management is carried out using not only indicators but an overall control package in which controls are used that are different for different dimensions of sustainability.	The authors' recommendation was to explore practices to help organizations manage projects and develop stakeholders' networks following sustainable development. Also, they suggested making a map of mechanisms of control for sustainability between various types of projects.
Kiani Mavi and Standing (2018)	119	The authors reviewed 41 critical success factors of sustainable project management and group them into project-related, project management-related, organization-related, external environment-related, and sustainability.	According to the authors, interpretive structural modeling techniques can be implemented to study the interrelations between critical success factors and to create a multi-level hierarchical model of sustainable project management structure in the construction sector.
Gilbert Silvius et al. (2017)	96	The authors used Q-methodology to study the decision-making process in project management under the sustainability conditions and revealed four dimensions of the decision-making process: people and quality, people and risk, time and cost, quality, time and risk.	The authors indicated to continue the study in other sectors and make a comparison of results according to the differences between organizations. Furthermore, they suggested measuring different phases of project management in the decision-making process.
Silvius (2017)	92	The author provided the results of the research that confirmed the hypothesis that sustainability can be understood as a new school of thought in project management. The article highlights the features of the school of sustainable development in project management: including projects in social perspective, stakeholder management approach, use of triple bottom line criteria, and adopting a value-based approach to project management.	The author's recommendation was to study the specificity of a sustainable school of managing projects in the context of various industries. Additionally, it was suggested to analyze the research methodologies of studies on sustainability in project management. Sustainable development should not be studied in general.
Brones et al. (2014)	81	The authors showed that in scientific articles the concept of sustainable project management and ecodesign is presented in a limited way. They stressed that environmental requirements are not consistent with project management, which affects the effectiveness of ecodesign in the product development process.	The authors recommended that studies be conducted in various organizations to investigate project management variables relevant to ecodesign. The recommendation also looked at the analysis of project management approaches that could improve the environmental performance of product development.
Martens and Carvalho (2016)	72	Through the analysis of case studies, the authors investigated how organizations implement the principles of sustainability in project management and how sustainability influences project success. They showed that companies are concerned about sustainability in project management and that public sector organizations are more concerned about the social dimension than others.	The authors suggested extending the case studies and exploring individual business niches to understand their strategies.

Cont. table 3

Dobrovolskienė et al. (2017)	58	The authors investigated how dimensions of sustainability influence decision-making by project managers. They found that project managers take into account only some factors, for example, health and safety. The study also showed that project managers focus more on the principles of sustainable development in project management than other members of the project teams.	The authors recommended studying how sustainability influences other project management phases, for example, project implementation.
Silvius and Schipper (2015)	39	The article provides a maturity model for sustainable project management as a tool for assessing and developing the implementation of sustainability principles to projects.	Further research directions are not known.
Martens and Carvalho (2016)	35	The authors identified the main dimensions and variables of sustainability in project management and explored their impact on project success.	The authors suggested conducting further research for a better understanding of the impact of sustainability on project success. It is recommended to use the AHP method and increase the number of experts in the study.
Yu et al. (2018)	33	The authors present a Construction Project Sustainability Assessing System (CPSAS), which covers four levels with pillars, categories and sub-categories, and indicators. They concluded that CPSAS can be used for stakeholders in construction projects.	It was suggested to test the proposed model for inter alia in industrial and ocean construction projects.
Yu et al. (2018)	26	The authors explored sustainability in project management through the prism of planning in engineering projects. They proposed and assessed sustainable project planning in the construction industry.	The authors recommended focusing further research on the impact of sustainable project planning on project outcomes and to explore differences due to various cultures.
Silvius and Schipper (2016)	26	The article presents the model for adopting sustainability in project management. It shows the relationship between projects, project success, and sustainability. The authors identified nine sustainability dimensions that influence project management and six criteria that allow measuring the success of projects.	The authors of the article recommended conducting empirical testing due to the perception of the relationship between sustainability and project success by project managers and other stakeholders.
Yuan et al. (2019)	21	Based on the study conducted in China, the authors proved that the behavior of project owners has a positive impact on building information modeling and the perceived usefulness has a significant influence on behavioral intentions. The results of the study also show that social influence is not significant for perceived usefulness.	According to the authors' suggestion, further research should be extended to study the generality of the model in different countries.

Cont. table 3

Larsson and Larsson (2020)	20	Based on the semi-structured interviews with suppliers and clients, the authors examined the uncertainties which influence fostering, integrating, and maintaining strategy, especially in infrastructure projects due to the collaboration as part of sustainable project management.	The authors suggested conducting further research in three areas: the influence of collaboration duration time on organizational learning, the influence of collaboration intensity on organization mindset, and the relationship between collaboration and stakeholders' engagement.
Martínez-Perales et al. (2018)	19	The authors of the article showed that certification systems have a positive influence on a project's success in the energy sector. They presented the relationship between project success and project duration, project budget, year of funding, and management system of certifications.	The researchers recommend to analyze the projects by other sectors to study the certifications management system influence on project success.
Silvius and Schipper (2020)	16	The study showed the dimensions which influence project managers to implement sustainability into their projects: pragmatic, task-driven, and intrinsically motivated.	The recommendation for further research indicates taking into account the project managers' characteristics for different projects, industry, project type, and another controlling variable that allows studying the stimulus patterns for sustainability adoption.
Chofreh et al. (2019)	15	The article presents the answer to the question of why the concept of sustainable project management is important. Furthermore, the authors showed the research themes in sustainability, project management, and sustainable project management that the researchers should explore.	The authors recommended focusing further research on the following topics: "evolution, terminology, research direction, architecture, components, system design, software application, modelling, data management, simulation, customization, ethics, project team, organizational capabilities, organizational readiness, training, human resource management, cost management, integration management, standardization, maintenance, corporate performance, system's performance, evaluation, change management, process management, system extension, history, and research trends" to develop sustainable project management concept.
Marnewick et al. (2019)	15	The study showed that being intrinsically motivated is the most important pattern of project managers and what is the correlation between the pragmatic, intrinsically motivated, and task-driven patterns in project management.	It is recommended to repeat the survey on a larger group of respondents and to study the impact of industry on patterns of sustainability stimuli of project managers.
Xiaolong et al. (2021)	14	The authors examined exploring and validating the effects (economy boost up, environmental protection, international relations, project management, and success) of megaprojects affecting sustainable project management.	In future studies, more factors should be used to measure the success of mega-projects. Furthermore, project management should be used as a mediator.

Cont. table 3

Toljaga-Nikolić et al. (2020)	13	The article determines knowledge and skills important for sustainable project management. The results show that the application of project management methodology helps in the implementation of sustainable development, especially the social aspect, regardless of the industry.	The future study should include various competences and their importance for the concept of sustainable project management.
Rosłon et al. (2020)	10	The authors proposed the model enabling the combination of construction issues and project economic optimization and sustainability.	The authors mentioned using the model in the combination of project management and construction management system.

Source: own elaboration.

The table above shows that the most cited scientific articles included in the analysis focus on key factors and dimensions of sustainability in project management and project management activities, for instance, planning and decision making. Furthermore, the behavior and competences of project managers were analyzed by researchers in the light of sustainability. Some articles are devoted to conceptual issues, e.g., the essence of sustainable project management. In addition, scientists attempted to create models for measuring and analyzing sustainability indicators in project management.

The articles subjected to in-depth analysis were based, among others, on a literature review, empirical research, and case studies. The case studies most often concerned the energy and construction sectors.

Recommendations regarding the directions of further research on sustainable project management can be divided into:

- Organisational:
 - conducting research enabling the comparison of the examined characteristics concerning the sector of the economy,
 - extending the research to include various organizations and types of projects,
 - comparing the sustainable project management in different countries.
- Problematic:
 - study of control mechanisms in sustainable project management,
 - study of success factors and their measurement in projects managed in accordance with sustainability and the impact of sustainability on success,
 - examination of phases of project management in terms of sustainability,
 - study of factors influencing sustainable project management and ecodesign,
 - study of the process of implementing sustainability in project management,
 - research in the field of collaboration and stakeholders management,
 - research on the impact of the certification system on the development of sustainability in project management,
 - examination of the characteristics and competences of project managers in the field of sustainable development and project management.

- Methodological:
 - selecting a larger number of respondents and experts in empirical research,
 - application of the AHP method,
 - implementation of interpretative construction modeling techniques,
 - using project management as a mediating variable.

5. Summary

Sustainability in project management is gaining importance in the science and management and quality literature. Recently, there has been a significant increase in scientific publications on the subject of sustainable development impact on project management.

The article presented a literature review of 65 articles (2011-2021) that relate to sustainable project management or sustainability in project management. Based on the synthesis of the author's keywords and in-depth literature review of 22 the most cited articles from the sample the research questions were answered.

As far as the first research question is concerned, the most dominated topics of sustainable project management in the scientific literature were identified. Keywords analysis showed that in recent years, scientists have dealt with the topic of sustainable project management taking into account many aspects, e.g., environment, corporate social responsibility, or triple bottom line. However, the most dominant items in the literature were: project success, risk management, project management phases, and processes. For instance, the studies described in the articles were related to factors of project success and their assessment due to sustainability. Additionally, risk management through the prism of sustainability in project management turned out to be an important area of research (including risk identification, risk factors, risk responses). The essence of research on sustainability in project management phases and processes has been clearly noticed. Scientists pointed to the need for the study of sustainable project planning and decision making.

The in-depth article review provided the recommendations for further research directions. After the analysis of main research findings and further research directions, the author defined three categories of research recommendations to explore the sustainable project management concept. As organizational recommendations, the authors suggested extending empirical studies for different countries, sectors, and companies to develop a general concept of sustainability in project management. When it comes to the subject scope of further research directions it was recommended to study how sustainability influences project success, project phases, project collaboration. Furthermore, among further research directions were studies on project management abilities important for sustainability, the correlation between sustainable project management and project management certifications.

All these things considered, analyzed in the article subject of research still requires exploration and research by scientists to better understand the concept of sustainability in project management. The results of the conducted literature research suggest that sustainability has an impact on project management in many dimensions.

In conclusion, the article shows that further research is needed to develop the concept of sustainable project management. As far as the author of the article is concerned, many articles based on a literature review have already been written that describe the concept in general, e.g. definition, rules, dimensions. The author of the article concludes that future research should be a continuation of the research carried out so far, but the source of information should be empirical research based on actually implemented projects under the conditions of sustainability.

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DO TELEMATICS TECHNOLOGIES HELP TO MANAGE ROAD TRANSPORT ENTERPRISES? EVIDENCE FROM SME IN POLAND

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Purpose: This study evaluates the acceptance of GPS/GPRS-based telematics technology in freight road transport companies registered in Poland.

Design/methodology/approach: The evaluation is based on a survey of 500 representative road transport companies carried out in 2020. The Technology Acceptance Model was estimated, and its results were checked for robustness. The scope of the information collected in telematics systems is defined in terms of its perceived utility and perceived ease of use at the operational management level. The latent factors affecting technology use are defined and implemented.

Findings: Most respondents (80%) claimed that telematics systems had a considerable influence on the effectiveness and efficiency of the whole company's operation. It contributed to a higher number of orders executed per time unit, more effective use of the driver's working time, and increased the entrepreneurs' trust in the company. The companies employing more workers recognize the higher usefulness of telematics systems and are motivated to use the technology more widely than smaller enterprises. TAMs estimated separately for small and medium-sized enterprises did not significantly differ among the parameter estimates.

Research limitations/implications: The Technology Acceptance Model is a useful analytical tool for evaluating telematics technology acceptance by the road transport sector. The study is based on a random sample of enterprises observed once in 2020. It is recommended to monitor them in two or three waves to compare the dynamics of the telematics usage process. It is planned to continue the study in that direction.

Practical implications: The outcomes are valuable in practice twofold. Firstly, the extension of telematics systems use is interesting for final users, i.e., road transport companies that will find scope for their application. Secondly, the results are helpful for system providers who get knowledge on telematics perception from enterprise management.

Originality/value: Although widely applied to other IT systems, the TAM model has not been used to evaluate the use of telematics in road transport companies. The paper justifies TAM's categories at the operational management level in road transport enterprises, contributing to understanding managers' behavioral aspects of decision-making.

Keywords: Intelligent Transport Systems (ITS), Technology Acceptance Model (TAM), Structural Equation Model (SEM), road transportation, small and medium enterprises.

Category of the paper: research and conceptual paper.

1. Introduction

This paper aims to evaluate the acceptance and the actual utilization of GPS/GPRS-based telematics technology in road transport companies registered in Poland. The motivation is two-fold. Firstly, it is interesting to find out managers' attitudes towards a wide use of intelligent transport systems (ITS) in the freight road transport sector, considering that the industry is dominated by small and medium enterprises (SMEs). Secondly, the results obtained in the study carried out in 2019 on the extent of telematics equipment utilization to support transport and management processes revealed that, on the one hand, the solutions are omnipresent. Still, on the other hand, the offered functionalities are used only to a certain degree, including but not limited to supporting transport and management processes (Zalewski, 2019; 2020). Therefore, another survey was designed and carried out in 2020. It was aimed to answer the question concerning the scope of telematics systems utilization in the operational management process and the internal and external factors affecting their use. Internal factors mean the factors that originate from the company, while the external ones are the stimuli from the company's environment. As a result of the COVID19 pandemic, many companies shifted to remote work, and all parties: contractors, clients, and clerks have gotten used to electronic documents. As a result, the scale of using systems integrated with telematics systems in road transport has increased significantly. Still, the answer to whether internal factors provided sufficient support for the use of telematics-management tools will be possible only after the ex post analysis.

Telematics consists of data collection, processing, and output which achieves goals using sensors, information and communication technology, and mathematical models (Bäumler & Kotzab, 2017). The authors distinguished the following areas of using telematics for freight road transport: fleet management, toll collection and control, tracking and tracing, emergency and disturbance management, control of public traffic systems, provision of traffic information, control of hazardous goods and heavy bulk transports, and primary traffic control units. Lewiński & Perzyński (2019) indicated the following applications of telematics for road transportation: navigation, vehicle management and control, vehicle communication, passenger information, traffic and control management, driver communication, weather information, and traffic route information. Above these, they emphasized that telematics allows for optimizing transport management and increasing the efficiency of transport means.

The terminology used in the study resulted from the structure of the Technology Acceptance Model (TAM; Davis, 1985). It enables the identification of the cause-and-effect relationships between the perceived usability and the ease of telematics systems' use and the attitude towards the use and the actual use. The advantages of the TAM are the possibility of identifying direct and indirect cause-and-effect relationships and extending the model with subsequent factors that affect the telematics systems' use. Regarding the fact that most road transport companies are micro-companies or small and medium-sized enterprises (SMEs), the assumption was made in the study that the discussed cause-and-effect relationships can depend on the company size. According to research on SMEs, it can be assumed that due to limited resources, there are significant differences in SMEs management methods compared to big companies that most management theories apply to (Analoui & Karami, 2003; Rajesh, Pillania, 2008). A critical indication comes from the findings reported by Turner, Ledwith & Kelly (2009). They examined 118 respondent companies, divided into micro-companies and SMEs, and hi-tech, low-tech, and service industries. They found that companies of all sizes spend roughly the same proportion of their turnover on projects, but the smaller the company, the smaller its projects are, and the less it uses project management and its tools. Strangely enough, hi-tech companies spend less on projects than low-tech or service companies but have more extensive projects and use project management to a greater extent.

Considering these findings and implementing the road transport industry's characteristics, we assumed that micro and small transport enterprises are less likely to benefit from telematics systems due to lower knowledge of their application in transport activity management. Therefore, the enterprise size measured by the number of employees became an additional variable in the Technology Acceptance Model.

Our paper contributes to the existing literature in a novel way of examining the degree of telematics integrated technologies acceptance and utilization by road transport enterprises registered in Poland but operating in entire Europe. To the best of our knowledge, there is no similar research in any publications. Here, we focus on the enterprise's management level. Typically a single user (an individual) is asked to demonstrate or compare their motivation to use a given application. Thus, managers are responsible for using telematics devices and integrated packages for the company's operational management. So an enterprise was defined as a microunit. We do not consider any particular product. We analyze how much the enterprises realize that they benefit from this kind of support. Since the Polish road transport sector (along with the German and British ones) is among the most significant transport stakeholders in Europe and has the newest generation of trucks and semitrailers, the findings and conclusions can be easily extended (EU Transport and figures, 2020). Another incentive to take advantage of the new solutions is that the questionnaires were collected during the first phase of the COVID19 pandemic. Recent organizational and legal circumstances contributed to an increase in the popularity of hi-tech devices. The study examined 500 enterprises that responded to the questions in June-July, 2020.

2. Technology Acceptance Model and its assumptions

In 1985 Davis presented The Technology Acceptance Model (TAM) concept (Davis, 1985). It was based on the assumption that a decision about using new information technology is the user's behavioral reaction that can be explained or even predicted based on the user's motivation; the motivation is, in turn, affected directly by external stimuli resulting from the technology's current features and capabilities, the user's characteristics and organizational factors (Venkatesh & Davis, 2000). The technology acceptance is meant as a will, demonstrated in the users' group, to use the information technology to implement the technology's tasks (Dillon & Morris, 1998).

Based on these assumptions, Davis extended his conceptual model to the version shown in Figure 1.

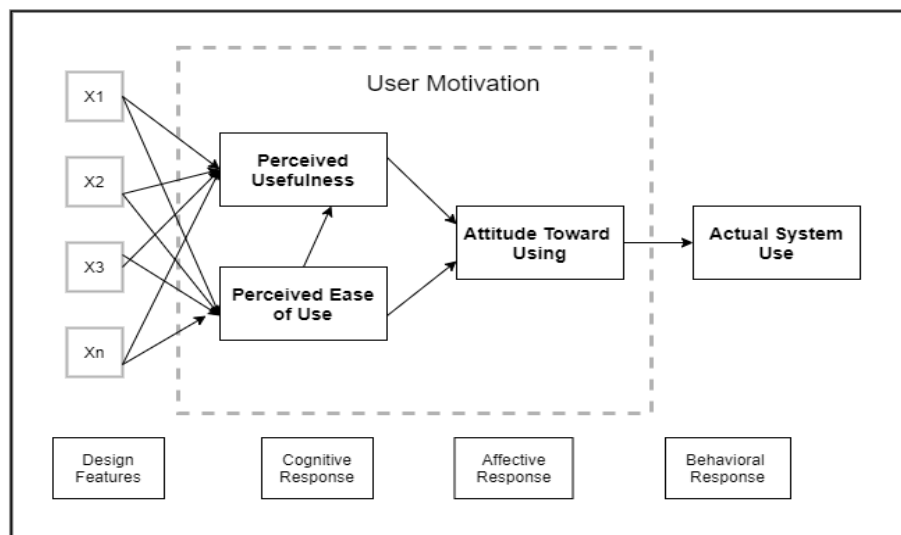


Figure 1. Technology Acceptance Model – a diagram based on Davis (1985).

Davis intended to develop a simple, theoretically justified model capable of explaining the factors that determine computer systems' use in general, i.e., for different users' end groups and different system types. He assumed that the user's attitude toward technology is the primary determinant of either using or rejecting the system. He proposed that the user's motivations can be explained by the three main factors: Perceived Ease of Use (PEU), Perceived Usefulness (PU), and Attitude Toward Using (ATU), which are latent variables. Davis also claimed that the user's attitude is affected by two convictions: Perceived Usefulness and Perceived Ease of Use, whereby the latter directly influences Perceived Usefulness. Moreover, it was assumed that the system design features (marked as X1, X2, X3 to Xn in Figure 1), also referred to as external variables, directly impact the two convictions. The TAM is then a theoretical base that explains how different factors affect the convictions, attitudes, and intentions (Davis, 1989, p. 985).

The original model developed by Davis in 1985 has been subjected to many transformations and extensions. Venkatesh & Davis (2000) proposed the TAM2 model, which provided a more

accurate and detailed explanation of the reasons why some users accepted the use of the particular system or technology concerning time, namely before the implementation, one month after the implementation, and three months after the implementation.

Venkatesh & Bala (2008) combined TAM2 and the Perceived Ease of Use determinants model (Venkatesh, 2000) to develop an integrated technology acceptance model known as TAM3. The authors completed the system/technology Ease of Use determinants catalog in this model.

Further studies carried out to modify the TAM model and adapt it to the changing reality led to the development – by Venketesh et al. – of a uniform theory of technology acceptance and use, which was the base for The Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003).

There is an abundance of papers devoted to TAM and its modifications. Analyzing two databases, i.e., Web of Science and Scopus, for the period between 1997 and 2020 and searching according to the paper title, abstract, keywords, and text content for the "Technology Acceptance Model" phrase, we get the search result of 18,845 papers in Web of Science and 14,429 papers in Scopus.

It shall be concluded that the number of papers and their topics is highly diversified. Many journal articles related to GPS/GPRS telematics systems and Global Navigation Satellite System (GNSS) refer to technical descriptions and simulations of the systems. Humphreys et al. (2020) examined the effectiveness of the GNSS system for high-level accuracy in positioning objects in a deep urban setting unaided by complementary sensors. Kassas et al. (2020) provided a framework for ground vehicle localization that uses cellular signals of opportunity, a digital map, an inertial measurement unit, and a Global Navigation Satellite System (GNSS) receiver. This framework enables localization in an urban environment where GNSS signals could be unusable or unreliable. The results helped much in reducing localization errors. Fernandez-Hernandez et al. (2020) focused on a high-accuracy service (HAS) provided by the Global Navigation Satellite System.

There are no papers on the acceptance of telematics technologies in road transport. An analysis of the journals' databases indicates that despite high popularity and many studies carried out on technology acceptance, only a few were devoted to telematics as a modern technology discipline. Another analysis of Scopus and Web of Science databases, using a similar search method but based on the phrases "Technology Acceptance Model in Telematics" or "Technology Acceptance Model & Telematics Systems & Road Transport," rendered only 11 papers in Scopus and 54 ones in Web of Science. The papers' content analysis revealed that they did not apply directly to the issues related to GPS/GPRS-based telematics technologies used by road transport enterprises. Nevertheless, they contributed to assessing individual perceptions of innovative solutions in transportation.

Chen & Chen (2011) analyzed factors affecting the travelers' intentions related to the use of GPS products and systems installed in vehicles. The survey questionnaire was designed based on the Technology Acceptance Model (TAM) and the unique properties of GPS equipment.

The results revealed that the Perceived Ease of Use had a significant and positive impact on Perceived Usefulness. Every Perceived Usefulness, Perceivable Pleasure of Use, and Ease of Use have a significant positive influence on the Attitude Towards Using. The Attitude Toward Using significantly affects the behavioral intention and will to use. Personal innovativeness moderates the relationship between attitude and behavioral intention.

Park et al. (2012) carried out a study on 1,011 participants and used the Structural Equations Model (SEM) to establish the technological acceptance criteria for the applied mobile map services. The study results revealed that the Perceived Mobility and the Perceived Location Accuracy significantly affected the users' acceptance of their intention to use mobile map services via computer equipment. An increase in Perceived Mobility positively affected the Perceived Usefulness and Ease of Use of the services. Moreover, the study revealed a more substantial influence of the approach on behavioral intention than the Perceived Usefulness.

Nordhof et al. (2020) reported on the study of social acceptance for using partially automated and autonomous passenger vehicles. The Unified Theory of Acceptance and Use of Technology (UTAUT2) was used to investigate the effects of the capacity and expected effort, social impact, facilitating factors, and hedonic motivation on the behavioral intention to use partially automated vehicles. A survey was carried out on 9,118 drivers in eight European countries. 71.06% of the respondents decided that partially automated cars are easy to drive, and 28.03% of the study participants intend to buy an automated car when it is available.

Recently, Yang et al. (2021) have proposed an integrated technology acceptance model to investigate the factors which affect drivers' intention to use mobile navigation applications, which can also apply to road transport. The vital element included optimizing mobile applications by programmers so that apps did not distract the driver's attention while driving a vehicle. The study was carried out on a population of 384 drivers.

3. TAM in the assessment of telematics acceptance by road transport enterprises

In the paper, we constructed the Technology Acceptance Model and proposed its modification taking into account the original Davis's motivation. As we decided to study the companies from the road transport sector, we assumed that our targets are defined as these companies' managers and owners. Thus, we can assume that they possess broader knowledge than the end-users of the typically employed systems in these companies. So the model construction was projected at the management level. Therefore the Perceived Use was defined as the Perceived Usefulness of information coming from intelligent transport systems (ITS) for the operational management of the transport processes observed in the company.

Consequently, the Perceived Use (PU) latent variable was described by increasing the system's efficiency in the following areas: the number of orders, timeliness, market confidence,

costs control, and profitability of orders. The Perceived Ease of Use (PEU) was defined by retracing the routes, truck punctuality in the sender's and receiver's locations, time delays reporting, driving time analysis, and fuel consumption. It is related to the standard scope of investigation in transport activity within Transport Management Systems (TMS). Moreover, it was assumed that the telematics system enables preparing analysis in a more precise, convenient, and fast way than standard office tools. It can be noticed that PU and PEU are defined by internal features that come from the enterprise. The following variable – Attitude Toward Use (ATU), covers external components from the enterprise's environment. The following characteristics define the Attitude Toward Use: the significance of information coming from telematics systems, the safety of data collected in the telematics system, and the level of autonomy in making decisions about using a telematics system. The latter concerns the links in the supply chains where a given transport enterprise operates. The actual use was observed as a practical use of the system.

The observed characteristics are thus closer to the manager's observations in the enterprise than individual psychological features, as was reported by Davis (1985) and former papers utilizing the TAM theory. A cognitive feature such as Perceived Use is thus related to the manager's Perceived Usefulness. The Perceived Ease of Use could be reported by managers as well as individual employees who use the system. The Attitudes Towards Use are based on the managers' perception concerning facts and belief in the system's data protection power. In this context, we perceive managers as the enterprise's rational (or informed) power, considering both advantages and costs of telematics systems utilization. Furthermore, the company's environment (contractors) requirements may increase interest in employing a broader scope of telematics.

Previous studies (Zalewski, 2019; 2020) revealed that enterprises applied telematics systems to track vehicle routes. Other advantages of the system included analyzing the drivers' working time in a given 24-hour driving period and forecasting whether the driver will be able to arrive at the destination within the pre-determined time slot for loading or unloading. Compatibility of telematics systems with cargo exchanges and clients applications, and compatibility with other onboard devices, e.g., refrigeration units, is a basis of proper communication.

Recently, when the COVID19 pandemic has changed the reality, entrepreneurs became aware that telematics offers more than truck tracing. That is why the study can be treated as reliable because the managers realized the system's advantages. One issue needs to be explained, though. The enterprises use telematics systems for different periods, ranging from several months to several years. We assumed they reported the system's usefulness as they had assessed it for the survey time. To prepare the Technology Acceptance Model for telematics, we developed a survey questionnaire. The respective questions are described in Appendix 1.

4. Data characteristics

The survey, which aimed to identify the factors of telematics technology acceptance, was conducted in June-July, 2020 among 500 randomly selected road transport enterprises that carry goods using the CATI method. The surveyed units were defined for the material criterion, i.e., enterprises providing road transport services, and territorial criterion, i.e., enterprises whose business activity is registered in Poland. The survey was carried out based on a sample of enterprises from the databases of the members of the Association of International Road Carriers in Poland. Consequently, the enterprises were selected from a population of 4,500 companies. The fact that decision-makers took part in the study (they were managers competent in the scope of the answers provided) was a vital aspect of the study. The statistical assumption determined the number of 500 respondents that the maximum error rate in the estimation would not exceed 5% (Aczel & Sounderpandian, 2002). The structure of the sample is presented in table 1.

Table 1.
Structure of the studied sample

Participation of enterprises by the form of conducted activity	%	Share of enterprises by the number of employees	%
Sole proprietorship	2.20	1 to 9	6.60
Limited liability company	80.80	10 to 49	56.00
General partnership	13.80	50 to 249	32.40
Joint-stock company	2.20	Over 250	5.00
Other (limited partnership)	1.40		
<i>Participation of enterprises by the homogeneity of the conducted business activity</i>	%	<i>The range of services provided</i>	%
At least 80% of revenues generated from transport activities	74.20	International	66.20
Less than 80% of revenues generated from transport activities	25.80	Domestic	23.40
<i>Participation of enterprises by experience in running a business</i>	%	Regional	7.10
More than 10 years	95.00	Local	3.30
From 5 up to 10 years	2.80		
From 3 up to 5 years	1.20		
Up to 3 years	1.00		

The data presented in Table 1 reveal that the sample of 500 enterprises selected for the study roughly reflects the structure of transport enterprises providing domestic and international transport services, in line with the data presented in the report (GITD 2020). An analysis of the survey data revealed that all enterprises participating in the survey had vehicles with telematics systems installed. All surveyed enterprises owned 24,975 vehicles, 97.3% of which were equipped with a telematics system (24,304 vehicles). Enterprises used a wide range of different telematics products, such as TomTom (20%), Navi Expert (17%), MIX Telematics (13%), Fleetmatics (13%); however, no significant dominance of any product was observed.

5. Empirical results

5.1. Measurement constructs in the TAM model

The list of all survey questionnaire questions analyzed in the paper is included in Appendix 1. A relevant designation of the variable x_i , $i = 1 \dots 14$ was assigned to the questions used to define and construct the latent variable. According to the definition proposed by Davis, the usefulness of the telematics technologies used in the enterprise should reflect the degree of the users' conviction that the technologies will improve the results of the users' work or help achieve a much higher operating capacity owing to the use of specific technology. The Perceived Usefulness of the telematics system was explained in the study by determining how it improves the enterprise's performance by increasing the system's efficiency in the following areas: the number of orders, timeliness, market confidence, costs control, and profitability of orders. The measurement method of the Perceived Usefulness (PU) and Perceived Ease of Use (PEU) variables was discussed in the previous section. It was assumed in the study that the Attitude Toward Using (ATU) for telematics systems must not be identified only with the concept of autonomous rather than forced decision concerning their implementation in the company. Therefore, it includes the safety of telematics systems perceived by the users and the awareness of the system's usefulness for the company's operation. The observable variables for this factor were marked as x_{11} , x_{12} , and x_{13} . Only the resultant variable in the TAM – the Actual System Use (USE) – was reflected directly in the survey questionnaire, in the question applying to the degree of using the telematics system in the company (x_{14}). It is the only observable variable.

All analyzed factors – latent variables included in the TAM, i.e., PU, PEU, and ATU – were verified for scale reliability. Cronbach's alpha (CA) statistics for PEU and PU are much higher than the recommended value of 0.7, which means satisfactory scale reliability (Cortina, 1993). The CA statistics values are higher than the required level, only for the ATU variable; the statistics value is slightly lower. Still, the difference is slight and amounts to ca. 6% of the recommended value. That is why the ATU variable was included further in the analysis.

Table 2.
Summary of latent variables and reliability statistics (AC)

Latent variable	Variables	Cronbach's alpha statistics (AC)
PEU (Perceived Ease of Use)	x_1, x_2, x_3, x_4, x_5	0.847
PU (Perceived Usefulness)	$x_6, x_7, x_8, x_9, x_{10}$	0.847
ATU (Attitude Toward Using)	x_{11}, x_{12}, x_{13}	0.661
USE (Actual Use of the System)	x_{14}	NA

5.2. Estimated TAMs

Structural Equation Modeling (SEM) methodology was used to determine the relationship between Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude Toward Using (ATU), and Actual System Use (USE) according to TAM. The models enable the analysis of cause-and-effect relationships between the latent variables, which cannot be measured directly (Bollen, 1989; Pearl, 2000; Byrne, 2010).

Two TAMs were estimated in this paper – a classical and extended one in which an additional variable was included. The company size was the new variable, measured directly with the workforce number (EMP variable). Both models were estimated in the SPSS AMOS v.16 package with the maximum likelihood (ML) method. A significance level of 0.05 was assumed for statistical analysis. Above these, the classical TAM was also estimated in two variants: for small enterprises (headcount up to 49 people) and medium-sized enterprises (headcount of 50 or more people). The estimation results for all TAM variants are summarised in table 3.

Table 3.
Estimated TAM models

Relations	Estimate	SE.	p-value
Classic TAM model (total sample)			
PEU → PU	0.526	0.050	0.000
PEU → ATU	-0.077	0.039	0.258
PU → ATU	0.374	0.048	0.000
ATU → USE	0.763	0.140	0.000
CMIN/DF = 2.023 IFI = 0.969 RMSEA = 0.045			
Extended TAM model (total sample)			
EMP → PU	0.147	0.000	0.000
EMP → ATU	0.174	0.000	0.000
PEU → PU	0.523	0.050	0.000
PEU → ATU	-0.065	0.039	0.340
PU → ATU	0.338	0.048	0.000
ATU → USE	0.762	0.138	0.000
CMIN/DF = 1.917 IFI = 0.968 RMSEA = 0.043			
Classic TAM model for micro and small enterprises			
PEU → PU	0.513	0.063	0.000
PEU → ATU	-0.036	0.045	0.670
PU → ATU	0.306	0.055	0.001
ATU → USE	0.756	0.211	0.000
CMIN/DF = 1.824 IFI = 0.961 RMSEA = 0.052			
Classic TAM model for medium-sized enterprises			
PEU → PU	0.562	0.085	0.000
PEU → ATU	-0.132	0.066	0.255
PU → ATU	0.437	0.083	0.000
ATU → USE	0.762	0.198	0.000
CMIN/DF = 1.525 IFI = 0.957 RMSEA = 0.053			

The results obtained for the total sample of enterprises confirm the statistically significant influence of the Perceived Ease of Use (PEU) on the Perceived Usefulness (PU), the Perceived Usefulness on the Attitude Toward Using (ATU), and the Attitude Toward Using on the Actual

Use of the System (USE). It means that the less complicated the system (PEU), the higher its Perceived Usefulness (PU) is. As the Perceived Usefulness (PU) increases, the greater the motivation to use it (ATU) is, which contributes to the actual broader use of telematics systems (USE). The relationship between the Perceived Ease of Use (PEU) and Attitude Toward Using (ATU) is statistically insignificant.

Based on the results obtained for the extended TAM, it can be reasoned that the companies that employ more workers (EMP) recognize the higher usefulness of telematics systems (PU) and are motivated to have the systems (ATU) more than smaller enterprises. The results comply with the authors' intuition and experience in the field. However, TAMs estimated for small and medium-sized enterprises did not reveal any significant differences in the parameter estimates. The only major difference in the parameter evaluation for both groups was observed for the PU → ATU relationship and amounted to 0.131 (0.437-0.306 difference). The calculated statistics $t = 1.316$ ($p = 0.188$) does not allow for evaluating the difference as statistically significant (Weaver & Wuensch, 2013). It is the stability of the parameter estimates across the samples used in research that matters.

The CMIN/DF statistics values lower than 2, IFI higher than 0.95, and RMSEA less than 0.05 are a testimony of a perfect adaptation of the models to the data (Żurek, 2016). Only for models based on subgroups defined by the number of employees the value of the RMSEA coefficient is slightly higher. For both groups, it is lower than 0.055, so it confirms that the model is well fitted to the data.

6. Robustness check

Despite the correct statistics confirming the model's quality, the results were additionally verified. A bootstrap procedure using the maximum likelihood (ML) estimator was employed to re-estimate the model parameters. The procedure was used for the model estimated based on the total sample. The bootstrap based on 5,000 samples helped calculate the parameter bias and standard errors of the biases, and determine the bias-corrected confidence intervals of 95% (Efron, Tibshirani, 1986). The results for internal TAMs are summarised in table 4.

Table 4.
Results of TAM estimation with the bootstrap methodology

Relations	Estimate	Bias	S.E. Bias	Lower	Upper	p-value
Classic TAM model (total sample)						
PEU → PU	0.526	0.004	0.001	0.441	0.614	0.000
PEU → ATU	-0.077	0.000	0.001	-0.213	0.054	0.315
PU → ATU	0.374	-0.001	0.001	0.232	0.517	0.000
ATU → USE	0.763	-0.005	0.001	0.698	0.810	0.000

Cont. table 4

Extended TAM model (total sample)						
EMP → PU	0.147	0.000	0.000	0.087	0.216	0.001
EMP → ATU	0.174	0.000	0.000	0.105	0.236	0.001
PEU → PU	0.523	-0.003	0.001	0.436	0.609	0.000
PEU → ATU	-0.065	0.000	0.001	-0.198	0.061	0.371
PU → ATU	0.338	-0.001	0.001	0.203	0.487	0.000
ATU → USE	0.762	0.021	0.003	0.697	0.808	0.000

Based on the results, the parameters reflecting the influence of the employment (EMP) variable on the PU and ATU for the extended model were unbiased. The presence of the model parameters bias does not prejudice a lack of statistical significance. The parameter bias value is assumed to be statistically insignificant when the standard bias error is greater than the bias (absolute value) (Byrne, 2010). It is valid for the PEU → ATU relationship in both estimated models. The confidence intervals corrected with the bias confirm the reliability of the parameters estimated with the maximum likelihood method (PEU → PU; PU → ATU; ATU → USE). The confidence level determined for the PEU → ATU relationship includes zero value in both models, suggesting the parameter's insignificance analogically to the findings made with the maximum likelihood method. Hence, the ML estimated models' results and verified with the bootstrap enable reliable inference based on the models.

7. Discussion

The Technology Acceptance Model is a useful analytical tool for evaluating telematics technology acceptance by the road transport sector for two reasons. First and foremost, the model is very well rooted in the behavioral context, particularly in the Theory of Planned Behavior (Ajzen, 1991). Secondly, it is universal, which means it can be used on different analysis levels. A short note about the usefulness of the TAM in cognition should be made. Based on the argumentation that TAM methodology is saturated, Benbasat & Barki (2007) formulated five recommendations to take the IT adoption literature beyond TAM to the next generation of adoption and acceptance research. They are the following: going back to the Theory of Planned behavior, a better conceptualization of system usage to include a broader perspective of what users do in and around the notion of system use, using multi-stage models to capture the influence of salient belief variables on system use at different stages of implementation, and the subsequent impact of this usage on users' beliefs at later periods, identifying the antecedents of the views contained in adoption models to benefit practice and finally making sure usefulness is measured beyond perceptions where possible. We believe that we adopted two of these recommendations. Firstly, system usage was the observed variable. It was verified by additional information about the area of systems application. Secondly, based on using telematics systems for a long time before the study, their usefulness was already justified.

The results obtained for the studied enterprises (total sample and divided into micro, small and medium-sized enterprises) confirm a statistically significant impact of the Perceived Ease of Use (PEU) on the Perceived Usefulness (PU), the Perceived Usefulness on the Attitude Toward Using (ATU) and the Attitude Toward Using on the Actual Use of the System (USE). It means that the less complicated the system (PEU), the higher its Perceived Usefulness (PU) is. Simultaneously, as the Perceived Usefulness (PU) increases, the greater the motivation to use it (ATU), which contributes to the actual broader use of telematics systems (USE). The relationship between the Perceived Ease of Use (PEU) and Attitude Toward Using (ATU) is statistically insignificant, which may be attributed to the fact that business entities have been using ICT technologies for quite a long time, and their scope has been extending gradually. Hence, the Perceived Ease of Use may slightly lose its significance versus the Perceived Usefulness as the factor determining the use of the enterprise's telematics system. Adequate service and support for the institution implementing the system may significantly mitigate the potential difficulty. An analysis of the sensitivity of the results confirmed their stability and reliability.

The model extended by a company size confirmed that small and medium companies utilize information from the telematics systems in the operational management process. However, medium companies do it more widely and frequently. It is in line with the observed fact that small enterprises are less vulnerable to digital transformation (Probst et al., 2017; Fischer et al., 2020).

As was mentioned in the introduction, the area and level of telematics systems application were the subject of previous research carried out in 2019 among road transport companies (Zalewski, 2020). The scope and level of telematics solutions advancement in road transport companies were analyzed in the research for the barriers to their use and clients' requirements. The results suggested that the obstacles to using telematics devices are strongly related to the contractors' requirements, which is linked to the scope of the devices' use by road transport companies. An increase in the range of telematics device use contributed to a rise in the added value in the enterprises.

Research in 2020 revealed a significant change in the level of telematics device use and motivation to use them. Most respondents (80%) claimed that telematics systems had a considerable influence on the effectiveness and efficiency of the whole company's operation. It contributed to a higher number of orders executed per time unit, more effective use of the driver's working time, and increased the entrepreneurs' trust in the company. A comparative assessment of the 2019 and 2020 research reveals a substantial change in the perception (attitude), application, and use of telematics systems.

The pandemic conditions completely changed the attitude toward telematics systems and forced moving many operations to ICT platforms, often based on remote solutions. It can be regarded as a positive effect of the pandemic, considering the Shumpeterian' creative destruction' (Freeman, 2009). Such solutions seem to be long-lasting, which will cause

a significant change in the manager's approach to the employed solutions in a long-term perspective. As Contractor (2021) argues, after the pandemic, businesses are facing implementing better information-gathering systems, 5G surveillance and monitoring, blockchain, and other integration of vendor–buyer computer systems. Looking closer into the European environment after Brexit, the changing transport requirements promote the long-lasting use of the reference solutions (Moskal, 2018). For these reasons, the conclusion is that enterprises using telematics systems are subject to advantages for vehicle tracing and operational management and external incentives caused by supply chains requirements and unexpected shocks.

8. Conclusion

This study's subject matter focused on assessing the acceptance level of GPS/GPRS-based telematics technology by road transport companies. The Technology Acceptance Model (TAM) was used for this purpose. Despite a broad scope of the TAM applications in the original version proposed by Davis in 1985 and its numerous modifications, the literature makes no mention of research on the acceptance of telematics technologies linked with road transport management systems. This study fills the gap. Our study proposed using a classical and extended (to include workforce number) TAM; we also estimated TAM models by micro, small, and medium-sized enterprises.

A random sample of 500 road transport companies registered in Poland was used for the study. Considering the scale and range of the transport operations performed by Polish transport companies all over Europe and their similarity in equipment modernity, the scope of the process, and size, the companies were selected correctly, which enables making generalizations on the European scale.

The (latent) measurement variables construct is applied to the enterprise level. The obtained empirical results turned out to be stable and cohesive for all estimated models. The following sequence of cause-and-effect relationships was established: PEU → PU → ATU → USE. The estimated models revealed adequate values of statistical indicators and resistance to potential bias. The results confirmed that road transport companies utilize information from telematics systems to improve their efficiency.

Comparing the results with the results of research carried out in 2019 indicates that the pandemic effect was observed in 2020, which involved broader use of ICT applications and devices, including telematics ones, by road transport companies. A forced implementation combined with an operational effectiveness analysis caused a significant qualitative change in transport service. It is a positive and probably long-lasting effect because micro and small enterprises need more time to implement digital solutions, often requiring extra expenditures.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix I

Survey questionnaire questions (Likert Scale 1-7; 1 – No Impact, 7 – Significant Impact)

Factor	Question	Variable
PU	How much does your company's telematics system increase work effectiveness in respect of the following factors?	
	• Contributes to a higher number of orders executed per time unit (e.g., month)	x_6
	• Improves the timeliness of tasks execution	x_7
	• Increases the contracting parties' trust in the company	x_8
	• Enables cost control on a current basis	x_9
	• Improves the orders' profitability	x_{10}
USE	How much do you use the telematics system, considering its technical capabilities?	x_{14}
PEU	Is the application of the telematics systems easy to learn, intuitive, and easy, and in what scopes?	
	• Retracing the routes for all orders executed	x_1
	• Analysis of the vehicle's timely arrival for loading and unloading	x_2
	• Analysis of delays and their reporting to the contracting party	x_3
	• Analysis of the driver's working time in the last 24 hours, 7 and 14 days	x_4
	• Analysis of the vehicle's fuel consumption	x_5
ATU	• Is the knowledge acquired from the telematics system necessary for your company's operation on the transport market?	x_{11}
	• Specify the safety level of the data stored in the telematics system	x_{12}
	• Does the telematics system implementation in your company result from the company's autonomous decision or a necessity imposed by your contracting parties?	x_{13}

IMPROVEMENT OF THE MACHINE CONTROL PROCESS USING THE WORK STANDARDISATION CARD

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Purpose: The aim of the article was to propose the possibility of implementing a work standardisation card for a company in the passenger land transport industry – a ski lift.

Design/methodology/approach: The analysed ski lift, located in Southern Poland, should undergo daily checks on the condition of its equipment to ensure trouble-free operation. Current non-standardised operations may increase the risk of error. The proposed document, the work standardisation card, makes it possible to supervise the control and minimise the possibility of failure.

Findings: The introduction of the work standardisation card allows to increase the efficiency of the work and the analysis of the results obtained allowed to classify the most time-consuming activities.

Research limitations/implications: In order to reduce costs, as a result of failures, and to increase quality and customer satisfaction, it is proposed to introduce documents as part of the working standard.

Practical implications: Future research should focus on opportunities to further improve machine condition monitoring. The presented methodology can be applied to other activities that occur during ski lift operation, such as breakdowns.

Originality/value: The work is a useful resource for companies in the tourism and transport industry and the transport sector, due to the universality of the standards used.

Keywords: standardisation, work standardisation card, production engineering, quality engineering.

Category of the paper: research paper, case study.

1. Introduction

Belonging to the concept of Lean Manufacturing, work standardisation is about improving activities and the stability and cyclicity of the production process. It is characterised as a sum of intermediate activities that lead to a rational standardisation of repetitive solutions (Pacana, Czerwińska, 2017; Míkva et al., 2016). It is defined as an unambiguous way of performing certain activities so that tasks can be completed without variation in terms of performance, quality, time and cost (Antosz et al., 2013).

The suitable introduction of standardisation into the production process makes it possible to prevent the occurrence of known errors during production, while at the same time eliminating the likelihood of other nonconformities affecting the process. This has the effect of reducing financial costs and saving time. Standardisation makes it possible to provide a transparent, visualised and safe working environment (Košturiak, Frolík, 2006; Míkva et al., 2016).

A special case of railways is the ski lift, where passengers are pulled along a prepared run by means of skis or other specialised equipment, using towing devices driven by a rope (Baran, 2010; Zwolenik, Pacana, 2018). The correct functioning of the pull-out mechanism depends on regular checks, which should be carried out before the route is made available to customers. Standardisation of the activities carried out, in particular in the form of a work standardisation card, can be a significant help for employees (Míkva et al., 2016).

The aim of the article was to develop a sample work standardisation card, taking into account its demand during control activities carried out with daily frequency. The created document was implemented in the activities preparing the ski lift machines, and the monthly results were averaged and presented in the article.

2. The concept and essence of work standardisation

A standard, which is a basis for activities improving the current state and bringing the achievement of company objectives, represents a procedure, principle or example in which the requirements are specified. Their determination should be based on facts and analysis, and they are intended to be observed and respected, with appropriate documentation. The standards must be familiar to the employees and fully understandable to them (Chan, Tay, 2018; Kurnia et al., 2018; Míkva et al., 2016; The Productivity Press Development Team, 2010).

The standards shall apply in the case of:

- reduce variability and correct errors,
- improvement of safety,
- facilitate communication,

- need for training assistance,
- increase work discipline,
- clarify working procedures (Košturiak et al., 2010; Míkva et al., 2016).

The essence of the standardisation of work is based on the creation of standards, i.e. schemes which will include the most effective methods of work, stabilising the process and guaranteeing that by performing certain steps, each time a product of identical quality as the target one will be obtained. The creation of standards consists of subjecting particular stages of the process to the adopted criteria (e.g. quality, efficiency) in order to evaluate their effectiveness. The obtained optimal sequence of activities is adopted as a standard which can always be improved (Chan, Tay, 2018; Imai, 2005; Míkva et al., 2016).

Based on competitive factors, which include: customer, employee, production area and Kaizen, i.e. optimisation, it is possible to set appropriate standards. Standardisation works according to the concept of Lean Manufacturing, which means that its main objective is to eliminate losses. The effect of reducing or eliminating them is to limit production costs, decrease the workload of employees by excluding unnecessary activities, shorten repair time (potential failures are diagnosed earlier) and increase the efficiency of operators (Pacana et al., 2018; Kolińska, Koliński, 2013).

The work standardisation card is a document that presents the work pattern for a given workplace, so that irregularities can be detected and potential losses eliminated. It is characterised by simplicity of execution and low costs of development and introduction (Antosz et al., 2013).

Each card is individually developed by the company, adapting its scope to its own needs. Its basic elements, which may be extended, include:

- enterprise data,
- the characteristics of the workstation, including name, number, work task, type of product manufactured, cycle time,
- workstation load,
- a brief description of the workstation, including: activity diagram, activities performed, direction of production flow, and equipment,
- duration of operations, i.e., the total duration of the operations performed by the machine, the man and the intermediate operations, e.g., movement of the operator,
- description of activities, divided into:
 - basic – necessary for the production of the product, for example assembly, handling, inspection,
 - auxiliary – performed directly at the workplace, but not directly related to production, e.g. cleaning, changeover,
 - additional – occurring sporadically and irregularly, e.g. breakdowns,

- the characteristics of the operation, i.e. frequency, type of operation (Value Adding, VA or Non Value Adding, NVA) and control points,
- a description of the symbols used,
- information on the approval of the document (Antosz et al., 2013).

Due to including the type of operations on the cards, it is possible to identify the activities that create added value and those that do not create this value. During the process improvement it is necessary to aim at reducing the activities not related to the quality of the final product, remaining at the minimum required participation in the production process (Kosieradzka, Smagowicz, 2015).

The development of standardisation charters is a multi-stage solution, whereby they are gradually adapted to the situation of the company and the type of production. This starts with the selection of an area in which there is repeatability, efficient machinery and high and stable quality, while maintaining safety principles. Then comes the information campaign among the workers, during which they are made aware of the objectives and effects of the actions. This is followed by the selection of workplaces and an analysis of the current state, during which losses are identified. During the development process, it is necessary to define and describe all activities carried out and to break them down by type, followed by a measurement to determine the total cycle time. The final step is to analyse the results, verify them and make corrections in order to obtain the final work standardisation card (Antosz et al., 2013; Kolińska, Koliński, 2013; Kosieradzka, Smagowicz, 2015). A sample card template is included in Table 1.

Table 1.
Example of a work standardisation card

Company		Name and address				
WORK STANDARDISATION CARD						
Department		Position		Operation		
Assortment				Time [s]		
Workplace description [graphic]					Auxiliary equipment	
Basic operations						
No.	Description of activities	Operation time [s]			VA/NVA	Checkpoints
		Man	Machine	Transition		
TOTAL						
Ancillary and auxiliary operations						
TOTAL						

Own study based on (Furman, 2017).

The implementation of standardisation into the production process can be facilitated by carrying out all the development steps, especially during the analysis of the current state and the execution of measurements. This is due to the fact that it is in these steps that most errors

and problems become apparent, resulting from insufficient standardisation of the process, linked to non-compliance with procedures or inadequate organisation of the workplace (Antosz et al., 2013; Kolińska, Koliński, 2013; Kosieradzka, Smagowicz, 2015).

The final version of the job standardisation card is often accompanied by a graphic job description and the conclusions of the analyses. The results of the analyses are a starting point for further improvement, as they allow the selection of preventive and corrective actions (Antosz et al., 2013; Kolińska, Koliński, 2013; Kosieradzka, Smagowicz, 2015).

According to Kaizen and the 6S methodology, standardisation never ends (Nazarali et al., 2017; Singh, Singh, 2009; Szczepańska, 2012). After some time, it is necessary to reconsider the existing standards and improve them to the prevailing conditions, creating new charters. That cycle allows processes to remain stable and also reduces costs by eliminating waste (Antosz et al., 2013; Kolińska, Koliński, 2013; Kosieradzka, Smagowicz, 2015; Kwiatkowski et al., 2016; The Productivity Press Development Team, 2010).

3. Improvement of the ski lift condition control process using the work standardisation card

The subject of analysis was the W-1 ski lift located at the Cieniawa-Ski ski station, of plate lift type. The horizontal length of the ski lift route is 310 m, the slope length is 314.33 m, and the difference in levels is 52 m, giving an average slope of 16.9%. The maximum speed of the ski lift is 2.5 m/s. The operating capacity is 400 persons/hour and the maximum theoretical capacity is 720 persons/hour. There are two types of stations: on the lower platform there is a drive-winding station with hydraulic tensioning, and on the upper platform there is a winding station. Both stations are load-bearing welded steel structures attached to the foundation. On the hoist route, there are 6 intermediate supports in the form of steel poles equipped with 2-bolt batteries and 2-bolt batteries with a pressure pulley. Towing devices are single person telescopic plates, and their number is 50 (+2 spare) (Cieniawa-Ski ski station, 2022).

The operation of the ski lift is managed from the control room located at the ski lift driving station in such a way as to ensure good visibility of the route. In the control room, there is a control panel with operational buttons, control lights, electrical indicators, a STOP safety button and the main switch of the ski lift, as well as a cabinet with electrical equipment and fuses. To maintain safety, STOP switches are located on each platform and are used in case a passenger falls on the route or the automatic switches do not work due to a rope derailment, the passenger crosses the uncoupling zone, improper winding of the rope of the towing devices or faults in the operation of the lift mechanism (Cieniawa-Ski ski station, 2022). The mechanism in the control room is shown in Figure 1.



Figure 1. Control panel of a ski lift. Own study based on (Cieniawa-Ski ski station, 2022).

Responsibilities of the ski station staff include daily inspection of the condition of the ski lift. The established procedure, written in the form of a flow chart, requires checking the lift mechanism, towing devices and the condition of the route supports (Cieniawa-Ski ski station, 2022). Figure 2 shows a flow chart of the inspection process for the condition of the lift and machinery.

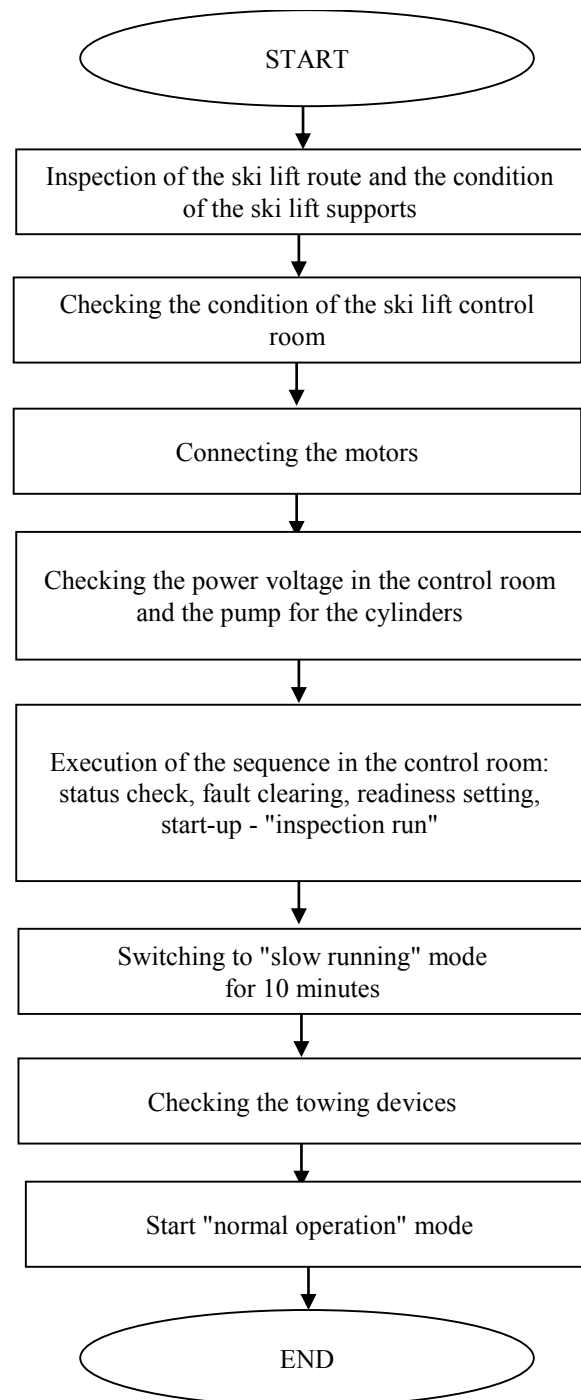


Figure 2. Block diagram of the ski lift control course. Own study based on (Cieniawa-Ski ski station, 2022).

The inspection takes place before the operating hours of the ski station and takes about 60 minutes. In addition, the inspection are tasked with the weekly lubrication of the bearings located at the drive-winding station and winding stations, in order to avoid potential failures.

This stage is necessary for the proper functioning of the machinery as it enables to minimize the occurrence of breakdowns. Analyzing the data from five seasons – because only during that time the ski station is in use – it should be noted that none of the occurring unplanned stoppages

negatively influenced the work of the ski lift, meaning that they could be quickly neutralized. Failures are presented in the graph in Figure 3.

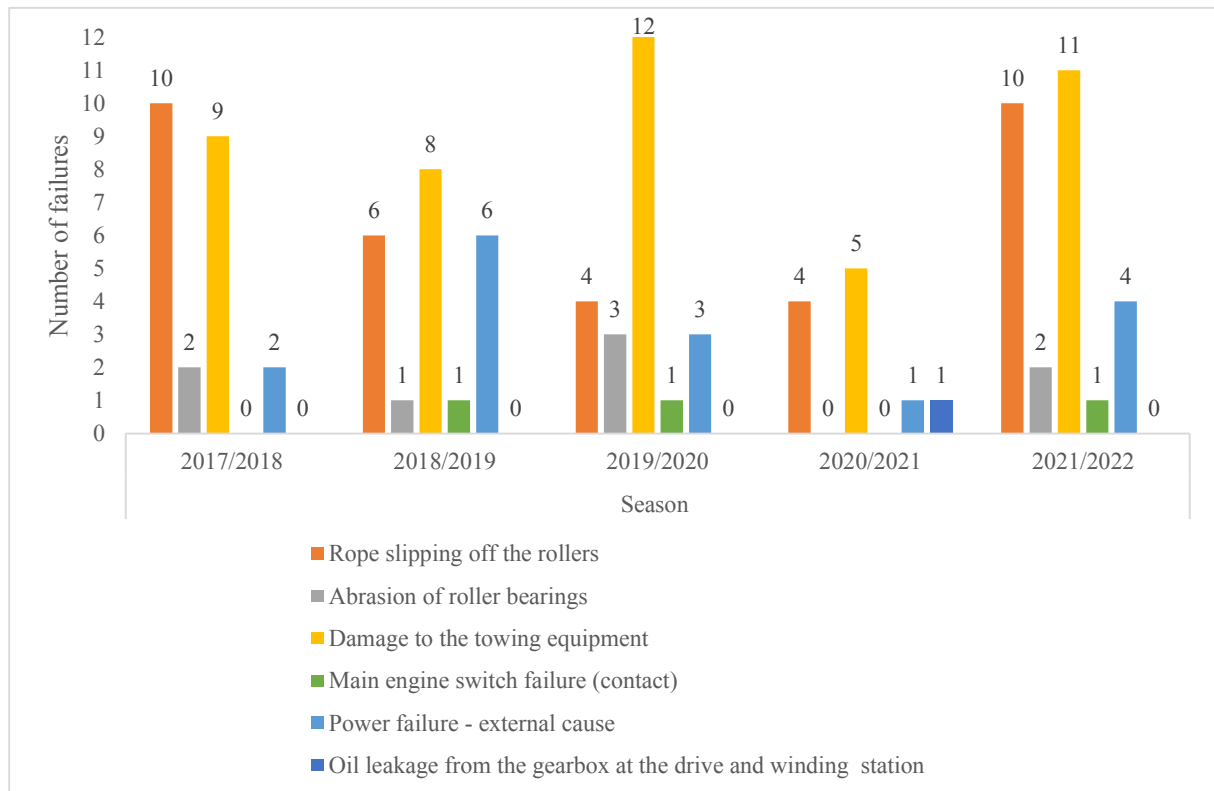


Figure 3. The most important failures that occur at the ski station and their frequency. Own study based on (Cieniawa-Ski ski station, 2022).

In case of slipping of the rope from the rollers and wearing out of their bearings, damage to the towing devices (orbs) and a problem with the main motor switch - the failure can be quickly repaired. Most of these problems are caused by weather conditions, since inaccurate checking of the ski lift route for accumulated snow leads to failures of the rope or the cable winch. Power cuts, however, are out of the company's control, but they occur occasionally and are acceptable. The most serious malfunction was, coinciding with the exceptionally short 2020/21 season, an oil leak from a box at the drive-winding station (lower platform), which had the potential to disrupt the operation of the machinery; the fault was rectified during a ski station shutdown caused by restrictions related to the SARS-CoV-2 pandemic.

In the case of the lift inspection according to the official instruction, no standardised procedure was developed – the activities performed were recorded, but not adequately. A work sheet template was developed for this purpose, which could serve to minimise potential errors occurring during inspection and also prevent potential failures.

Prior to the analysis, the time of each operation was measured. Research was carried out in a monthly cycle, averaging the results obtained. During the observations, no malfunctions that would prevent the lift from operating or other impediments to the control process were found. Using the previously identified activities, they were then divided into primary and secondary activities. The second category includes activities that preventively reduce the risk of failure.

Finally, the control components were detailed and additional elements were distinguished, resulting in 15 basic activities and 2 weekly activities, which were completed on the work sheet in Table 2.

Table 2.
Developed standard operation card for the ski lift

WORK STANDARDISATION CARD					
Lift	W-1		Employee	XYZ	
Workplace description [graphic]				Auxiliary equipment	
<p>The diagram illustrates the ski lift system layout. It includes a 'Lift route' connecting the 'UPPER PERON' and 'LOWER PERON'. The 'UPPER PERON' has a 'Winding station' (T1) above it. The 'LOWER PERON' has a 'Drive and winding station' (T1) below it. A 'Ski lift engines' block is connected to the 'LOWER PERON' and a 'CONTROL ROOM'. The 'CONTROL ROOM' contains numbered circles 3, 6, 7, 10, and 14. The 'Ski lift engines' block contains numbered circles 4, 5, 8, 9, 11, and 15. Arrows indicate movement: 1 and 13 are on the lift route; 2 and 14 connect the lower peron to the control room; 12 connects the control room to the drive and winding station. Transitions T1 and T2 are shown between the winding stations.</p>				<ul style="list-style-type: none"> - protective clothing, - gloves, - operating manual - sets of spanners (flat and socket spanners), - set of screwdrivers, - bearing grease 	
Basic operations					
No.	Description of activities	Operation time [min.]			VA/NVA
		Man	Machine	Transition	
1	Inspection of the lift route and condition of the route supports	15	-	10	VA
2	Moving to the lift control room	1	-	1	NVA
3	Checking the condition of the lift control room	5	-	-	VA
4	Connecting the engines	2	-	-	VA
5	Switching of engines from idle to ready for operation	-	2	-	VA
6	Control voltage in control room and pump to actuators	5	-	1	VA
7	Pressure equalization to the correct level	-	5	-	VA
8	Manual execution of the engine sequence: - status check, - fault clearing, - readiness setting, - start-up - "test run".	5	-	-	VA
9	Change to "inspection run" mode	-	5	-	VA
10	Checking the correct behaviour of the machine	3	-	1	VA
11	in the control room	-	10	-	VA
12	Change to "slow running" mode	-	-	2	NVA
13	Moving an employee to the lower platform	10	-	-	VA
14	Checking the towing devices on the lift route	-	-	2	NVA
15	Activation of "normal driving" mode	-	1	-	VA
TOTAL		46	23	15	

Cont. table 2

Preventive actions [weekly]					
T1	Lubrication of bearings in the drive-winding station and winding station	30			VA
T2	Moving from the station			10	NVA
TOTAL		30	-	10	

Own study based on (Cieniawa-Ski ski station, 2022).

By analysing the results obtained, most of the inspection time is devoted to checking the condition of the lift, including the route supports (activity 1) as well as the towing devices (activity 13). Any failure affecting this part will result in an automatic stop of the mechanism and risks posing a danger to the participants.

The activities that take place in the ski lift control room, located next to the lower platform, at the drive-winding station, are extremely important. All the activities related to the ski lift engines, marked 3-11 and 14-15, i.e. checking the condition, correct execution of the engine sequence or consideration of the driving mode order, affect the correct operation of the station during the working day. Breakdowns that would have caused an interruption in service did not occur during the period in question; the documentation shows that they are extremely rare. The preventive measures taken by the employees really support the smooth and smooth operation of the ski lift.

The card also notes the weekly activities that are part of the necessary maintenance. Ensuring that lubrication is carried out on the bearings located at the drive-winding station and winding station (lower and upper platforms, one after the other), significantly extends the life of the parts. Consequently, the mechanism operates for a greater number of man-hours, resulting in reduced expenditure.

By introducing standardisation in the form of a charter, it is possible to systematise activities and, consequently, to improve the process. The information provided makes it possible to implement preventive and corrective actions, which will contribute to reducing the occurrence of failures, minimising machine operating costs and increasing customer satisfaction.

4. Conclusions

Through standardisation, it is possible to provide a clear, visualised and safe working environment. The feedback from its execution makes it possible to determine schemes that include the most efficient working methods. With these, it is possible to achieve a stable process that guarantees the desired product, which meets the defined standards.

The article analyses the course of cyclic control of a ski lift. Due to the care of the ski station employees, the number of failures that occur during the season is small, but it is possible to achieve a lower number. The problem is the lack of a standardized document according to which

the inspection was to be carried out - the current procedure and its record is not efficient because it is not performed according to the agreed standard. The actions to date allow for a lack of information flow between staff and those responsible for removing failures.

The aim of the study was to develop a work standardisation card to standardise the activities during the inspection of the machine operation and the condition of the ski lift. The created document was based on the results of tests of activities carried out by workers in a certain period of time. The card obtained allowed to standardize the activities of the staff during the inspection, and the results allowed determining the average time of realization of the activities. The result is a standardised procedure, thanks to which it is possible to minimise the occurrence of failures resulting from human error.

The effect of the presented actions is the possibility to reduce the risk of failure, which contributes to the improvement of machine operation and provision of services of a high level of quality, compliant with customer requirements, translating into an increase in process efficiency and reduction of expenses on its implementation.

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