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FOREWORD

Presented number of Silesian University of Technology. Scientific Papers. Organization and Management Series. Contemporary management. Presented papers contain result of researches conducted by various universities from Poland. The number consists of 42 papers.

The papers presented in the number concentrate on many topics connected with organization and management. There are in the number papers about: quality management, marketing, capital management, public management, production management, impact of CIVID-19 pandemic on management, Industry 4.0, Industry 5.0, SME enterprises, human resource management, innovation management, sharing economy, change management, digitalization, resilience in management, economics, financial management, sustainability, start-ups' management, virtual reality, technology management and competitiveness.

Bożena Skotnicka-Zasadzień
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QUALITY MANAGEMENT OF HOSPITALIZATION PROCESSES

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Purpose: The aim of this article is to identify attributes related to the quality of the hospitalization process, categorized from absolutely necessary to those whose presence does not significantly impact this quality (according to the Kano methodology). The identified attributes also simultaneously contribute to shaping patient satisfaction. The primary objective of this article is to indicate at what level in the satisfaction assessment factors determine the quality of the hospitalization process and to what extent they align with the expectations of hospitalized patients.
Design/methodology/approach: The literature review will focus on identifying factors determining the quality of the hospitalization process. The empirical part of the article will revolve around classifying these attributes according to the Kano methodology through survey research. The next stage of the research process will involve assessing the satisfaction of hospitalized patients in areas corresponding to the Kano attributes - through survey research - and identifying discrepancies between expectations and satisfaction levels.
Findings: Among the attributes that particularly determine the attractiveness of a hospital unit are those related to reducing time. Shortening the admission time to the ward, waiting for discharge, and the time it takes to conduct prescribed tests are emphasized. Additionally, the importance of adhering to the treatment stages according to the planned schedule is highlighted. Therefore, it is recommended as a priority to simplify procedures for both admission to the ward and discharge, as well as to strictly adhere to the treatment schedule while optimizing it to reduce the waiting time for prescribed tests during hospitalization.
Research limitations/implications: The article presents the results of literature research, which can be complemented in further studies on this topic. One limitation of the research is the relatively narrow group of patients who completed the satisfaction assessment survey, both in terms of the number of patients, geographical area, and the number of hospital facilities. Additionally, the study only presented attributes related to the organization and the quality of the hospitalization process, without delving into broader topics related to personnel or material conditions, which likely also influence the level of patient satisfaction. These limitations point towards directions for future research.
Practical implications: The results of the conducted research can have practical applications in the business field. Satisfaction assessment surveys completed by hospitalized patients from various hospitals will identify areas where patient satisfaction is the lowest. Consequently,

they can serve as a basis for developing guidelines for efforts aimed at improving the quality of the hospitalization process. Additionally, the Kano methodology will indicate which attributes that determine the quality of the hospitalization process are most significant to patients, thereby guiding which actions should be implemented first.
Social implications: The implementation of the solutions recommended in the article, focusing on improving the quality of the hospitalization process, will result in raising the standards of hospitalization services provided by hospitals. The interest shown by hospital facilities in this topic demonstrates their social responsibility, and the added value for society will be the opportunity to access hospitalization processes that are more aligned with patients' expectations, especially in areas where patients have absolute expectations.
Originality/value: The article is primarily dedicated to individuals responsible for managing hospitals, who make decisions regarding its development and the improvement of the processes within. These individuals can gain insights into how satisfaction with the implemented processes can be measured comprehensively, and furthermore, how to determine the importance of individual quality attributes (Kano).

Keywords: hospitalization process, quality of the hospitalization process, patient satisfaction, Kano method.

Category of the paper: Research paper.

1. Introduction

Caring for life and health has always been one of the key challenges that humans face, as one's state of health influences their perception of the world and even their level of life satisfaction (Fiorillo et al., 2021). A potential hospital patient (with planned hospitalization) can, on one hand, choose a hospital facility that, in their opinion, has a good reputation and trust, often resulting from the high quality of services provided (Budynek, 2023). On the other hand, they may encounter a limited number of hospital beds and shortages (Shuv-Ami, Shalom, 2020). These shortages are identified on basically all areas of hospital facility assessment. (Improta et al., 2017; Upadhyai et al., 2021).

For the purposes of this article, based on literature research (Riblet et al., 2017; Hiidenhov et al., 2001), focus group studies, and participant observations by the authors of this publication, characteristics determining the quality of comprehensive hospital treatment have been categorized into three sets. The first set pertains to the condition and availability of material infrastructure, encompassing both medical equipment and hospital rooms, as well as sanitation facilities (Asiamah et al., 2022; Shuv-Ami, Shalom, 2020). The second set includes attributes related to hospital staff, both medical and non-medical (this not only refers to the number of staff members per facility but also to desired qualities they should possess) (Luna-Aleixos at al., 2023). The final set of attributes comprises factors determining the quality of the hospitalization process itself (Salomon et al., 1999). Given the extensive scope of the subject matter and the limited space in this text, all discussions will focus solely on the last set of attributes, which is the management of the quality of the hospitalization process.

2. Literature research aimed at identifying factors determining the quality of the hospitalization process

The concept of quality emerged in the works of philosophers in ancient Greece in the 5th to 4th centuries BC. Plato associated it with a level of perfection, while Aristotle regarded quality as a definition of an object. Plato and Aristotle's concepts were adopted and widely disseminated in Western culture. Independently, the idea of quality of life developed in the East, which was always linked to the human pursuit of excellence. One of the earliest surviving examples is the Chinese "Book of the Way and Virtue" (Lao Tzu, 2023) likely from the 4th or 3rd century BC. It introduces the concept of excellence and the path that leads to it. The author does not address the quality of material goods, but contemporary Eastern cultural perceptions of quality have expanded upon these ideas. Until the industrial revolution, a definition of quality based on excellence was largely sufficient for both producers and markets. The level of excellence, serving as a reference point for evaluating specific products and services, did indeed generate excessive costs for entrepreneurs (overquality). However, it also allowed for long-term customer satisfaction and often determined competitiveness (Wagner et al., 2014). In more contemporary times, former Prime Minister of the United Kingdom, John Major, stated in his address that the days of the industrial revolution passed in the 19th century, and today we are witnessing a quality revolution (Malinowska et al., 2014). This is because continuous improvement in quality and cost reduction are almost an absolute necessity to remain competitive in the market.

The requirement for constant quality improvement and increased operational efficiency aimed at cost minimization poses challenges for hospitals grappling with various issues (González et al., 2005; Prakash, Phadtare, 2018). There is increasing discussion about shortages in medical staff, deficiencies in medical infrastructure, continuous increases in the prices of electricity and gas, rising inflation, and the minimum wage for workers, all of which have an impact on cost management. Considering limited financial and personnel resources, it is crucial for decision-makers in medical institutions to determine which aspects must absolutely be at a high level according to their customers (patients) and what patients are willing to accept or absolutely reject. In the literature on the subject, there is a multitude of definitions of quality itself, as well as factors determining the quality of the hospitalization process and strategies aimed at improving the quality of this process (Vandamme, Leunis, 1993; Fuseini et al., 2023).

In the ScienceDirect database, when you enter the phrase "hospitalization process" into the search engine, you get 257,682 scientific articles and other publications. However, when narrowing the search by adding the term "quality" found in the title, abstract, or keywords specified by the authors, the number of scientific papers in this area is 24,582. It is worth noting a rising trend in the number of these publications in recent years (Table 1).

Table 1.
The number of publications including the terms "hospitalization process" and "quality" from 2017 to 2023 according to the ScienceDirect database

Year	The number of publications	The increase in the number of publications from a given year to the previous year
2017	1291	-
2018	1436	11%
2019	1583	10%
2020	1758	11%
2021	2193	25%
2022	2276	4%
2023	2528*	11%

* The projected value, with the lower limit of publications at 2340 and the upper limit at 2715.

Source: Own study based on the ScienceDirect database.

It is emphasized that healthcare quality is a complex matter that requires an interdisciplinary approach (Oltedal et al., 2007) and can be shaped through three aspects: structural quality, process quality, and outcome quality. The focus of this study is specifically on process quality. It should be noted that in Poland, the quality of medical services is regulated by the Act on Medical Activity dated April 15, 2011. Additionally, healthcare quality is governed by the Act on Quality in Healthcare and Patient Safety dated June 16, 2023, which defines principles and procedures for (https://orka.sejm.gov.pl/): the operation of the quality monitoring and assessment system in healthcare, differentiating the level of public funding for hospital care services, establishing internal quality management systems for entities engaged in medical activities, granting and withdrawing accreditation, defining the operation, organization, and tasks of the Agency for Quality in Healthcare, further referred to as the "Agency," and the Accreditation Council operating under the President of the Agency.

Furthermore, Article 4 of the law specifies quality indicators for healthcare, classifying them into one of three areas:

1. Clinical quality - understood as a set of indicators related to the level and outcomes of healthcare services provided, described by parameters such as: a) Treatment effectiveness, b) Readmission for the same cause, c) Mortality after procedures: during hospitalization, within 30 days, 90 days, and one year from the end of hospitalization, d) Experience in performing specific healthcare services, e) Structure of medical procedures performed for specific health issues.
2. Consumer quality - understood as the results of patient opinion surveys regarding the organization of healthcare service delivery processes.
3. Managerial quality - understood as a set of indicators related to the efficient use of resources and the implementation of management systems, described by parameters such as: a) Accreditation or other quality certification or certificate held by an independent accredited entity, b) The degree of resource utilization available to the entity, c) Length of hospitalization, d) Structure of provided healthcare services.

Based on a literature review, determinants of hospitalization process quality have been identified (Table 2).

Table 2.
Attributes of hospitalized patient satisfaction

Author	Determinants of Hospitalization Process Quality
Chang, Wen Jen Chang, Yen Hsiang (Chang et al., 2013)	Short hospital stay Timeliness of the process Patient feedback surveys Accurate patient documentation Ease of scheduling appointments Clearly defined list of treatment fees
Fernando Barrios-Ipenza Arturo Calvo-Mora Fernando Criado-García Walter H. Curioso (Barrios-Ipenza et al., 2021)	Scheduling medical appointments Level of bureaucracy Waiting time at the clinic Computerized service Ancillary tests Handling complaints and grievances Time spent on patient care Clinic hours Treatment costs Improvement in health status Side effects during medication intake
Parasuraman, A. (Parasuraman, 1986)	Tengibles Reliability Responsiveness Assurance Empathy
Haksik Lee, Yongki Lee, Dongkeun Yoo (Haksik, Lee et al., 2000)	Material possessions Reliability Responsiveness Trust Empathy Consistency, steadfastness
Kenneth E. Clow Carolyn Tripp James T. Kenny (Kenneth et al., 1996)	Purchase intentions Risk Expertise Material possessions Reliability Responsiveness Empathy Consistency, steadfastness

Source: Own study based on literature research.

Most of the research presented in the literature on this subject relates in a general way to the issue of the quality of medical services, including hospital services, usually based on the SERVQUAL method, where the following elements are evaluated: tangibles (tangible aspects), reliability, responsiveness, assurance, and empathy. Over time, the number of assessed areas increased to six or even seven factors (Akim, 2023). However, it has been observed that the SERVQUAL method is insufficient for examining the impact of individual attributes on the quality of the hospitalization process.

3. Research methodology

The main objectives of this article are as follows:

1. Identification of factors determining the quality of the hospitalization process and their categorization (Kano).
2. Assessment of patient satisfaction with their hospital stay in the area of factors determining the quality of the hospitalization process.
3. Identification of the gap between expectations (the highest desired level of patient satisfaction) and the actual state of patient satisfaction in the area of factors determining the quality of the hospitalization process.
4. Providing recommendations aimed at reducing or eliminating the identified discrepancies between the expected and actual states, as identified during the empirical research phase.

These specified research objectives have shaped the research methodology, and each stage of the research process has indicated desired outcomes at each stage (Table 3).

Table 3.
The research process stages along with the identification of results

No.	Stages of research process	Results of stages of research process
1.	Identification of factors determining the quality of the hospitalization process - based on literature research	List of identified determinants of the research process
2.	Selection and reduction of the identified factors determining the quality of the hospitalization process based on literature research - through participant observation by the study authors and focus group research in a randomly selected group of patients.	List of reduced determinants of the hospitalization process
3.	Based on the list of reduced determinants of the hospitalization process, constructing a diagnostic tool for determining the expectations of hospitalized patients (factors that are absolutely necessary and those whose absence is unacceptable) - using the Kano methodology.	Survey identifying expectations regarding the hospitalization process
4.	Based on the list of reduced determinants of the hospitalization process, constructing a diagnostic tool for assessing the satisfaction of hospitalized patients in the areas identified as factors determining the quality of the hospitalization process.	Survey for assessing satisfaction with the hospital stay in terms of the hospitalization process
5.	Conducting research	• Completed surveys identifying expectations regarding the hospitalization process • Completed surveys assessing satisfaction with the hospital stay in terms of the hospitalization process
6.	Analysis and conclusions from the conducted research	Conclusions and diagnosis. Identification of gaps between expectations and actual satisfaction in the area of the hospitalization process.

Cont. table 3.

7.	Recommendations for business practice and directions for further research	Guidelines for hospitals aimed at actions to reduce or eliminate discrepancies between patient expectations and the level of their satisfaction in the areas of hospitalization process determinants. Directions for further research.

Source: Own study.

During the focus group research, the factors determining the hospitalization process identified in the literature review, which constituted the next step of the research procedure, were reduced to the most significant and mutually exclusive factors. Additionally, they were supplemented in areas not covered in the literature review (van Loenen et al., 2014; Teng et al., 2007). The focus group research was conducted on February 6, 2023, at the Internal Medicine Department of the Provincial Specialist Hospital of the Virgin Mary in Częstochowa. Ten patients participated in the study, randomly selected but diverse in terms of gender, age, and education. One of the authors of this study served as the moderator of the research. It's also worth noting that the other two co-authors were responsible for taking notes, recording the progress of the study, supporting the moderator, and identifying exceptional and noteworthy responses and key findings.

The result of the focus group research was a list of factors determining the quality of medical services, including the hospitalization process, which served as the basis for the development of two research tools:

- Survey identifying expectations regarding the hospitalization process (Kano).
- Survey assessing satisfaction with the hospital stay in terms of the hospitalization process.

In the area of determinants of the quality of the hospitalization process, two groups of factors were identified:

1. Factors related to the organization of hospital services: Schedule of doctor's visits, Hours of medical consultations, Visiting hours for patients, Admission time to the hospital ward, Waiting time for discharge (Hospital Treatment Card), Level of bureaucracy (number of forms to fill out).
2. Factors related to the quality of hospital services: Execution of services according to the treatment schedule, Ability to perform prescribed tests within the hospital during hospitalization, Waiting time for the execution of prescribed tests during hospitalization, Availability of medications during hospitalization, Accuracy of information in the discharge summary (Hospital Treatment Card).

The first research tool, the Survey Identifying Expectations Regarding the Hospitalization Process, was constructed according to the methodology used in building the Kano model, which is also utilized for assessing the quality of healthcare services (Jiayi Mao, 2022). The aim of this study was to understand the needs and expectations of hospitalized patients in hospitals, and the survey was directed towards patients from around the world. In this research, the focus

was primarily on what respondents considered essential for a hospitalization service to be positively evaluated and what could pleasantly surprise them, constituting added value in their opinion. As mentioned earlier, the Kano Model was used for assessing the quality of hospitalization services, which is considered innovative since there are not many publications in the literature that utilize this research methodology (Parasuraman, 1986). In the literature, this method is sometimes referred to by various names, such as "asymmetrical impact on overall customer satisfaction" (Mikulic, 2006), "customer requirement model" (Lee, 1996), "customer needs model"(Jonsson Kvist, Klefsjo, 2006), "two-dimensional quality model" (Schveneveldt el al., 1991) or "attractive quality theory model" (Nilsson-Witell, Fundin, 2005).

The second research tool was constructed in a slightly different manner. Its purpose was to examine the opinions of actual patients from a combined hospital, which was the subject of the research. The questionnaire included questions related to the same attributes that were assessed in the study using the KANO methodology. However, in this case, a rating scale was used, ranging from 1 (most dissatisfied) to 5 (most satisfied).

The empirical research was aimed at finding answers to the extent to which the hospitalization process should be improved to enhance the quality of healthcare. The methods employed during the empirical research allowed for a scientific exploration of the chosen topic. The research utilized a two-stage empirical research method: Kano – studying expectations and assessing the actual satisfaction of hospitalized patients.

The first stage of the research was conducted using a questionnaire based on the Kano methodology (named after its creator, Professor Noriaki Kano). The Kano methodology is a tool used in quality management and helps to understand and classify customer expectations regarding products or services, in this case, the expectations of patients regarding the hospitalization process. Surveys were collected using the CAWI method (Computer-Assisted Web Interview), and responses were obtained from 212 respondents who were provided with a link to the questionnaire through social media. In this case, respondents did not have to be patients of the selected hospital for the research. Their assessments of selected attributes influencing the perception of the quality of hospital services were important.

The questionnaire consisted of 41 attributes, and each attribute had two straightforward questions – one regarding the presence of a specific feature and the other regarding its absence. Respondents were asked to provide one of the following responses: "absolutely essential", "expect it", "don't care either way", "can tolerate it", "unacceptable" (Matzler, Hinterhuber, 1998; Santhoshkumar, Jeyarajasekar, Kumar, 2022). Attributes related to the organization of hospital services and the quality the medical service were listed in Table 4. In Table 5, as an example, questions (functional in nature: "What if it is this way?" and dysfunctional: "What if it is not this way?") were presented for a selected attribute: ommunicated schedule known to patients. (indicated in the questionnaire with the symbol MSQ1).

Table 4.
Attributes related to the organization of the hospitalization process and the quality of medical services

No.	Attribute
SO1	Medical appointment schedule
SO2	Doctor's consultation hours
SO3	Visiting hours for patients
SO4	Admission time to the hospital ward
SO5	Waiting time for discharge (Hospital Treatment Card)
SO6	Level of bureaucracy (number of forms to fill out)
MSQ1	Execution of treatment stages as per the planned schedule
MSQ2	Ability to perform prescribed tests within the hospital during hospitalization
MSQ3	Waiting time for the execution of prescribed tests during hospitalization
MSQ4	Availability of medications during hospitalization
MSQ5	Accuracy of information in the discharge summary (Hospital Treatment Card)

*SO (Service Organisation), MSQ (Medical Service Quality).

Source: Own study based on empirical research.

The example questions regarding the functional and dysfunctional aspects for attribute MSQ1 are presented in Table 5.

Table 5.
An example question related to attribute MSQ1

MSQ1. Individual treatment stages carried out according to the previously communicated schedule provided to patients.				
a. What if it is the case? (functional form of the question)				
like it	expect it	don't care	live with it	dislike it
b. What if it is not the case? (dysfunctional form of the question)				
like it	expect it	don't care	live with it	dislike it

Source: Own study based on Kano's Methods.

Next, in accordance with the Kano methodology guidelines, responses regarding each attribute were examined and assigned to a specific type, namely: QE – Questionable, AE – Attractive, RE – Reverse, IT – Indifferent, OD – One-dimensional and ME -Must-be (Table 6).

Table 6.
Kano evaluation table

Requirements		**Disfunctional**				
		Like it	**Expect it**	**Don't care**	**Live with it**	**Dislike it**
Functional	Like it	QE	AE	AE	AE	OD
	Expect it	RE	IT	IT	IT	ME
	Don't care	RE	IT	IT	IT	ME
	Live with it	RE	IT	IT	IT	ME
	Dislike it	RE	RE	RE	RE	QE

Source: Own study based on Kano's Methods.

In searching for correlations between a given attribute of hospital services organization and patient satisfaction, coefficients of satisfaction (CC) and dissatisfaction (DC) were applied using the following formulas (Berger et al., 1993):

$$CC = (AE+OD)/(AE+OD+ME+IT) \quad (1)$$

$$DC = (OD+ME)/(AE+OD+ME+IT) \quad (2)$$

The value of the satisfaction coefficient (CC) ranges from zero to one. The closer the value is to 1, the greater the impact on patient satisfaction. On the other hand, if the dissatisfaction coefficient (DC) is close to one, patient dissatisfaction affects the respective quality attribute (Matzler, Hinterhuber, 1998).

4. Results of the research

In the first step, the characteristics of the respondents in both surveys were analyzed. Due to the fact that the KANO methodology survey was conducted using the CAWI method, where there was a requirement for a response to each question, it was possible to collect 212 fully completed questionnaires. On the other hand, the survey aimed at patients of the researched hospital was conducted using printed questionnaires. In this case, 149 questionnaires were collected, sometimes containing incomplete answers to the questions in the questionnaire. Therefore, the analysis was somewhat more challenging. The basic characteristics regarding the age and gender of the respondents in both surveys are presented in Figures 1 and 2.

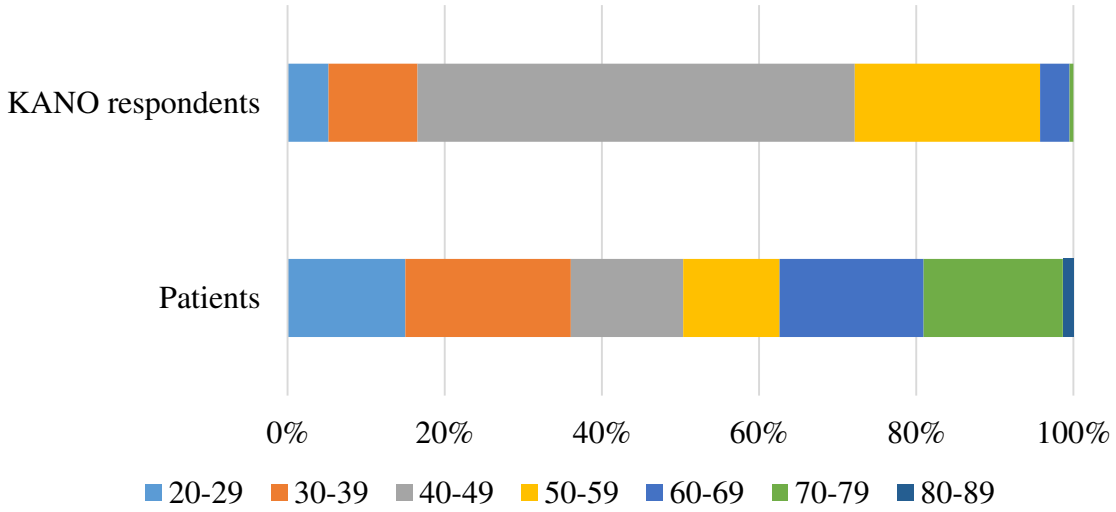

Figure 1. Age of respondents.

Source: Own study based on empirical research.

In the case of the age distribution of respondents in both surveys, significant differences can be observed. Among the respondents participating in the Kano methodology survey, the largest group fell into the age range of 40-49 years. However, in the case of patients of the researched hospital, respondents from the age groups of 20-29, 30-39, and 60-69 were similarly numerous.

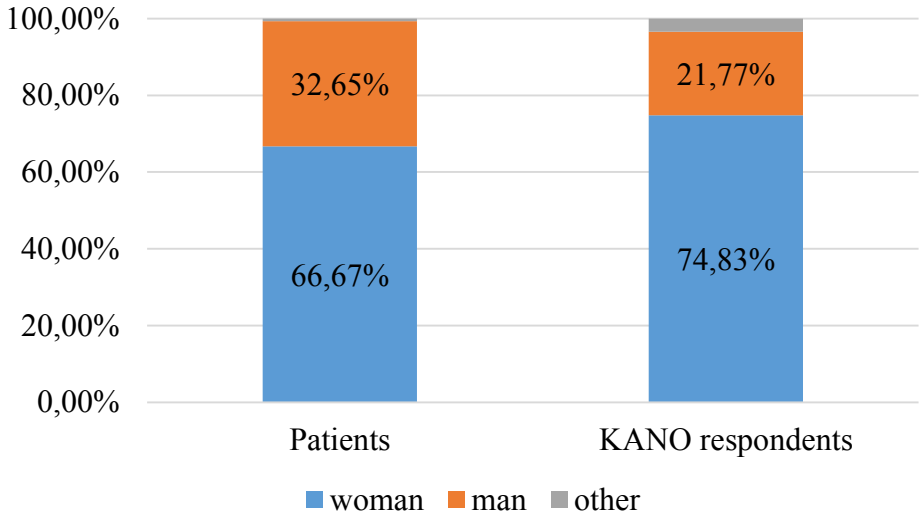

Figure 2. Gender.

Source: Own study based on empirical research.

In the case of the gender distribution of respondents in both surveys, there were not as significant differences as in the age category. In both cases, women predominated (almost 80% for the Kano study and nearly 70% for patients of the researched hospital).

According to the Kano methodology, for each of the eleven attributes mentioned above (from SO1 to MSQ5), an analysis of response statistics was conducted (Table 7). There was a division into two categories of questions: functional (what if it is like this?) and dysfunctional (what if it is not like this?).

Table 7.
Set of response statistics from respondents according to the Kano methodology for attributes SO1-SO6 and MSQ1-MSQ5

	ME	OD	AE	IT	CLASS	CC	DC
SO1	15%	17%	33%	34%	IT	0.51	0.33
SO2	19%	17%	30%	34%	IT	0.47	0.36
SO3	11%	4%	28%	57%	IT	0.32	0.15
SO4	23%	25%	32%	21%	AE	0.56	0.47
SO5	19%	22%	32%	27%	AE	0.54	0.41
SO6	15%	13%	27%	45%	IT	0.40	0.28
MSQ1	19%	15%	39%	27%	AE	0.54	0.33
MSQ2	20%	15%	27%	39%	IT	0.42	0.34
MSQ3	26%	14%	32%	29%	AE	0.45	0.40
MSQ4	20%	26%	26%	28%	IT	0.52	0.46
MSQ5	13%	29%	26%	32%	IT	0.55	0.42

Source: Own study based on empirical research.

The analysis indicates that the set of 4 attributes, namely SO1, SO2, SO3, SO6, identifies the IT class, which means a neutral state. This implies that respondents do not perceive these attributes significantly. Therefore, these attributes will not have a significant impact on patients' satisfaction or dissatisfaction. This is confirmed by the satisfaction index (CC) values, which mostly do not exceed 0.5 for this set of attributes. Regarding the mentioned 4 attributes, only slight differences can be observed in the index values and the assigned classes. It is worth emphasizing that three attributes, SO4 and SO5, identify the AE class. These attributes are clearly perceived by respondents and meet their requirements, implying a state of satisfaction.

As for the attributes directly related to the quality of medical services, the analysis indicates that the set of 3 attributes, namely MSQ2, MSQ4, and MSQ5, identifies the IT class, which means a neutral state. This implies that respondents do not perceive these attributes significantly. Therefore, these attributes will not have a significant impact on patients' satisfaction or dissatisfaction. This is confirmed by the satisfaction index (CC) values, which mostly hover around the level of 0.5 for this set of attributes. Regarding the mentioned 3 attributes, only slight differences can be observed in the index values and the assigned classes. It is worth emphasizing that two attributes, MSQ1 and MSQ3, identify the AE class. These attributes are clearly perceived by respondents and meet their requirements, implying a state of satisfaction.

The above analysis confirms that improving hospital services is not only about identifying a set of attributes but, more importantly, recognizing those with the greatest impact on patients' satisfaction levels. From a hospital management perspective, particularly in organizing desirable services, it may be worthwhile to focus primarily on the attributes that have the greatest significance and influence from the recipient's perspective, which is the hospital patient.

In the second stage of the research, data from questionnaires constructed specifically for this study by the authors were analyzed. The surveys were collected over two months, in July and August 2023, by two hospital units within the group. The number of responses to individual questions ranged around two hundred. In some questions, there was a lower response rate due to the non-obligatory nature of providing an answer. In others, respondents had the option to select multiple choices, which increased the number of votes. Due to the theme of this paper, certain areas directly related to the factors were selected and analyzed. Based on a subset of questions from the entire set, several areas requiring improvement were identified (Table 8).

Table 8.
Basic statistics for attributes SO1-SO6 in the patient satisfaction study

	SO1	SO2	SO3	SO4	SO5	SO6
Mean	4.507042	4.439716	4.207143	4.192857	4.297101	3.914286
Standard error	0.058914	0.063156	0.080144	0.087148	0.085069	0.105104
Median	5	5	4	5	5	4
Mode	5	5	5	5	5	5
Standard deviation	0.702038	0.749941	0.948277	1.031144	0.999339	1.243606
Sample variance	0.492858	0.562411	0.899229	1.063258	0.998678	1.546557
Kurtosis	0.575641	0.451745	0.729393	-0.03739	1.13235	0.006869
Skewness	-1.21037	-1.1313	-1.09487	-1.03524	-1.38457	-1.0194
Range	3	3	4	4	4	4
Minimum	2	2	1	1	1	1
Maksimum	5	5	5	5	5	5
Meter	142	141	140	140	138	140
Confidence level (95.0%)	0.116468	0.124864	0.158459	0.172306	0.168219	0.207809

Source: Own study based on empirical research.

In general, the results indicate that the average responses to these questions are relatively high (close to 5), suggesting that the study participants are satisfied with these aspects (Table 8). For example, SO1 has an average of about 4.51, indicating that the average response to this question was higher than the midpoint of the scale. Low values of standard deviation and variance in the sample suggest that the responses are relatively close to each other, indicating low variability. The left-skewness suggests some dispersion of responses towards lower values.

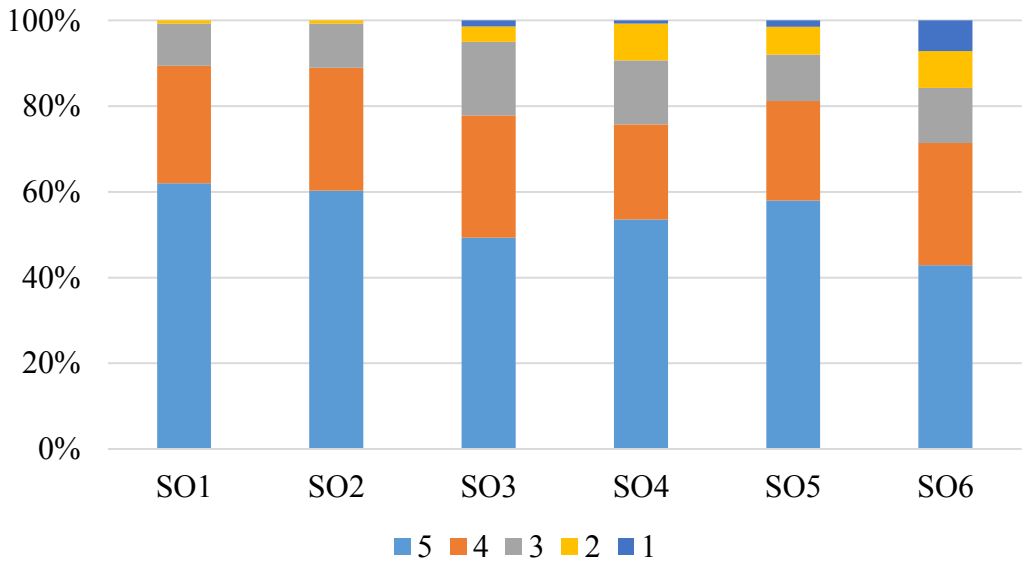

Figure 3. Evaluation of attributes SO1-SO6.

Source: Own study based on empirical research.

Taking into account the level of patient satisfaction regarding the attributes highlighted in the area of organizing medical services, it should be noted that this satisfaction is at a relatively high level (Figure 3.). The highest satisfaction is reported by patients in terms of adherence to

the medical appointment schedule (SO1), with 62% rating this attribute with the highest score (5 points), and 27% of respondents assigning 4 points to this attribute. Similarly, the consultation hours (60% of respondents - 5 points, 29% of respondents - 4 points) were evaluated positively. Attributes SO6 and SO3, on the other hand, received relatively lower ratings. Only half of the patients (49%) are fully satisfied with the established visiting hours (SO3). However, it is unclear whether the visiting hours are perceived as too short or too long by this group. The attribute SO6 - Level of bureaucracy (number of filled-out forms) received the lowest satisfaction rating. In this case, only 42% of respondents expressed full satisfaction with the current state of affairs, leaving room for improvement initiatives. When comparing these results with the results of studies conducted using the Kano methodology, it should be noted that in the area of organizing medical services, the attributes that most strongly influence patient satisfaction are: Time to admission to the hospital ward (SO4) and Time waiting for discharge (Hospital Treatment Card) (SO5), which did not fare as well in the opinion of patient satisfaction. Therefore, it is recommended that the hospital management take steps to both shorten the time for admission to the ward (53% of fully satisfied patients) and reduce the waiting time for discharge (57% of fully satisfied patients). At the same time, a survey was conducted using the Kano methodology, presenting the same attributes for respondents to evaluate. The results are presented in Table 9.

Table 9.
Basic statistics for the attributes MSQ1-MSQ5 in the patient satisfaction survey

	MSQ1	**MSQ2**	**MSQ3**	**MSQ4**	**MSQ5**
Mean	4.489209	4.510638	4.381295	4.485915	4.472868
Standard error	0.06953	0.06415	0.073203	0.073265	0.073067
Median	5	5	5	5	5
Mode	5	5	5	5	5
Standard deviation	0.819746	0.761737	0.863056	0.873047	0.829886
Sample variance	0.671984	0.580243	0.744865	0.762212	0.688711
Kurtosis	2.237124	1.353642	1.487806	2.584659	1.75006
Skewness	-1.60659	-1.46256	-1.37568	-1.7724	-1.57859
Range	4	3	4	4	3
Minimum	1	2	1	1	2
Maksimum	5	5	5	5	5
Meter	139	141	139	142	129
Confidence level (95.0%)	0.137482	0.126828	0.144745	0.144839	0.144576

Source: Own study based on empirical research.

Analyzing the obtained ratings, you can see that the mean values are close to 4.5 for each of the variables, suggesting that the average response to these questions was relatively high. The standard error is relatively low, indicating good precision in estimating the means. The median and mode are both 5 for each variable, which means that half of the responses were equal to 5, and this value was the most frequently chosen option.

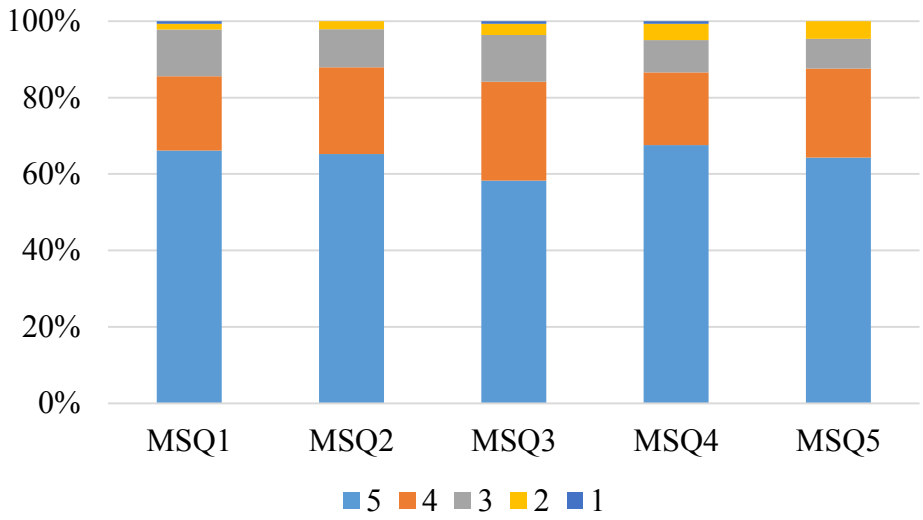

Figure 4. Evaluation of attributes MSQ1-MSQ5.

Source: Own study based on empirical research.

Factors in the area of medical service quality (MSQ) in achieving full patient satisfaction generally scored higher than factors related to service organization (SO) (Figure 4). The highest satisfaction is observed among patients in terms of MSQ4 - Availability of medications during hospitalization, with as many as 68% of patients being fully satisfied with the current state of affairs. MSQ1 - Execution of treatment stages according to the planned schedule was also highly rated (66% of fully satisfied patients). This situation is very favorable for the research entity because, in accordance with the Kano methodology, this attribute corresponds to the perception of the organization as attractive (AE). On the other hand, the factor MSQ3 - Waiting time for prescribed tests during hospitalization received the lowest satisfaction rating (58% of fully satisfied patients). Although more than half of the surveyed patients express full satisfaction with the execution of this factor, it should be emphasized that considering the Kano methodology, this is a crucial attribute for patients and determines the hospital's attractiveness. Therefore, it is recommended to take action in this area aimed at reducing the waiting time for diagnostic tests during hospitalization.

5. Conclusion and summary

The quality of the hospitalization process is of paramount importance for former, current, and future patients facing the need for hospital treatment. In the context of the Polish healthcare system, private hospital facilities with contracts with the National Health Fund (NFZ) are increasingly prominent, providing hospitalization services. Therefore, it becomes crucial for public hospital institutions to effectively manage this process to compete with smaller, sometimes more specialized private hospital units. This situation can be challenging for large

state-run institutions with complex organizational structures, a substantial workforce, and sometimes outdated processes, making management and change implementation difficult. It's commendable that the hospital team recognized the seriousness of the situation and placed the patient as an external driver of development, giving them the opportunity to express themselves. Patients can now assess their satisfaction with various areas of the hospital's operations. Additionally, considering the Kano methodology, information was obtained about which attributes are particularly attractive and provide a competitive advantage. Among the attributes that significantly determine the attractiveness of a hospital unit are those related to reducing time. Shortening admission time to the ward, waiting time for discharge, and the time required for conducting prescribed tests are emphasized. Furthermore, the importance of adhering to the treatment stages according to the planned schedule is highlighted. In contemporary times, the belief that "time is money" is gaining increasing significance, as evidenced by the results of ongoing research. It is worth noting that the surveyed entity performs well in this regard. However, considering the dynamics of changes in patient satisfaction, increasing demands, and needs, continuous efforts should be made to improve the processes in place. The research clearly identifies what is most important to the community, and the satisfaction levels of hospitalized patients indicate areas where this satisfaction can be further improved. Therefore, it is recommended, first and foremost, to simplify procedures for both admission to the ward and discharge, and to strictly adhere to the treatment schedule while optimizing it to reduce the waiting time for prescribed tests during hospitalization.

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COMPARATIVE INDICATOR ANALYSIS BASED ON AGGREGATED DATA IN THE CONTEXT OF NEEDS AND INTERPRETATIVE POSSIBILITIES IN PROCEDURAL TERMS

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Purpose: The aim of the work was to demonstrate the interpretation possibilities caused by the presentation of prepared information being the result of analytical work, and influencing the final assessment resulting in the perception of the examined phenomena or the state of the examined object, but also indicating directions and finally ways of proceeding, i.e. potential or recommended actions.
Design/methodology/approach: A procedural approach to the issue of comparative indicator analysis allowing to demonstrate the needs and possibilities of interpretation requires aggregated data sets, necessary for the proper conduct of inference activities, which translates into the perception of the examined object or issue.
Findings: The analysis of the existence of interdependencies or their absence is determined by both the procedure and reliable data, hence the procedurally structured considerations, carried out in subsequent stages of analytical comparative work, make it possible to demonstrate the existing similarities, connections or problems.
Social implications: Indicative comparative analysis is a tool for collecting information about an object or phenomenon, taking into account a broader context, i.e. society, economy or the state of infrastructure. This gives the opportunity to compare the tested object on the basis of the background, enabling conclusions and recommendations.
Originality/value: Limiting the interpretative differences of the studied phenomena allows, on the basis of the background, i.e. references to the environment and identified trends, to predict development directions, and by making future states more probable, to propose final assessments that translate into recommendations or procedures.

Keywords: indicator analysis, multi-criteria assessment, procedure, aggregated data, indicators.

Category of the paper: Conceptual paper and Case study.

1. Introduction

Indicator analysis makes it possible to compare and interpret, and consequently predict future states (Kafel, 2013). It also makes it possible to derive recommendations - based on the adopted assumptions - relating to the analyzed issues or objects, taking into account the social, economic or infrastructural situation (Bernat, 2022). This approach makes it possible to discover and, ultimately, describe the existing dependencies, but also similarities or differences, and even disproportions that occur in real conditions, including those that are difficult to grasp (Eisenhardt, Sull, 2001).

The activities carried out at the stage of analytical work are used to collect the necessary information so that, after processing, it is possible to present the results (Dalecka, 2016) in terms that are relevant from the point of view of the adopted research assumptions. Such algorithmic action in the form of a procedure is laborious and time-consuming (The Global Competitiveness Report 2016/2017, 2016). Analytical work is multi-stage, and the search for correlations may lead to the recognition of interdependencies, but it does not ensure that (Jak przeprowadzić analizę danych…, 2020). Just noticing and describing difficult to detect or highlighting existing differences, thanks to the conducted analytical work, creates the basis for further work, directing the activities - including inference - to recommendations or ways of proceeding.

Comparative analysis can be seen as a useful tool for gathering information about an object or phenomenon, taking into account the situation of society, the economy or the state of infrastructure (Bernat, 2017). It will be possible only on the basis of aggregated data, which will allow to demonstrate the occurrence of different states in the considered areas of the analyzed issues (Human Development Reports, 2020). This gives the possibility of structuring and hierarchization, but also synthesis indicating potential opportunities in the future (The Global Competitiveness Report 2016/2017, 2016). Hence the assumption that the comparative analysis carried out in this way will make it possible to demonstrate the presence or absence of similarities, connections or problems.

A comparative analysis of the researched issue, object or phenomenon, e.g. in relation to a given community, region or entity, should not be conducted without ignoring the background of problems or potential interdependencies (Stępień, 2016). Therefore, by definition, it should be required to describe the specific situation resulting from the conducted analysis, taking into account the general conditions constituting the point of reference. The purpose of such proceedings would be to obtain information correcting the final conclusions. Such an approach should be considered appropriate, as it allows for the discovery or highlighting of the features of the examined objects against the analytical background (Uchwała KRBR 2015), which enables the search to be directed and in-depth analysis aimed at bringing the recommendations and resulting actions closer to real, and not only identified needs. Hence, the aim of the work was to show possible differences in interpretation caused by the presentation of prepared

information being the result of analytical work, and affecting the final assessment resulting in the perception of the studied phenomena or the state of the tested object, but also indicating directions or, finally, ways of proceeding, i.e. potential or recommended actions. An example of this approach is choice of the most suitable indicator framework is comparison indicator standards for Smart sustainable cities (Huovila, Bosch, Airaksinen, 2019).

The comparative analysis is used to use a variety of assessments, such as determining the optimal solution (Fadda et al., 2021) or comparisons of methods of assessing the results of enterprises (Narkunienė, Ulbinaitė, 2018), but the approach related to limiting interpretative differences is not represented in the literature on the subject. This is particularly important in the context of available aggregated data. A special issue was devoted to the consequences of differences in the interpretation of the studied phenomena, which included articles aimed at stimulating the debate regarding the criteria for assessing aggregated data for the purposes of comparative analyses (Neumann, Graeff, 2015).

Analytical works should, if possible and certainly justified, cover a designated time space, e.g. months or years, indicating regularities (Lachowski, 2019), i.e. trends or tendencies describing the changes taking place or their absence, i.e. refer to the interpretative location in space-time. This, in turn, requires the search for indicators reflecting the suggested perspective of looking at the analyzed issue or object. Wanting to get a fuller picture of "the level of human development in a given country requires the collection of a lot of information from various, and above all, reliable and objective, and therefore verifiable sources and the analysis of indicators reflecting the current state of the quality of life of residents, and not only the country or economy" (Bernat, 2019). This constitutes a challenge for researchers at the stage of preparing analytical works.

2. Multi-criteria assessment

The challenges of the preparatory stage result not only from the adopted goals or criteria, but also from the way of describing the condition of the examined objects or issues, e.g. phenomena affecting society and related to poverty, inequality, climate, environmental degradation, prosperity or, to a lesser extent, from the way of describing the condition economy or finance, as well as geopolitical location or infrastructural problems (Ciais et al., 2021). These difficulties are a challenge, and at the same time an impulse to describe not only current or temporary states, but also to conduct analytical work in the context of the probability of occurrence of specific events in the future on the basis of available historical data (Matthew et al.).

Multi-criteria analysis allows for the compilation of various indicators describing the state of the object (issue) or the course of the phenomenon and comparing them for selected references. As part of the case study, the object (country) was analyzed on the basis of the background by referring it to the reference environment. A number of criteria were used in the inference, which enable the assessment of the functioning of the tested object in various areas. And as shown in Fig. 1, the analysis may include a number of criteria regarding the tested object and the reference background. The scale of ratings used allows, in turn, to quantify the existing similarities or differences.

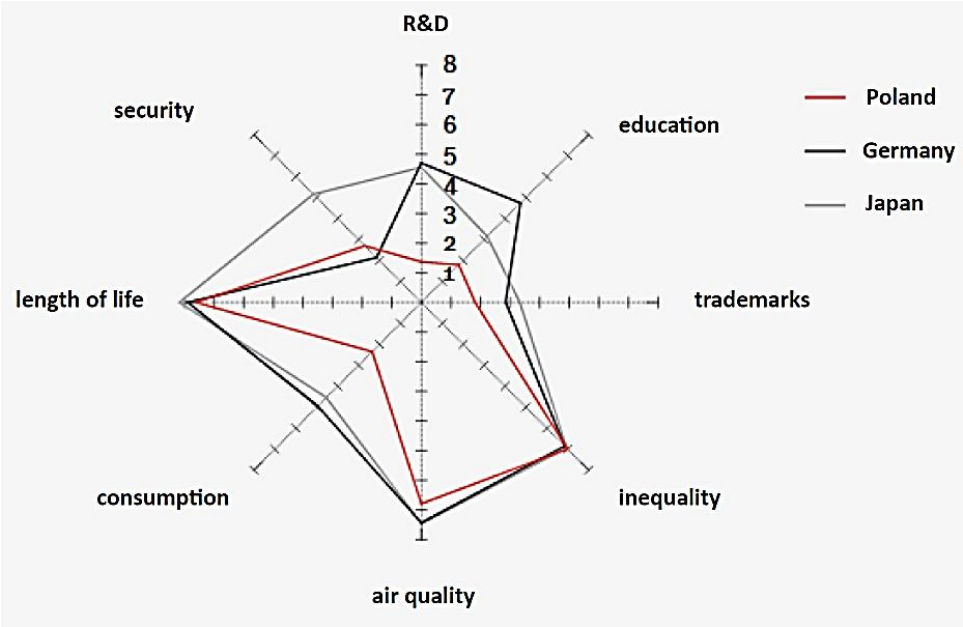

Figure 1. Multi-criteria analysis of the object based on the background.

Source: http://pie.net.pl/wp-content/uploads/2019/02/PIE-Indeks_Odpowiedzialnego_Rozwoju.pdf, 1.04.2020.

Fig. 1 characterizes the situation of Poland against the background of developed economies, namely Germany and Japan. Such imaging shows the distance between the tested object and the leaders or reference objects. Nevertheless, when analyzing the situation of a given facility (country), one should not only check how it compares to the leaders, but also make comparisons with similar facilities (in this case, countries of the region). Therefore, the situation of the examined object should also be compared to objects -constituting the background- of similar "parameters". In the cited example, Poland had to be compared with culturally, economically and geographically similar countries of the Visegrad Group. Such a comparison showed that the results in terms of the examined indicators constituting the assessment criteria do not differ significantly for the countries of Central and Eastern Europe (Bernat, 2019). In the case of the Visegrad Group, differences emerged in areas such as: security, R&D and trademarks. The criteria listed in Fig. 1 are components of the responsible development index (IOR) enabling multi-criteria assessment (Polish Economic Institute, 2019).

As shown in Fig. 1, in comparison to countries such as Germany or Japan, there are significant differences in five out of eight criteria adopted for the analysis. Therefore, the presentation of the object against the background of other references shows the main directions and scale of challenges in catching up the distance between the tested object and the research background, taking into account the considered criteria.

It should be noted that the countries analyzed in Fig. 1, similarly to the countries of the Visegrad Group, are classified - according to the HDI (Human Development Statistical (2019)) - as very developed countries, but there are significant differences between them. Fig. 1 shows that life expectancy (8) and the level of inequality (7) are the criteria in which Poland's assessments are comparable to the analytical background and are very high (max. 8). There is a small distance between Poland (6.75) and Japan and Germany (7.5) in the case of air quality, but in terms of safety, the differences between Poland (2.5) and Germany (2) and Japan (5) are significant. European countries clearly lose half the distance. This illustrates the need to examine many criteria in order to highlight the occurrence of similarities, but also differences.

Collecting not so much useful as comparable data can also be problematic. In the analyzed case, these will be areas such as expenditure on education or expenditure on research and development, where the differences shown will require interpretation. Therefore, it seems reasonable to ask whether these interpretations will not affect the usability understood as data comparability. The answer to such a problem should be sought in the multi-criteria analysis, which is necessary to determine the current state. This will make it possible to identify possible future states and, consequently, to plan actions aimed at improving the situation in the studied areas.

Comparative analysis carried out in stages makes it possible to highlight a number of dependencies, at the same time illustrating -necessary for the proper conduct of the synthesis process-the links and complexity of these links. This leads to the question of whether the reference of the situation of the tested object to the background, i.e. preparatory analytical activities from the point of view of the proposed procedure, will be sufficient to discover and describe the existing complexity correctly (Staruch, 2019). Since the connections are unclear and the processes take place over time, the connections assessed after the fact will be an indicator of changes, translating into conclusions. Therefore, the conclusions resulting from the conducted analyzes may be subject to a certain degree of uncertainty, which in the extreme case may exclude them as a reliable research material for further work. This is especially important in the case of comparative analysis. Therefore, the analysis should be carried out in stages, so that - on the basis of the analytical background - it is possible to show dependencies in relation to the examined object or the analyzed issue. Hence the proposal of a procedure in accordance with the order of the procedure, namely: a) background analysis, b) analysis of the main issue, c) searching for and, consequently, demonstrating analytical connections or their absence. Comparative analysis therefore appears as a tool for balancing the uncertainty

accompanying research work, but only on the condition of properly conducted analytical work taking into account its phased nature.

The procedure described above is a consequence of the research assumption, indicating the need to conduct a targeted analysis to enable an indicator assessment that meets the needs of interpretation. Interpretation possibilities, in turn, result from the adopted assessment criteria. Hence, systematic considerations in the form of analytical comparative works aimed at demonstrating the existing similarities, connections or problems and their correlation seem to be the most advantageous analytical approach, i.e. a procedure providing a range of useful, reliable and, above all, comparable information.

3. Comparative analysis

A comparative analysis describing the social, economic or infrastructural situation in a broader context requires criteria and assessments that allow - not so much for measurement, but as a consequence - to compare the examined object (issue) with the environment (Bernat, 2019). Both reliable data and the correct procedure are necessary to achieve the research assumptions, but in order to implement such a process and obtain a positive correlation effect, it is necessary to carry out an analysis of the initial state in order to indicate the areas that should be included in the comparative analysis, but also to determine how to measure and assess the condition described by a given criterion (Rostkowski, 2019). The starting point for such considerations may be, for example: the social or economic situation analyzed in relation to the analytical background, not only in local but also global terms.

An example of the above-mentioned approach may be the Human Development Index (HDI), which reflects the quality of life, i.e. the situation of residents, describing very important, if not basic, areas of functioning of given communities, such as long and healthy life, knowledge and standard of living. In turn, an example of a useful aggregated data set is the statistical annex (Human Development Statistical, 2019) to the report on the standard of living, on the basis of which analyzes can be conducted in correlation with the HDI index. The possibilities of presenting the collected information are presented in Table 1. Such a juxtaposition shows the situation of the examined object (in the analyzed example, it concerns the country) against the background of the others, which will be the starting point for further analytical work.

Table 1.
Human Development Index HDI and its components

HDI 2017	Country/development level of the group/region	HDI	The life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita	HDI '16
Pos.	Name	value	number of years	number of years	number of years	2011 PPP $	Pos.
5	Niemcy	0,936	81,2	17	14,1	46136	4
19	Japonia	0,909	83,9	15,2	12,8	38 986	19
-	b. wysoki	0,894	79,5	16,4	12,2	40 041	-
27	Czechy	0,888	78,9	16,9	12,7	30 588	27
33	Polska	0,865	77,8	16,4	12,3	26 150	34
38	Słowacja	0,855	77,0	15,0	12,5	29 467	39
45	Węgry	0.838	76,1	15,1	11,9	25 395	45
-	Europa i Azja Środk.	0,771	73,4	14,1	10,3	15 331	-

Note. Gross national income (GNI) per capita estimated using purchasing power parity (PPP).

Source: http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf, 30.03.2020.

The HDI index (Table 1) makes it possible to compare social development. Dimensions describing the living space of the inhabitants of a given community (country) - i.e., a) the health dimension resulting from the assessment relating to life expectancy, b) the educational dimension defined as the average years of education for adults aged 25 and more and the expected years of education for children of school age starting education and c) the dimension reflecting the standard of living, which is determined by gross national income per capita (GNI per capita) - are the information basis for guiding further work.

Poland, like the other analyzed countries, is in the group of countries with a very high development index (33rd place in 2017 - an advancement by one place in the ranking compared to 2016, which takes into account the time factor) (Human Development Reports…, 2019). However, Poland, the Czech Republic and Hungary are below the average (0.894) of the HDI for very highly developed countries, which illustrates the differences.

The use of gross national income (GNI) per capita to assess the situation of inhabitants in the HDI index reduces the spreads that occur when using GDP as a measure, which also results from the use of the purchasing power parity rate (PPP). These differences - in the considered period - are significant, because in Poland GDP per capita is USD 13,811.66, and GNI measured (PPP) is USD 26,150, so GNI (PPP) is almost twice (1.893) higher than GDP. For comparison, the Czech Republic's GNI/GDP is 30588/20368.14, i.e. GNI(PPP) is 1.5 times higher than GDP. On the other hand, the GNI/GDP of Germany 46136/44469.91 (1.037) or Japan's GNI/GDP 38986/38428.10 (1.014) illustrate the existence of a different type of differentiation. Countries with very high development, which include Poland and other analyzed countries, occupy positions from 1 to 58, but within this ranking there are significant disproportions between them, which was shown by the comparison and differences in GDP and GNI. The observed discrepancies may have analytical consequences. The quoted comparison of GDP with GNI reflects the occurrence of significant or even fundamental differences, which illustrates the problem of interpretation possibilities resulting from the adopted indicator.

The assessment of the situation of individual objects (e.g. countries) or issues is crucial, but also difficult to carry out in practice, because it requires the use of a set of comparable criteria that reflect the situation, i.e. those that describe the reality and determine their value for the examined objects, also in the framework -if it's possible- of the research assumptions time horizon, which determines the adopted goal of the work, both in terms of needs and interpretation possibilities, translating into ("correct" - it should be clarified in context) recognition of implementation possibilities, i.e. an objective assessment of the situation. This requires the use of indicators that allow for comparative analysis. The use of generally known and commonly used global indicators, such as: GDP, HDI or locally developed indicators, such as the responsible development index (IOR) or sustainable development index (IZR) will be an acceptable way to measure the level of the status of the phenomenon (issue) or object under study at the stage of preliminary analytical work. However, the analysis of the background will not always be a reliable description of the examined dependencies, e.g. quality of life, which has been demonstrated by comparing the GDP and GNI indicators. Therefore, the reference to the environment, i.e. the study of the background, systematizes the situation of individual objects (e.g. countries) directing further work including analyzes of issues relevant in the context of possible mutual interactions, i.e. potential links, dependencies or interactions.

4. Conclusions

Comparative analysis, the purpose of which is to describe the occurring phenomena or to demonstrate the current state of the tested object against the reference background, is both a substantive and procedural challenge, so that the demonstrated dependencies or identified discrepancies are a description of the actual state, and not a reflection of interpretation differences related to the information the content of the presented indicators or a specific perspective of the application process. The need to provide reliable and comparable data requires a balance to be struck between the cross-cutting and the detailed nature of the issues covered at the preparatory stage. This prompts the search for methods that enable conducting targeted analytical work, as well as the use of stages in these works, which end with the algorithmization of the procedure, both at the stage of collecting information, as well as its development or visualization.

Both verifiable data and the correct procedure are the elements necessary to achieve the research assumptions, i.e. the description of the actual situation, the purpose of which is to demonstrate the presence or absence of connections and interactions, and thus correlation or lack thereof. The analysis of the initial state, by indicating the areas of comparative analysis, but also by defining the measures necessary to assess the state of the described objects and phenomena, requires many criteria, because only then can the considerations be conducted

contextually, e.g. in relation to the social situation or in relation to broader analytical background, both locally and globally. Sets of measures of indicators that take into account different assessment perspectives require more expenditure at the stage of analytical work. At the same time, this enables a more cross-sectional search of data sets in order to capture and highlight the existing differences, which in turn gives the opportunity not so much to improve the interpretation match as to limit interpretation differences, which are also a consequence of the analytical procedure itself.

Comparative indicative analysis based on aggregated data makes it possible to describe the situation of a given object or issue, taking into account the needs, but also interpretation possibilities. However, in order for the obtained information to be reliable, analytical work is necessary, taking into account both the reference background and multi-criteria indicative characteristics. The analysis of the background with the similarities shown allows to search for differences and indicate convergences, which may become the basis for further analytical work at the stage of studying the proper phenomena. Ratio analysis based on aggregated data improves procedural efficiency, but also reduces interpretation discrepancies, which is particularly important in the context of searching for correlations or showing dependencies that give a picture of probable future states at the stage of studying the phenomena proper.

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HOW DO YOUNG CONSUMERS SEE FAMILY FIRMS? EMPIRICAL EVIDENCE FROM POLAND

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Purpose: In this paper we investigate how young consumers see family-owned firms and products provided by this group of business entities.
Design/methodology/approach: The study was designed to be conducted on a population of young consumers who are currently at the stage of increasing their knowledge about the principles of market operation and running a business. The structured online web interview (CAWI) method was selected. A total sample of N = 1069 consumers aged 20-25 years completed the survey. A series of C&RT was conducted. In order to test the model's generalizability and provide an insight on how the model will predict new independent data such an unknown dataset, a procedure of k = 10-fold cross validation was used, using a randomly selected sample called Train Data.
Findings: Results of the study revealed that consumers are positively oriented towards products made by family-owned companies. They are highly convinced that signing products with family-owned trademarks emphasizes their family character. About 20% consumers declare to notice family firm trademarks in the products offered. The most important values sought in products by young consumers are: product quality, price and quality of ingredients, while three most significant features of family-owned businesses perceived by young consumers are tradition, low scale of production and high quality of products indicating high reputation of family-owned businesses.
Research limitations/implications: The main limitation of this study results from the lack of full representativeness of the examined sample. The research looked at young consumers, so the conclusions cannot be applied to consumers with different demographic characteristics. The second limitation is the type of research tool used. The questionnaire allowed only to diagnose subjective beliefs about one's own preferences and attitudes, and not to study real shopping behavior.

Practical implications: The findings complement the current discussion of the uniqueness of family firms. They might also help family business owners to increase efficacy of their marketing activities.
Originality/value: The paper explores the research gap in the area of the attitudes of young consumers, who have knowledge of market mechanisms, towards family businesses and products offered by this group of business entities.

Keywords: family business, perception, young consumers.

Category of the paper: Research paper.

Introduction

Family firms are the oldest and most widespread business entities making a major contribution to GDP generation in most countries (Colli, 2002; Ramadani et al., 2020). Their stability is crucial for global economic growth (Ramadani, Hoy, 2015). According to data from the Central Statistical Office, there are over 2 million family businesses in Poland, which generate 63-72% of GDP and generate about 8 million jobs. The important social and economic role played by family businesses makes them the subject of a high number of research papers (D'Angelo et al., 2016; Kellermanns et al., 2008; Schwass, Glemser, 2016; Sharma, Chrisman, Gersick, 2012; Dorda, Shtëmbari, 2020; Haynes et al., 2021; Rovellii et al., 2021; Aparicio, 2021). In spite of the fact that different aspects of functioning of family businesses have gained better understanding for the last decades, research areas worth deeper investigation can be identified. A relatively poorly recognized aspect of family business research is the area of consumer perception of family businesses (Elsbach, Pieper, 2019; Andreini et al., 2020; Sharma et al., 2020; Schellong et al., 2019; Beck, Prügl, 2018; Köhr et al., 2021; Rajan, Salunkhe, Kumar, 2023; Bargoni et al., 2023). This paper, taking inspiration from the study by Andreini et al. (2020), aims at exploring how consumers see family firms. The study was designed to be conducted on a population of young consumers who are currently at the stage of increasing their knowledge about the principles of market operation and running a business on the Polish market. The structured online web interview (CAWI) method was selected (Salant, Dilman, 1994). A total sample of N = 1069 consumers mostly aged 20-25 years completed the survey. The study contributes to traditional literature on the relationship between consumers and family business by accounting how family firms are 'seen' by young consumers. It can enrich the knowledge of family business owners and managers in terms of selecting the optimum cooperation strategies towards their stakeholders-consumers.

This paper is organized as follows. The introduction addresses the problem of perceiving family firms and family firm products by the group of young consumers. In the following section selected factors referring to consumer perception are described in the context of the specificity of family firms. The next section presents research methods, procedures and

measures. This section is followed by the analysis of the results obtained in this study. The paper ends with concluding comments and implications for further research.

Literature review

The important social and economic role played by family businesses makes them the subject of much research. Their stability is crucial for global economic growth (Ramadani, Hoy, 2015). An increase in interest in the subject of family business was recorded at the turn of the 70s and 80s of the twentieth century, and the dynamic development of research has occurred in the last twenty years (D'Angelo et al., 2016; Kellermanns et al., 2008; Schwass, Glemser, 2016). Their stability is crucial for global economic growth (Ramadani, Hoy, 2015). An increase in interest in the subject of family business was recorded at the turn of the 70s and 80s of the twentieth century, and the dynamic development of research has occurred in the last twenty years (Debicki et al., 2009; Chrisman et al., 2010; Gedajlovic et al., 2012; Aparicio et al., 2021; Rovellii et al., 2021). Researchers place particular emphasis on explaining the specificity of family businesses resulting from the involvement of the family in the functioning of family businesses (Sharma et al., 2012; Chrisman et al., 2003; Chua et al., 1999; Haynes et al., 2021).

Similarly, brand and reputation play an important role in determining a company's behavior and performance. However, despite a significant increase in research on family businesses over the past two decades, the application of marketing theories and concepts in the context of family businesses is limited. Alonso Dos Santos, Llanos Contreras, Mahto (2021) postulate the need for research to better understand reputation, branding, communication and marketing prospects in family businesses. Cuevas Lizama, Llanos Contreras, Alonso Dos Santos (2021) indicate that research on the strategic value of the reputation and identity of a family business is still a topic not fully explored, and there is no complete clarity as to what the reactions of different interest groups will be when these elements are communicated to them. A relatively poorly understood aspect of research on family businesses is also the issue of consumers' perception of family businesses (Andreini et al., 2020; Schellong et al., 2019; Beck, Prügl, 2018; Elsbach, Pieper, 2019). The research conducted by Nikodemska-Wołowik et al. (2020) among Polish consumers shows that the level of knowledge of family businesses by consumers is low. Little research has been devoted to the issue of whether family businesses gain advantages or disadvantages over non-family businesses in terms of consumer perception and behavior (Lude, Prügl, 2018). Shen and Tikoo (2021) investigated whether there is a link between family identity disclosures by companies and consumer product ratings, and whether there is an impact of company size on that relationship. Alonso-Dos-Santos et al. (2019) found that passing on the family identity of a business positively affects the purchase intention of potential consumers. However, other research suggests that the term "family business" can generate both positive and negative

associations from different stakeholders – suppliers, customers, and communities (Botero, Litchfield-Moore, 2021). Small family businesses can create a strong brand with emotional added value, which will bring them a competitive advantage (Tien, 2021).

In today's competitive environment, the growth and survival of family businesses depends to a high extent on how much they can build, expand or reconfigure organizational capabilities in response to a changing environment (Kayid et al., 2022) and in response to the requirements of the sustainable growth. One of the aforementioned capabilities is family firms' the ability to encourage consumers to buy their products and services (Compare also Galvagno et al., 2023). This process depends to a high extent on how consumers perceive these firms and products they offer.

Consumer behavior includes two types of activities 1. physical activities, such as acquiring, using, disposing of a product, and 2. mental activities. The second type of activity often preceeds and conditions physical activities. This includes among others: realizing the need to have a good, obtaining and processing information about alternative ways of satisfying a perceived need, making a choice specific product and its evaluation in the course of use, expressing emotions before, during and after the purchase (Antonides, van Raaij, 1998).

In this paper, attention has been paid to consumer activities understood as activities related to the choice of a consumer good of a specific origin. These types of activities are shaped by many variables, including perception and beliefs. Perception is understood as a set of processes taking place in the human psyche that contribute to a subjective image of an object or phenomenon. It includes acquiring - by means of the senses - information about objects/phenomena, as well as their interpretation and use for the needs of a specific activity. Perception is also associated with noticing (realizing) the existence of something. In the literature on psychology, two concepts of the emergence of perceptions are indicated: the first assumes that the consumer's knowledge, experiences, expectations, motivation and education influence the way of defining and classifying the observed object. The second concept indicates the importance of information from the environment in creating a pattern (the so-called cognitive representation), which becomes a reference point in the process of recognizing and analyzing objects. According to this approach, the consumer combines information and organizes it in memory in such a way as to facilitate the interpretation of new stimuli reaching him, and then uses it in the process of satisfying his needs (Kapoor, Madichie, 2012).

The consumer's perception is an essential condition for the company's marketing activity. It determines which of the mechanisms of persuasion (i.e. the mechanism of evoking emotions or evoking associations) should be chosen in order to build effective advertising of products. By choosing the right approach, you can create preferences for specific products and an appropriate attitude to family entities as producers of consumer goods.

The emergence of consumer beliefs about an enterprise or a product is conditioned on the one hand by his perceptual abilities (sensory perception), and on the other hand, by many psychological factors. They can have both a mental and a preparatory source. The consumer's mental attitude towards an enterprise / product results from all his convictions, attitudes, views and way of thinking characteristic of the social group he belongs to (Bednarz et al., 2022; Botero, Litchfield-Moore, 2021). On the other hand, the preparatory attitude results from previous purchasing experiences, on the basis of which the consumer predicts the occurrence of certain features of the objects.

Andreini et al. (2020) confirmed that consumers play a major role in shaping 'these firms' family nature 'as a key attribute upon which the purchasing process may depend'. The findings by Andreini et al. (2020) contribute firms' family nature by introducing a new ontological perspective, one in which consumers are actively involved in forming the meanings implied in firms' family nature at the micro, meso and macro levels. In other studies family businesses were perceived by the consumers as human (Beck, Prügl, 2018, Jaufenthaler 2023) as well as being sensitive to social responsibility (Panwar et al., 2014; Schellong et al., 2019). Family owned firms were also confirmed to be seen as authentic (Lude, Prügl, 2018). They enjoy a better reputation than non-family businesses (Cuevas Lizama, 2021). A high number of studies confirmed that companies owned and controlled by families are highly trustworthy (Binz et al., 2013; Duncan, Hasso, 2018). Signalling the family nature of the business to consumers can contribute to a competitive advantage over non-family businesses (Rauschendorfer, Prügl, Lude, 2022). Research shows that family businesses do not always inform consumers of their family identity and customers are not always aware that they are dealing with a family-owned business (Ibáñez et al., 2022).

The aforementioned explains customers' positive or negative influence on the sale of family firms' products and services. From this perspective it is crucial for family business owners and managers to understand and monitor how consumers perceive their business and products or services offered. The important questions to be answered are: 1. what are the permanent and 2. what are the occasional characteristics attributed to the family business; what are the expectations of consumers towards family businesses, what emotions consumers are aroused by information about the family nature of the provider of goods and services. This is possible among others by probing and clarifying the associations associated with the term "family business". The level of knowledge of family business brands and the opinions formulated by young consumers as recipients of marketing activities are an important guideline for the company regarding marketing communication and designing buyer experiences.

Research methods

The study was designed to be conducted on a population of young consumers who are currently at the stage of increasing their knowledge about the principles of market operation and running a business on the Polish market. The group of young people aged 20-25 years, due to their high involvement in using social media, is currently a significant leader in shaping opinions on particular products and services offered by different companies (Compare Bergstroem, Jervelycke-Belfrage, 2018). From this point of view it is of importance for every business manager to know how this group of consumers perceives products offered and what are the values associated with both the business and the products. The structured online web interview (CAWI) method was selected (Salant, Dilman, 1994). A total sample of N = 1069 consumers, mostly aged 20-25 years, females in majority, completed the survey and n = 19 (1.8%) were excluded from further analyses due to incomplete or unreliable response.

To get a deeper understanding of what we know about how consumers form meanings about family firms, a series of C&RT (Decision Making Tree Analyzes) was conducted. Each of them allows us to detect the conditions under which consumers form beliefs about the 'essence' of family businesses in conjunction with their orientation on products made by family-owned businesses.

In order to test the model's generalizability and provide an insight on how the model will predict new independent data (i.e., an unknown dataset), a procedure of k = 10-fold cross validation was used, using a randomly selected n = 737 (70.2%) sample called Train Data. The model estimates were then tested on the data obtained from the Test Data (n = 313, 29.8%) that had not been used in the estimation procedure. The C&RT procedure was selected because of its stability in multicollinear data estimation (Gupta et al., 2017), which is the case in this study, where the indices describing consumers' convictions about family company brands were obtained in the survey.

In order to assess the consumer's convictions about family companies and orientation towards their products, an online survey was carried out, comprising four sections addressing three objectives: 1. acquisition of sociodemographic characteristics (i.e., sex, age, level of education, size of the place of consumer's residence); 2. assessment of the consumers' orientation on products offered by family companies (i.e.); 3. general convictions about family-owned companies and their products (i.e. honesty, traditions, low scale of production, high quality of products, reliability, responsibility etc.); and 4. consumer values sought in the product (i.e. price of the product, quality, ingredients, product design and origin).

Research results – analysis

The consumer orientation on products made by family-owned companies was measured using four statements: 1. Information that a product is made by a family company is of importance to me; 2. I notice the family business brand labels/tags in branded graphics of products; 3. I am convinced that family firm brand labeling/tagging emphasizes product traits; and 4. I am willing to pay a higher price for a product made by a family company. The first and second statements let us measure convictions about products made by family-owned businesses and the third and fourth statements measure the behavioral aspect of consumer's orientation towards products made by family-owned businesses.

Table 1.
Summary of Consumer's Orientation Towards Products Made by Family-Owned Businesses Obtained in the Test Sample (n = 313)

Aspect of Consumer's Orientation	Consumer's Response		
	No	Uncertain	Yes
Conviction that Signing Goods with Family Brand Marks Emphasizes the Trade	5.4%	24.6%	70.0%
Readiness to Pay a Higher Price	41.1%	37.5%	21.4%
Conviction on Importance of Family Brand Marks	50.0%	30.7%	19.3%
Noticing Family Businesses Brand Marks Located in Products Design	62.5%	13.9%	23.6%

Source: Authors'own survey.

Customers generally agree that branding products with family brands emphasizes the trade [70.0%], for other aspects of orientation towards products made by family-owned businesses about 20% [between 19.3% for convenience about importance of family brand marks and 23.6% for noticing them] consumers are positively oriented towards products made by family-owned companies.

In order to assess consumers' convictions about the 'essence' family-owned businesses, based on their impressions, the participants were asked to indicate three, out of eight, attributes describing a typical family company, or list any additional attributes, if needed. The predefined options encompassed: a) Honesty, b) Tradition, c) Small Scale of Activity, d) Low Product Quality, e) High Product Quality, f) Solidity, g) Responsibility. These predefined options were selected based on the literature (Andreini et al., 2020; Fernández-Aráoz et al., 2019).

Table 2.
Summary of Frequency Indicating by Consumers Features of Family-Owned Businesses

Features	%
Tradition	80.2
Low Scale of Production	48.9
High Quality of Products	36.7
Honesty	29.7
Reliability	29.4
Responsibility	24.0

Source: Authors'own survey.

Results revealed that three most commonly indicated features in population of young consumers are Tradition (80.2%), Low Scale of Production (48.9%) and High Quality of Products (36.7%) indicating high reputation of family-owned businesses in this population.

In order to assess the importance of values sought by young consumers in products the participants were asked to rank between 0 (meaning "Not At All") to 10 (meaning "Most Important") of five key features sought in products they usually buy.

Table 3.
Summary of Analysis of Importance of Values Sought in Products in Young Consumers' Population

Values Sought in Products	M	SD	Q2	Skew	Kurt	SE
Quality of Products	7.59	2.32	8	-1.22	0.863	0.0855
Price	7.05	2.50	8	-0.878	-0.0177	0.0919
Ingredients	5.92	2.74	6	-0.366	-0.811	0.101
Product Design	5.76	2.74	6	-0.305	-0.861	0.101
Product Origin	4.12	2.63	4	0.190	-0.841	0.0970

Note: M - Mean; SD - Standard Deviation; Q2 - Median; Skew - Skewness; Kurt - Kurtosis; SE - Standard Error of The Measure.

Source: Authors'own survey.

Results of the analysis revealed that most important values sought in products by young consumers are Quality of Products (M = 7.67; SD = 2.28), Price (M = 7.05; SD = 2.39) and Ingredients (M = 6.08; SD = 2.96). Although the product origin and design are the values less important in consumer's hierarchy, their importance is estimated about 5 (the midpoint of the scale) [i.e. Product Design (M = 5.73; SD = 2.64)] and Product Origin (M = 4.23; SD = 2.64)].

Results revealed that consumers are positively oriented towards products made by family-owned companies, they are highly convenient that signing products with family-owned brands' logos emphasizes the trait and about 20% consumers declare to notice such marks located in product design. The most important values sought in products by young consumers are *quality of products*, *price* and *quality of ingredients* and three most common features of family-owned businesses perceived in the population of young consumers are *tradition, low scale of production* and *high quality of products* indicating high reputation of family-owned businesses.

Four decision tree models were estimated in the Train Sample (*n = 737*) to describe rules of predicting different aspects of consumer's orientation towards products made by family-owned businesses. Then predictions were tested against the data obtained in the *Test Sample* (*n = 313*) to test the validity of established models. Summary of the analysis is presented in table below (Table 4).

Table 4.
Summary of Predictive Validity of C&RT Models in the Test Sample (n = 313)

Prediction	Conviction that Signing Goods with Family Brand Marks Emphasizes the Trade, %			Readiness to Pay a Higher Price, %			Conviction on Importance of Family Brand Marks, %			Noticing Family Businesses Brand Marks Located in Products Design, %		
	No	Uncer-tain	Yes	No	Uncertain	Yes	No	Uncertain	Yes	No	Uncertain	Yes
No	0.0	0.0	0.5	78.4	50.9	26.8	72.5	45.8	37.5	91.9	92.9	79.7
N.S.	22.2	30.3	7.8	10.4	34.3	32.4	18.3	36.5	17.2	2.0	2.4	0.0
Yes	77.8	69.7	91.8	11.2	14.8	40.8	9.2	17.7	45.3	6.1	4.8	20.3
Summary of Model Validity												
Accuracy	0.716 (0.662; 0.765)			0.546 (0.489; 0.602)			0.559 (0.502; 0.615)			0.629 (0.573; 0.683)		
Kappa	0.224 (0.117; 0.327)			0.280 (0.175; 0.379)			0.276 (0.171; 0.111)			0.107 (0.004; 0.215)		
Sensitivity	0.000 (0.00; 0.01)	0.302 (0.25; 0.35)	0.917 (0.89; 0.95)	0.784 (0.74; 0.83)	0.3426 (0.29; 0.40)	0.4085 (0.35; 0.46)	0.726 (0.68; 0.76)	0.365 (0.31; 0.42)	0.453 (0.40; 0.51)	0.918 (0.89; 0.95)	0.023 (0.01; 0.04)	0.202 (0.16; 0.25)
Specificity	0.996 (0.99; 1.00)	0.911 (0.88; 0.94)	0.287 (0.24; 0.34)	0.587 (0.53; 0.64)	0.8195 (0.78; 0.86)	0.872 (0.84; 0.91)	0.575 (0.52; 0.63)	0.820 (0.78; 0.86)	0.876 (0.84; 0.91)	0.155 (0.12; 0.20)	0.985 (0.97; 0.99)	0.941 (0.92; 0.97)

Note: N.S – Uncertain.

Source: Authors'own survey.

Results of the analysis revealed that the best predicted aspect of orientation towards products made by family-owned businesses is conviction that signing them with family brand logo emphasizes the trait [*Accuracy = 0.716, CI95 = (0.662, 0.765)*], meaning that about 71% of young consumers can be accurately predicted by rules in the assessed model. Although the model is accurate, detailed inspection revealed that it is valid in prediction of positive orientation in this aspect [*Specificity = 0.917, CI95 = (0.89, 0.95)*] accurately predicting orientation in a group of consumers who are convinced that signing products with the logo of a family brand emphasize the trade, but validity of predictions that consumer is unconvinced or is convinced that signing products with that logo would not emphasize the trade are insufficient [*Specificity = 0.000, CI95 = (0.00, 0.01)* and *Specificity = 0.302, CI95 = (0.25, 0.35)* respectively].

Results of the analysis revealed that majority, i.e. 65.4%, of consumers who declare value product design low notice family brand marks located in products designs and live in cities above 20 000 inhabitants (*n = 17/26*), but it is the very small sample of the entire group (*4%*). Consumers who declare they do not notice the family brand logos in product design are in majority (i.e. 62,8%) those who value high (i.e. higher than 2/10) esthetics of product design (*n = 384/611*).

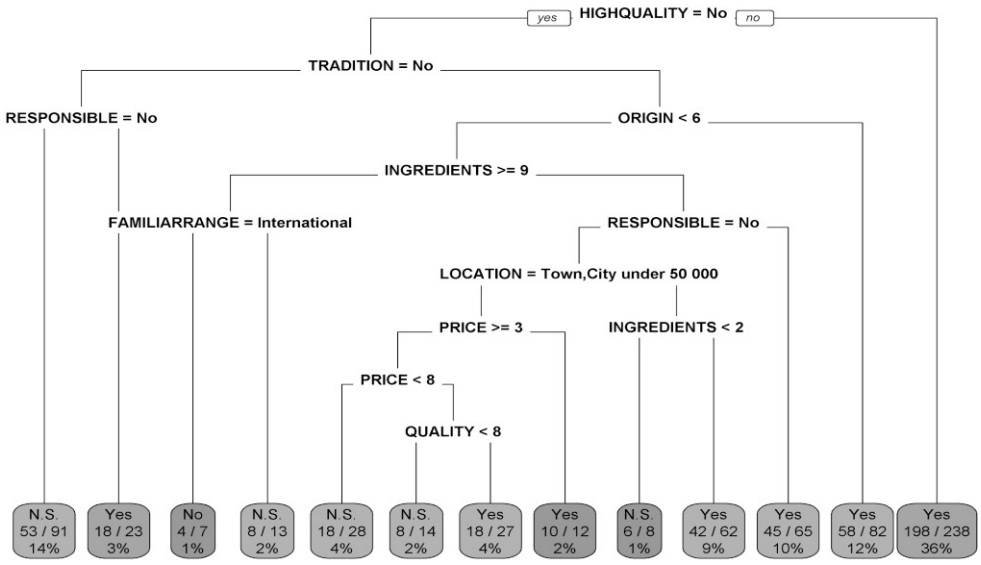

Figure 1. Decision Tree Model Assessed to Predict if Consumer Notice if Products are Made by Family-Owned Companies.

Source: Authors'own survey.

Model assessed to predict if consumers notice family-owned brand marks located on products revealed that the only accurate prediction can be made for those consumers, who do not notice those marks (n = 384/611; 91%). These consumers tend to pay attention to product design. The most accurate predictions if consumers notice family-owned companies' brand marks located on product design are consumers not living in town or cities under 50 000 inhabitants and not being concentrated in product design.

Model assessed to predict if consumers are convenient about the significance of marking products with family brand logos revealed that consumers who do not perceive products made in family-owned companies as products of high quality in majority (i.e. 55.1%) do not agree if it is significant to mark products with family brand logos (*n = 288/432*). Consumers over 25 years old, who perceive products made in family-owned businesses as products of high quality are in majority (i.e. 568.1%) either convenient about the significance of marking them with family brand logos (*n = 18/31*).

Results of the analysis revealed that 83.2% (*n = 198*) of consumers being concerned about high quality of products made in family-owned companies 38% (*n = 238*) are either convinced that marking products with family-owned business logos emphasizes the trade. If consumers are convinced that the products produced in family businesses are not of high quality, they need to perceive *Tradition* as one of the most important feature of those businesses and do not highly value products design (i.e. less than 6/10) to be convenient about the facilitating the trade with family-owned brand logos located in product design (*n = 58/82*) or they don't value highly (ie. less than 9/10) the quality of ingredients and perceive family-owned businesses as reliable (*n = 45/65*). Most frequently consumers unconvinced about the facilitating effect of family-

owned brands logos in product design are those who do not see them as products of high quality and traditional and do not perceive family businesses as reliable (*n = 53/91*).

Results of the analysis revealed that consumers who are convenient that marking products with the logo of family-owned brands emphasizes the trade are in majority those who point that one of most important features of family-owned businesses is that their product can be characterized with high quality (n = 198/238, 36%). Moreover the model predicts that the majority of consumers uncertain if marking products with family-owned brand logos emphasizes the trade are those who either do not point that products made by family-owned businesses are characterized with high quality or those companies are traditions and either responsible for their products (n = 53/91, 14%).

Predicting if consumers is ready to pay a higher price or products made in family-owned companies is most accurate (i.e. 55.9%) if consumers perceive the high quality of these products and reliability of these businesses (*n = 33/59*) or if they do not perceive family-owned businesses as reliable they moderately value the price of products (i.e. between 5 and 7) and they perceive the high quality and solidity of products made in family-owned companies (*n = 19/34*). Consumers convinced they are not ready to pay a higher price for products made in family owned companies are in majority (i.e. 71,8%) males who perceive products made by family-owned companies as not solid and not of high quality (*n = 84/117*) or females who do not value the product's origin (i.e. less than 5/10) and quality (i.e. less than 3/10) and do not point honesty solidity of products or their high quality as main features of family-owned businesses (*n = 54/75*).

Results of the analysis revealed that the model of predictions if consumers are likely to pay a higher price for products made by family-owned companies is the most complicated of all assessed models. The most accurate predictions can be made for consumers, who are uncertain if they are ready to pay a higher price for product made by family-owned companies (n =54/121; 18%) who pay a high attention to product price and point that high quality of products is one of features describing family-owned businesses and either responsibility for products is not a feature describing it. Consumers who are certain they do not want to pay a higher price for products made by family-owned companies are those who are not likely to pay a higher price for products made by family-owned businesses (n = 84/117; 17%), who are males and do not point either high quality either solidity of products as one of features describing family-owned businesses. The other way that being certain that consumer is not ready to pay a higher price for products made by family-owned companies is being the college student, who do not pay a high attention to product origin and pointing high quality but not solidity of products as descriptors of the family-owned businesses 'essence' (n = 40/74, 11%). The third most common conditions predicting accurately that consumers do not want to pay a higher price for products made by family-owned companies is if consumer are females pointing honesty but either do not point the high quality or solidity of products as one of best descriptors of family-owned businesses and paying high attention to product quality but not the product origin (n = 54/75; 11%).

In order to estimate the importance of each predictor in every model of prediction of customer's orientation towards products made in family-owned companies, a series of analyses were conducted using a Gawrey at al. (2003) method. In each analysis the series of simulations is conducted to estimate the difference in accuracy of the model if a particular predictor is absent, and then values are ranked in a range of 0 through 100, where 0 means the smallest and 100 means the highest change in accuracy indices if predictor is excluded from the model (Quinlan, 1992). Results of the analysis conducted to estimate the importance of each predictor in predicting each particular aspect of consumer's orientation towards products made by family-owned companies is presented in a table below.

Table 5.
Summary of Importance of Predictors in Tested Models

Predictors	Rank of Predictor Importance			
	Notice	**Significance**	**Emphasize**	**Higher Price**
Demographic Characteristics				
Gender	35.36	8.46	92.62	6.46
Age	73.15	39.69	8.03	24.72
Education Status	28.54	20.23	4.23	20.46
Location	54.98	7.55	16.42	23.35
Familiarity with Family Brands				
Being Familiar With Family Brands	88.00	18.37	27.10	6.91
Level of Familiarity With Family Brands	95.74	19.82	27.64	4.21
Category of Family Brands Known	93.72	19.47	27.57	6.99
Hierarchy of Consumer's Values Sought in Products				
Price	31.83	49.16	38.96	32.66
Quality	12.67	0.00	30.97	1.99
Origin	0.10	65.31	40.87	22.51
Ingredients	10.77	43.14	3.40	6.58
Design	100.00	34.77	15.56	19.28
Feature Sought in Family Brand Nature				
Honesty	34.04	67.48	30.63	47.70
Tradition	4.42	4.96	61.26	13.56
Low Scale of Production	37.97	46.95	15.23	47.81
High Quality of Products	97.05	100.00	100.00	100.00
Reliability	42.57	75.30	44.87	62.80
Responsibility	25.64	35.51	30.28	20.01

Source: Authors'own survey.

Results of the analysis revealed that the most important predictor of consumer's orientation towards products made by family-owned companies is convenience about high quality of products, which is the most important predictor in all aspects of orientation towards products made by family-owned companies except of noticing marks of family-owned companies, which rank is marginally smaller (*Importance = 97.1*).

Tradition is the feature sought in family-owned companies that is quite not important in predicting if consumer notice the family-owned companies brand marks or even is convenient about their significance (*Importance < 5.0*), but tradition is one of most important predictors in prediction if consumer is convenient about emphasizing the trade with marking products with family-owned logos (*Importance = 61.26*), and is not trivial in predicting if consumer is ready to pay a higher price for products made in family-owned companies (*Importance = 13.56*).

Demographic characteristics are generally poor predictors of consumers orientation towards products made by family-owned companies, except of the gender which is one of the most important in predicting if the consumer is convenient about the emphasizing role of marking products with the family-owned brand marks in the trade (*importance = 92.6*).

The less important aspect of family-owned companies in predicting the consumer's orientation towards their products is the responsibility, which is the fifth (of six) important features in describing the 'essence' of family-owned companies to predict any of aspect of orientation towards products made by family-owned companies.

Conclusions

Products of family businesses are positively perceived by young consumers. They evoke positive associations because they are associated with tradition, uniqueness resulting from the small scale of production and high quality. At the same time, it has not been confirmed that the family character of the product manufacturer translates directly into the purchasing intentions of this group of consumers. The most important criteria for choosing products that they are aware of are: quality, price and composition. Their origin (e.g. from a family business) is of medium importance for shaping purchasing decisions and is not a prerequisite for young consumers to pay a higher price for a product. The most important predictor of consumer orientation to products manufactured by family businesses is their high quality. Consumers who are convinced that branding products with the logo of family brands emphasizes their commercial value are mostly those who indicate that one of the most important features of family business products is their high quality, which is one of the key determinants of purchase intentions. It can therefore be concluded that the high quality of products is an intermediary variable between the positive perception of family businesses and the purchasing intentions of young consumers.

At the same time insufficient effectiveness of marketing communication of the analyzed companies was identified, since only about 20% of consumers declare noticing family business marks on the products offered. On this basis, it can be cautiously concluded that family businesses in Poland do not effectively expose their family character in product labelling.

Like any scientific study, this too has its limitations. First of all, they result from the lack of full representativeness of the examined sample, which were students. The research looked at young consumers, so the conclusions cannot be applied to consumers with different demographic characteristics. The limitation is also the type of research tool which was used. In the study. The questionnaire allowed only to diagnose subjective beliefs about one's own preferences and attitudes, and not to study real shopping behavior. From this perspective, it would be interesting to study the actual perceptions of consumers using other research instruments, for example, an experiment. It would also be valuable to extend the scope of research to other countries in order to identify the impact of cultural variables on the perception of family businesses.

Despite these limitations, it is worth paying attention to the fact that no simple correlation between the family nature of the company and the declarations of young consumers regarding the priority in choosing their products or the willingness to pay a higher price for the good produced by these enterprises was confirmed. At the same time, the positive perception of this group of business entities was confirmed, and the role of product quality was identified, which is a moderator between the perception of family businesses and the shopping intentions of young consumers. This means that family-owned companies can be a potential source of their competitive advantage by strengthening the image of these entities as companies that attach particular importance to the quality of products. This element should be more prominent in the marketing communication of family businesses. At the same time it worth emphasizing that increasing efforts towards building relationships with consumers as strategic stakeholders of family business should be supported, as Bieniok underlines (2020) by activities directed towards protection of the natural environment.

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DETERMINANTS OF CAPITAL STRUCTURE FORMATION IN INTERNATIONALISED COMPANIES

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Purpose: The aim of the article was to examine the level of debt value in companies pursuing international expansion in food sector in India, against the background of macroeconomic indicators.
Design/methodology/approach: The following methods were used in the article:1. Calculation of statistical descriptive values for debt level, revenue and total assets, 2. A parametric Student's t-test to test for differences in the capital structures of the companies studied, 3. The Pearson coefficient for determining the relationship between capital structure and the ratio of revenue generated from international sales to total sales revenue. Sixty-five companies from the food sector in India participated in the study. The study covered the period 2014 - 2021.
Findings: The results of the used study indicate that there is a steady decline in the level of corporate debt and an increase in revenues. This is associated with an increasingly better financial situation of the companies - an increase in revenue levels and an increase in foreign direct investment (increasing macro environment indicators). The results presented confirm previous findings in the literature.
Originality/value: In the article, the obtained results allowed capturing the unique relationship between debt structure and internationalisation of enterprises in the food sector. An additional value is the presentation of the relationship between the formation of macroeconomic factors and the internationalisation process.

Keywords: capital structure, internationalization, macroeconomic indicators.

Category of the paper: Research paper.

1. Introduction

The financial strategy of a company and its important effect, the capital structure, change in companies depending on factors of both a macroeconomic and microeconomic nature.

In addition to these factors, which play an important role in the case of domestic enterprises, in international enterprises (which are in various stages of internationalisation), additional factors play a role, such as political risk, currency exchange rate changes, the specifics of the

host country's development processes, differences in capital costs between countries and many, many others.

Based on the literature collected and empirical research conducted in a selected country with a globally significant economy (India), the Author identifies the role of internationalisation in shaping capital structure against other factors influencing changes in the capital structure of firms.

As a result, he or she can determine whether debt (and hence the share of foreign capital in total financing) is increasing or decreasing in multinational companies. It is also valuable to compare companies producing exclusively for the domestic market and internationalised companies, taking into account changes in capital structure.

2. Factors influencing the formation of capital structure in multinationals

In studies on the formation of capital structure in internationalised enterprises, great attention is paid to the existence of differences or similarities in terms of the impact on capital structure of various factors relevant to the operation of the enterprise. Thus, for example, J. Wald, studying French, German, Japanese, British, American (USA) companies, found that correlations between the long-term debt ratio and such company characteristics as:

- risk taken in the business,
- profitability
- the size of the company,
- its growth tendencies, are similar in the companies of the countries studied, but there are also differences.

Germany was the only country where large companies have a relatively lower level of total debt. In France, there was a positive correlation between a company's size and its indebtedness, but this relationship was still weaker than in the United States, the United Kingdom or Japan. In contrast, among the countries surveyed, the United States was the only country where company growth was correlated with lower debt levels. In contrast, the profitability of the companies surveyed was negatively correlated with their level of debt. This correlation was most pronounced in the UK, Germany and France. It is therefore difficult to find clear correlations between the characteristics of the countries in which the companies studied were located and the way in which the above-mentioned factors affect debt levels and capital structure.

Other studies were carried out by (Cappa et al., 2020). They studied three factors that they classified as part of a company's strategy:

- internationalisation,
- diversification,
- vertical integration.

They concluded from their research that internationalisation and integration of a company are negatively correlated with its debt, while diversification is positively correlated. This is understandable as diversification processes in a company create additional costs, which increases the need to raise external funds.

A study carried out between 2012 and 2016 on a group of 170 Italian listed companies, proved that any change in a company's strategy affects its capital structure and therefore its debt level. Some studies refer to the food industry. Thus, for example (Serrano et al., 2018) point to differences in the financial situation of food companies depending on the phase of the company's internationalisation process. In the first phase - export, profits are low, also due to the incurring of costs initiating export activities - this can result in an increased need for foreign capital. In the second phase - profits increase due to economies of scale - growth to a greater extent can be financed by profits.

Third phase - the company is highly internationalised, with geographic differentiation of individual components (subsidiaries) and (especially in the food industry) the costs of entering regional markets are reduced. Cost reduction is achieved through the skillful application of a global strategy. The problem of shaping the capital structure under the influence of various factors, both external and internal, is also addressed in the Polish literature (Gostkowska et al., 2022) described the formation of the capital structure in the enterprises of the Visegrad countries (Poland, the Czech Republic, Slovakia, Hungary) with the determination of factors that influence the capital structure of enterprises in these countries.

The research covered 259 listed companies between 1998 and 2020. Six hypotheses were adopted:

1. A negative relationship exists between company growth and debt levels;
2. Liquidity and debt level are negatively correlated;
3. A negative relationship exists between taxation and debt;
4. A positive relationship exists between asset structure and debt;
5. A positive relationship between company size and debt;
6. A positive relationship between asset structure and debt.

The study found that the 5th and 6th hypotheses did not hold - negative relationships were obtained. Much also depended on country specifics. In the Czech Republic and Slovakia there was a correlation between the profitability of the company and the level of debt, in Poland and Hungary there was no such correlation. In the Czech Republic, company size was positively correlated with debt, in Poland and Hungary it was negatively correlated, and in Slovakia there

was no relationship between these quantities. The nature of the other correlations was confirmed. In most countries thus:

1. Debt profitability is negatively correlated with debt;
2. In the developed market economy countries, the size of a company (except Germany) is positively correlated with its debt; in the Visegrad countries (except the Czech Republic) there is no such correlation;
3. Firm growth is negatively correlated with debt (apart from the United States).

Undoubtedly, both high liquidity and high taxation may induce companies to reduce debt - although the behaviour of companies may vary due to the differential effect of these factors.

3. India's economy and food sector

The Indian economy ranks third in Asia, behind China and Japan, in terms of GDP. India is among the fastest growing countries in the world. The average growth rate has remained around 6% per annum over the past few years. India's economy is dynamic and diverse, which makes the country play a significant role on the international stage. Growth to date has been supported by strong investment activity, bolstered by the government's increase in capital expenditure and buoyant private consumption, particularly among higher income earners. Inflation remained high, but the current account deficit narrowed in Q3 2022 as a result of strong growth in services exports and a decline in global commodity prices.

The World Bank revised its GDP forecast for fiscal years 2023 and 2024 to 6.3% from 6.6% (December 2022). Growth is expected to be constrained by slower consumption growth and difficult external conditions. Rising borrowing costs and slower income growth will weigh on private consumption growth, while government consumption is expected to grow at a slower pace due to the withdrawal of pandemic-related fiscal support measures. The Reserve Bank of India has withdrawn measures to curb inflation by raising the interest rate. India's financial sector also remains strong, driven by improving asset quality and strong private sector credit growth.

The central government is likely to achieve its fiscal deficit target of 5.9 per cent of GDP in the coming fiscal year. The level of the general government deficit is also expected to decline. The current account deficit is projected to narrow to 2.1 per cent of GDP from an estimated 3 per cent in FY 2023/2024, thanks to strong services exports and a narrowing merchandise trade deficit (Report, 2023).

The food sector is one of the most developed sectors in India, positive changes are evident not only on the quantitative level (quantity of goods produced) but also on the qualitative level (higher quality and efficiency of goods production), (PAIH, 2023). The development of the food sector has certainly been fostered in recent times by a liberalised foreign direct investment

policy in the sector, systematically introduced reforms and skillful macroeconomic policies. Additional factors contributing to the attractiveness of the market are also (PAIH, report, 2023):

- growing affluence of society and the associated increase in disposable income,
- increasing urbanisation leading to changes in lifestyle habits (including eating habits) and resulting in greater demand for processed goods,
- changes in Indian consumer preferences,
- development of local retail chains,
- the development of the advertising market and a reduction in the level of digital exclusion in Indian society.

The state of the economy and the health of the food sector mean that companies operating in India will have the opportunity to commit their resources to developing their business in international markets. According to publications by some Indian authors3, the agri-food sector is one of the most important in India, overall the non-industrial sectors in the country are 45% of the value of the total economy, in this group the agri-food sector plays a major role. A 2017-2021 study of the top ten Fast Moving Consumer Goods (FMCG) companies found that they rank fourth in the Indian economy. One of the leaders here is Nestle India reporting the highest operating earnings per share, which is also the leader in the agri-food market.

In view of the literature analysis and the high importance of the food sector in India, the following research hypothesis is formulated:

H0: Indian food sector companies are reducing their debt levels, with increasing variation in debt levels among these companies.

To verify the research hypothesis, an empirical study was conducted (Chapter 5 of the article) using the research methods described (Chapter 4 of the article).

4. Research sample and methods

In the drawn research sample, 64 companies were considered. Representatives of the food sector in India were selected through random sampling. All the companies that participated in the study exported their products in international markets. They reported a certain level of international sales in their financial statements during the study period. Financial data was sourced from the Emis and Thomson Reuters databases. In stage one, the option to search for financial data extracted companies from the food sector. An additional limitation was that listed companies had to be drawn. The period analysed was 2014 - 2021. The statistical analysis of the database thus collected was preceded by the collection of the following financial information for the companies in the study group. The following financial data was collected:

1. Revenue level.
2. Level of international sales.
3. Equity level.
4. Level of external capital.
5. Balance sheet total.

Selected values of macroeconomic indicators for 2014 and 2021. The methods for verifying the research hypothesis set were based on the use of parametric static tests. In order to structure the research procedure, the following steps were applied related to performing the relevant calculations in the statistical software:

1. Calculation of statistical descriptive values for debt level, income and total assets.
2. A parametric Student's t-test to test for differences in the capital structures of the companies studied.
3. The Pearson coefficient for determining the relationship between capital structure and the ratio of revenue generated from international sales to total sales revenue.

The final stage of the study was to collect information on selected macroeconomic indicators for the country.

5. Results of empirical research in the food sector in India

In stage one, information was collected on the debt levels of individual companies that exported their products. Due to lack of data, it was not possible to collect information in each year on all 64 companies surveyed and their debt levels. The first stage of the analysis consisted of collecting information on the level of indebtedness during the period under study. The second stage consisted in analysing the value of this debt in relation to the year, in order to verify the decrease or increase of the value in a given year. Data on the number of observations indicating an increase/decrease in indebtedness are summarised in Table 1.

Table 1.
Analysis of changes in debt levels for Indian companies in the food sector

	2015/14	2016/15	2017/16	2018/17	2019/18	2020/19	2021/20
Decrease	30	51	51	49	50	50	49
Increase	23	2	2	2	1	0	1
Total	53	53	53	51	51	50	50
% share	56%	96%	96%	96%	98%	100%	98%
% share	44%	4%	4%	4%	2%	0	2%

Source: Own research.

Between 2015 and 2014, it can be seen that 30 companies in the sector studied showed a decrease in debt levels, representing 56% of all observations available in the sector. On the other hand, 44% (23 observations) of the companies showed an increase in the level of debt in 2015 compared to 2014. In the subsequent years analysed, a clear trend can be seen, which indicates to the studied collective a decrease in the level of debt year-on-year in the companies analysed. The trend continues until the end of the period studied, until 2021. Therefore, the collective was also described in statistical terms in the context of the analysis of the level of debt itself. It was decided to provide a descriptive presentation of the collective of companies in the food sector, using quartile 1 (Q1), quartile 2 (Q2) and quartile 3 (Q3) calculated for this purpose.

Table 2.
Statistical analysis of the community of companies in the food sector in the area of debt levels

	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Q1	33888,91	38085,05	40943,77	50132,18	48304,97	61350,36	57029,04	47953,8
Q2	117484,9	144573,1	142669,1	165625,3	135593,7	152979,7	158973,3	150770,1
Q3	376578,2	517655,4	467040,6	518707,4	379921,8	458103,5	403052,9	392207,2

Source: Own research.

The value of quartile one in the analysed period increased from 2014 to 2017. This means that 25% of all analysed companies in 2014 had a debt level less than 33888.91 thousand zloty less, in 2015 had a debt level less than 38085.05 thousand zloty, in 2016 had a debt level less than 40943.77 thousand zloty, in 2017 had a debt level less than 50132.18 thousand zloty. In 2018, the level of the first quartile (Q1) decreased to a value of PLN 48304 thousand, in 2019 it increased to a value of PLN 61350, 36 thousand. From 2019 onwards, a decrease in debt in the area of quartile 1 values can be seen in the entire collective. It is worth noting that the value of quartile 2 in the analysed period is rather on a similar level - it increased until 2017 reaching a value of PLN 165625.3 thousand, then systematically decreased from year to year reaching a value of PLN 150770.1 thousand in 2021. With regard to the interpretation of the third quartile, it is not possible to indicate a clear trend in the analysed year. However, it is worth noting that the value of the third quartile represents the upper limit of the debt level for 75% of all analysed companies from the food sector, which, in the assessment of the debt level as a whole, should be considered optimal for the preservation of financial liquidity of the analysed companies. The level of revenues is also indirectly significant for the formation of the capital structure. A statistical description of the value of revenues achieved is presented in Table 3 - in accordance with the adopted methodology, values for quartile 1, quartile 2 and quartile 3 were calculated.

Table 3.
Statistical analysis of the community of companies in the food sector in the area of revenue levels

	2014	2015	2016	2017	2018	2019	2020	2021
Q1	92161,76	99308,93	107789,4	138166,8	160831,1	176361,7	178827,7	182429,1
Q2	246319,7	300438,7	294275,4	314579,1	319065,3	320960,8	416400	398906,9
Q3	783844,2	823787,6	945100,1	986815	1090082	1004623	1138459	1085444

Source: Own research.

The value of the first quartile (Q1) increased steadily throughout the analysed period. This means that 25% of the entire analysed set of companies from the food sector generated a higher value of revenues from year to year. On the other hand, the value of the second quartile (Q2) in the analysed period shows similar values. The value of the third quartile (Q3) increased between 2014 and 2020, indicating a slight decrease in 2021. This means that in the analysed period, 75% of all companies generated a higher value of their revenues from year to year, with the exception of 2021 where the level of revenues slightly decreased. The generation of revenue is made possible, among other things, by the assets held in the company. Table 4 presents a statistical description for total assets in the analysed companies from 2014 to 2021.

Table 4.
Statistical analysis of the food sector community in the area of total assets

	2014	2015	2016	2017	2018	2019	2020	2021
Q1	78939,52	101787,9	96446,36	120529,4	103714,8	124501,9	128074,2	124792,2
Q2	198158,1	291064,3	252811,3	342712	289194,3	328259,9	310316,1	346845,8
Q3	636986,3	708360,3	650193,5	787267,5	802067,5	901082,4	915971,8	875604,6

Source: Own research.

The value of quartile one for the balance sheet total analysed in the sector increases steadily in 2018, 2019 and 2020. Until 2017, no clear trend can be identified for the value of quartile one. The value of quartile two increases steadily until 2017, recording a slight decrease in 2018 and again from 2019 onwards the value of quartile two increases. This means that half of the companies analysed have been increasing their revenue levels. On the other hand, no clear trend can be identified in the analysis of the value of quartile three, but it should be noted that its value is significantly different from that of quartile two in the period analysed. To deepen the debt analysis, a parametric t-student test was calculated to check for differences in the area of debt levels between the companies themselves. Summary results for the tests carried out are presented in Table 5.

Table 5.
T-student test for analysis of debt levels of companies in India

T- student tests	H0 rejection tests	Tests that do not reject H0
Total	302	539

Source: Own research.

The table shows the pooled result for all the implemented t-student tests. A total of 841 tests were performed to assess differences in debt values for individual food companies. The results indicate that there are no statistically significant differences between debt levels for the individually analysed debt levels among food companies. It is not possible to conclude unequivocally that the level of debt is the same in all companies in the sector under study, but the results from the analysis of the Student's t-test allow us to conclude that the level of debt in the exporting companies sector does not differ in a statistically significant way.

Table 6.
Pearson correlation for international sales and capital structure in India

Pearson tests	H0 rejection tests	Tests that do not reject H0
Total	0	81

Source: Own research.

The table shows the aggregate result for all the Pearson correlation tests carried out. A total of 81 tests were performed to investigate the existence of a relationship between capital structure and the international sales ratio. The results indicate the existence of a relationship between capital structure and international sales ratio.

To supplement the information on the internationalisation process of food companies in India, macroeconomic information was also collected on selected macroeconomic indicators for India in 2014 and 2021.

Table 7.
Macroeconomic data for 2014 and 2021 in India

Country	**GDP per capita**	**Exports (billion USD)**	**FDI (billion USD)**	**Company taxes stock**	**Average interest rate working capital loans**	**Inflation**
2014	1,630	318,2	34,4	30%	12%	6,41%
2021	2,098	348,2	64,0	25%	8,89%	5,59%

Source: Own research based on World Bank data.

GDP, export and direct investment levels point to a growing economy, while a reduction in the tax rate could help attract investment. However, higher interest rates and inflation levels may pose challenges for businesses and consumers. A rise in Gross Domestic Product may signify an improvement in India's standard of living and increased access to goods and services, may suggest growing economic activity in the country. Export growth is an important indicator for the Indian economy, it may suggest a high level of competitiveness of Indian products and services in international markets and India's growing share in global trade. A significant increase in foreign direct investment (FDI) may indicate foreign investors' confidence in the Indian market. This can contribute to the growth of economic sectors and job creation. A reduction in the corporate tax rate may be an attempt to attract investment and boost corporate activity.

Lower taxes may be attractive to investors and entrepreneurs. An increase in average interest rates for working capital loans can be a challenge for companies, especially those that rely on external financing. High interest rates may affect business costs. The inflation rate remains relatively high. Rising prices can affect the cost of living and business, so controlling inflation remains an important challenge. It is worth noting that the economic situation in India is the result of a number of factors, including government policies, changes in international markets and domestic economic issues. Monitoring these indicators and their effects is key to understanding the dynamics of the Indian economy.

An increase in exports is important for the Indian economy as this can contribute to the country's income from international trade. This can be a result of improved competitiveness of Indian goods and services in global markets. A significant increase in the value of foreign direct investment (FDI) is a positive sign and may indicate India's attractiveness to foreign investors. FDI can contribute to job creation, infrastructure development and economic growth. A reduction in the corporate tax rate can encourage companies to invest in India and expand their operations. This can contribute to increased economic activity and job creation. An increase in average interest rates for working capital loans may pose a challenge for companies, especially small and medium-sized enterprises, which may be more sensitive to changes in financing costs. The inflation rate, although down slightly in 2021, remains relatively high. Controlling inflation may be an important objective of the Indian government to ensure price stability and improve the living conditions of citizens.

However, it should be borne in mind that these figures are only an overall picture of India's economic situation in these years, and the effects of these indicators can be complex and depend on many other factors, such as economic policies, global trade and investment trends, and internal changes in the Indian economy.

6. Conclusions

Analysing the data on the level of indebtedness of agri-food companies in India, we note a steady decline in the indebtedness of these companies and a steady increase in the sales revenue of the surveyed companies. The decline in debt levels is driven by two factors:

- The increasingly better financial situation of the companies in the sector associated with the growth in revenues.
- The increasingly better conditions in which these companies are operating, which is linked to both India's economic development and the increase in foreign direct investment, demonstrating that Indian companies are already showing some kind of rootedness in their host countries.

India undoubtedly represents an interesting market for companies wishing to develop their operations in the food sector. Favourable economic conditions (Table 7) provide opportunities for domestic and foreign companies to expand in the Indian market. Indian companies are adapting their financial strategy to the development of the expansion process in foreign markets - this can be seen above all in the gradual reduction of debt levels during the period under review. The situation of reducing debt levels may be due, as the literature indicates, to the possibility of taking advantage of cheaper financing that is available in foreign markets.

On the basis of the research carried out in the article, the research hypothesis set forth should be accepted:

H0: Indian food and beverage companies are reducing their debt levels, with increasing variation in debt levels among these companies.

The basis for adopting hypothesis H0 was:

1. An analysis of the level of debt (Table 1) and an indication of declining values of this debt over the study period 2014-2021.
2. Indication of statistically significant differences in the area of debt level for the Indian companies under study (Table 5).
3. Confirming the existence of a correlation between the level of debt and the international activity of companies in the food sector (Table 6)

In addition, the study indicated the existence of a good macroeconomic environment for the development of companies in international markets (Table 7) and a good financial condition of the companies under study (Tables 2, 3, 4).

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POLISH HOSPITALS IN SEARCH OF WAYS LEADING TO EXCELLENCE THROUGH NEW TECHNOLOGIES

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Objective: The paper presents the challenge of creating an excellent hospital in the context of adaptations to the conditions offered by new technologies. This task was guided by the goal of recognizing technologies, their perception and attempting to determine the maturity level of hospitals in the context of understood pro-innovation activities. A survey was conducted among management personnel of hospital facilities. It consisted of an attempt to identify the maturity level of hospitals in terms of innovation. In addition, the survey aimed to show the attributes of the future hospital. Some of them, according to the authors' supposition, referred to new technologies.
Project/methodology/approach: Achieving such an objective required a literature review as well as conducting a survey among management personnel of hospitals. The research method allowed to illustrate the problem analyzed. The diagnostic survey (in which respondents used an ordinal scale) allowed estimating the maturity level in the context of innovation. In addition, an open-ended question was posed in the questionnaire, which encouraged respondents to determine the characteristics of the future hospital. This allowed the set limits of cognition to be adequately achieved. The conceptualization elements included a diagnostic formulation (how is it?), while symptomatic insights: (why is it so?) and intervention insights: (what to do?), form the basis for the next research stage.
Findings: It was found that the challenge of today's world is the duty of continuous improvement, as the period of continuity and high predictability of the environment has come to an end. The importance of technological, social and environmental determinants was recognized, as well as their impact on the development of Polish hospitals. The analysis revealed a number of solutions that can be implemented. The study confirms that management personnel are aware of the need to invest in innovation, and their level of maturity is different in different types of hospitals (its level of reference).
Research limitations/implications: Further studies are justifiable, which would provide a new light on the opportunities that technology brings and the risks associated with them. In addition, it is reasonable to show the level of hospitals' efforts to improve technological excellence. In the future, it is expedient to explore the performative dimension of technological solutions on employees, patients and hospital stakeholders. The aspect of the potential for technology to influence health promotion, prevention, treatment and rehabilitation in the context of hospital activities seems interesting but unexplored.

Practical implications: Particularly worthy is the continuation of observations on changes of a technological nature, which allow the maximization of the benefits of their implementation not only in the financial terms, but also in the qualitative (services provided) or social (people's health, life well-being) terms.
Originality/value: The paper highlighted the need to identify the unique characteristics of an excellent hospital in the context of technology (which the highest form of excellence will be the creation of a Polish smart hospital). It provides a starting point for further exploration. The analysis of the paper's content may be helpful to other healthcare service organizations operating in a dynamically changing environment.

Keywords: new technologies, hospital improvement, hospital of the future, smart hospital.

Paper category: scientific paper.

1. Introduction

In the era of nuanced phenomena and reality riddled with uncertainties, the organization's managers tend to design and implement changes that lead them towards excellence. They achieve this goal by possessing a number of specific skills (Wolniak, 2017; Stańczyk 2018; Szczepańska-Woszczyna, 2016; Kożuch, 2004). The disasters that have befallen society in recent years (the Covid pandemic, Russia's aggression against Ukraine) make this thesis even more difficult (Wolniak, 2022; Orzeł, Wolniak, 2021; Pytlak, 2022; Diokpa et al., 2021). All conditions are probabilistic, which causes the creation of development visions to become even more challenging (Chojnacka, 2021). Circumstances provoke the promotion of leadership and business strategy synchronization with disruptions generated by the environment (Fuller, Theofilou, 2021). New information and communication technologies (ICT) become an accelerant for improvement, opening the cyberspace operation perspective (Althoff et al., 2022; Temelkowa, 2020) and creating a new model for the operation and management of organizations (Chomiak-Orsa, Greńczuk, 2022; Adamik, Sikora-Fernandez, 2021; Khafaji et al., 2019; Grębosz-Krawczyki et al., 2021; Zakrzewska-Bielawska, 2021). ICT technologies in hospitals support the managers' work, as well as physicians or other employees of the medical institution. However, the level of their implementation in Polish health care facilities falls short of global standards (Kautsch, 2015). Thanks to ICT, heads and presidents are supported in carrying out daily tasks and shaping future solutions. The hospital managers can optimize time and resources in the facility by improving operational efficiency. Medical services gain access to medical devices that improve the diagnosis and treatment of patients. This allows them to meet the growing demands of patients. Medical professionals engaged in science, thanks to the ability to collect a huge amount of data, its processing and analysis, conduct tests of new therapies or prepare innovative therapeutic solutions. The hospitalized patients also gain from the development of smart technologies. For example, they can count on faster and more accurate diagnosis (among others, diagnostic technologies such as MRI scanner, CT scanner,

telemedicine tools supporting preventive measures of society contribute to this). Also, the monitoring of patients' health status, after or during treatment, becomes much easier (Krittanawong et al., 2021; Bayoumy et al., 2021). Patients, thanks to the development of telemedicine, can provide such monitoring remotely, which, according to research findings, is much more convenient and effective (Busso, Gonzalez, Scartascini, 2022). According to researchers, the electronic registration system being implemented also has a positive impact on waiting times for service, which is perceived as valuable by all hospital stakeholders (Lulejian et al., 2014). In addition, there is a perceived benefit from the coordination of care between specialists and facilities (Skowron, 2023), as well as the availability of more effective and less invasive therapies and technologies. It is an undeniable fact that innovations used in hospitals can contribute to raising the level of healthcare.

Although modern solutions bring many benefits, it is important not to forget the risks associated with them. Devices, machines, systems or software are not free from defects. Blind trust in them can lead to mistakes (e.g. errors in diagnosing patients or inappropriate selection or dosage of drugs). Also noteworthy is the aspect of the possibility of technical failures, which could result in the inability to access a patient's health information, thus disrupting the treatment process. Another significant threat is the risk associated with loss of data privacy, or the possibility of cyber-attacks (Makuch, Guziak, 2020). Not insignificant is the possibility of weakening physician-patient interaction. Focusing on the disease entity (guided by the need to obtain an accurate diagnosis) to the exclusion of empathy shown to the patient can be detrimental to the entire treatment process and deprive it of an essential element, such as humanity. And yet, according to research, patients expect from a physician not only professionalism, but also inspiring trust, caring, kindness, tenderness or empathy (Moczydłowska et al., 2014). Another threat is the possibility of employees becoming disruptive, frustrated, overworked leading to technostress (La Torre et al., 2019; Brod, 1984; Ayyagarii et al., 2011; Suh, Lee, 2017; Tarafdar et al., 2015) or staff dependence on technology. For hospital managers, significant difficulties are the troubles arising from the limited resources for implementing and maintaining systems, or the high cost of purchasing medical equipment. To this set should be added the lack of time for technology training or the possibility of employee resistance to planned innovative changes. An extremely important aspect that cannot be overlooked is the difference in accessibility to technology by different social groups. People who use hospital services should be able to have equal access to health care services (Constitution of the Republic of Poland Article 68), regardless of whether they find themselves or not in the virtual world.

The conditions presented provoke reflection on the aspect of technology in the context of improving activities undertaken in hospitals. The aspect of improvement and implementation of pro-quality solutions gains momentum, facilitated by the Act on Quality in Health Care and Patient Safety, which was passed on June 16, 2023. It defines the rules for the operation of a quality management system in healthcare providers. The healthcare quality system includes:

authorization, an internal quality and safety management system, accreditation and medical registries of adverse events. Quality will be studied using indicators relating to four areas: clinical (level and effects of services provided), consumer (patient opinion), management (efficiency of resource use and implementation of management systems). The entity that monitors healthcare quality indicators is the National Health Fund (NHF).

Managers of healthcare providers are required to meet the requirements of the Act, otherwise they will not be contracted with the National Health Fund to provide healthcare services, and thus will not receive public funding for this purpose. This fact causes hospital managers to cooperate with prominent specialists who are highly experienced in developing system documentation or auditing hospitals (such as UEP Prof. Monika Dobska, PhD), or external organizations that have been preparing various entities and institutions to implement quality management systems for compliance with ISO standards for many years (such as TÜV Rheinland Poland or the ProQualita Quality Center). Assistance in implementing the internal system is particularly needed by entities that do not have experience in implementing accreditation standards for hospitals or those that have not yet applied for ISO 9001 certification. Hospitals at every stage of their activities to adapt the services they provide to the requirements of the Act can be supported by new technology. Quality improvement is supported by innovative products offered by many commercial companies. Many of them are established as a result of public-private partnerships aimed at building a system to support the healthcare sector's development. Clusters are being formed (such as InnoStar) associated with the European Institute of Innovation and Technology (EIT) Health unit, in which the Silesian University of Technology is involved. EIT Health partners include the Medical University of Łódź, the Medical University of Gdańsk, the University of Warsaw, the Technical University of Łódź and the Łukasiewicz Research Network. Many Polish research centers take the lead in innovation for health and this makes the number of products dedicated to health care increase. An innovative and quality-focused hospital today can use operational models, high computing power, and artificial intelligence, but it should not forget about the organizational, functional, technical and behavioral design of hospital space, as reminded by Prof. Anna Szewczenko of the Department of Design and Quality Research in Architecture, Silesian University of Technology.

2. Literature review

The circumstances in which organizations operate make planning difficult (which assumes a high degree of continuity). Managers of Polish hospitals face such a situation every day. Peter F. Drucker, one of the most prominent management thinkers, recognizes that managers customarily started planning from yesterday's trends and made projections of the future based

on them in various possible combinations, but with a great number of the same elements and the same configuration. Even since the 1980s, he states, it has become impossible to plan this way. It is possible to assume or predict the occurrence of an exceptional event, but it is impossible to plan it. Drucker suggests implementing strategies that anticipate the likelihood and content of the biggest changes (Drucker, 1995). New realities and disruptions should be transformed into opportunities, and this raises the need to reformat the existing mindset of managers. Their "blissful mediocrity" augurs relegation to the margins. Drucker expects a commitment to honest calculation and intellectual honesty from managers to face the real results of their actions. Meeting such a challenge prompts investment in data, data platforms, software, disruptive technologies and security systems to improve analytical competence (Koratkiewicz, Kabalska, 2021). It becomes quite a challenge to refine information architecture in an orderly and systematic manner. Routine is replaced by inquisitiveness, the ability to ask questions and seek answers. This challenge is fostered by the development of technology, with passionate and committed people behind it.

Extrapolation and anticipation of the future is possible, not only thanks to the expertise of managers or their experience, but also intuition (Janasz, K., Janasz, W., 2014). Proactively creating a path towards excellence can trigger the need to redefine the organization's mission and position (Shoemaker et al., 2018; Brown, Eisenhardt, 1998; Huy et al., 2014; Martinsuo et al., 2022; Hamid et al., 2019). This process of construction is referred to by the term "organizational renewal" (Janasz, K., Janasz, W., 2014). The COVID-19 pandemic has led to a management boom in which the "command and control" scheme has been replaced by "listen and lead" (Choi, 2020). Work is increasingly based on the collective action of many people (Doughert, Dune, 2011; Klessova et al., 2020), welding together people, capabilities and resources (Moczydłowska, 2010), and provoking the inclusion of a set of data collection and analysis tools (Santos et al., 2021; Tambare et al., 2021).

Pro-quality changes intensify after the Senate passed the new Health Care Quality and Patient Safety Act of June 16, 2023. It will generate new insights into an old daily routine. The legal guidelines will make hospitals not only pro-quality, but also pro-innovation.

The need to absorb scientific and technological knowledge is considered an urgent challenge (Fjelstad et al., 2012). In the conditions of digital transformation, shaping the organization of the future, it is difficult to imagine it without the support of technology. It has become, so to speak, a builder erecting a bridge between the unknown and the expected (Chojnacka, 2023).

An accelerator of technology implementation in Polish hospitals became the COVID-19 pandemic, although its earlier implementation is an undeniable fact. The inventions of technicians and technologists systematically infiltrated the hospital space and provided service to patients, physicians, and society as a whole. What has become possible thanks to digitization and informatization has contributed to the creation of radical qualitative changes that benefit both recipients and providers. The benefits of the information civilization's development are

also being reaped by control and supervisory bodies (including: the State Sanitary Inspectorate, the Ombudsman for Patients' Rights, Governors), the health insurance institution acting as payer (the National Health Fund), or the Ministry of Health. The new reality is that society as a whole also reaps the benefits of technological innovations in saving health and lives. An indirect expression of this is the World Health Organization's (WHO) commitment to strengthening the capacity of member states to collect, collate, analyze, use and manage health data. Noteworthy is the SCORE for Health Data package, launched in 2020. Its goal is to strengthen national health information systems. SCORE allows improving the availability of up-to-date, reliable and comparable health data to track progress toward sustainable development goals related to saving the health and lives of the entire population.

Hospital managers are close to modern technologies, which are used in the areas of surgical medicine, diagnostic imaging, medical statistics, patient data retention, patient health monitoring, application of artificial intelligence algorithms in medical diagnoses.

The pressure to improve quality or rationalize costs at the same time prompts the use of digital technologies. Research studies unequivocally show that ICTs allow new value to be achieved in hospitals (Kordel, 2022). Among others, they enable research to be undertaken into innovative ways of providing healthcare services, as a result of the possibility of making changes to existing procedures. These initiatives are in both administrative and clinical areas. Still required are updated studies indicating improvements in efficiency through the introduction of a broad electronic infrastructure into healthcare facilities.

Among ICT-based solutions, it is important to distinguish the ones that relate to: digitization, and internal as well as external integration, or those related to analytics. Their representation is shown in Table 1.

Table 1.
Technology-based solutions adopted by hospitals

Digitization	Internal integration
1. Tools providing support in the process of patient admissions, their flow and communication with potential patients (pending services). 2. ICT security, understood as solutions that guarantee protection of access to the data produced, to unauthorized persons. 3. Virtualization – this includes IT hardware and software necessary for storing and retrieving data (from desktop servers, local servers and from virtual clouds). 4. Digitization of clinical documents – solutions which eliminate paper documents, as well as image documents, and convert them into electronic documents. 5. Dematerialization systems for administrative documents (conversion of documents used in administration to electronic versions).	1. Administrative management systems – ICT-based solutions for managing accounting, financial flows or logistics. 2. Human resource management systems – solutions used to manage personnel including legal, economic or social aspects. 3. Electronic medical records – solutions that provide support for computerized single, up-to-date and integrated management of patient's personal and clinical data throughout the medical assistance cycle.

Cont. table 1.

External integration	Analytics
1. Digital patient services – enabling the provision of services to patients through digital channels (including services that support patient interaction). 2. Digital services for external stakeholders – enabling creation of integrations between the hospital and regional services, physicians, primary care. 3. Integration with electronic health record – ICT solutions that provide integrations with Electronic Medical Record (EMD) platforms, understood as a format for recording health data from various treatment providers.	1. Computerized medication management – solutions that support the prescription, preparation and administration of medications. 2. Clinical management tools – support clinical decisions to improve the quality of services offered and achieve/maintain increased standards of care (e.g., incident reporting systems). 3. Management panels – solutions that support management and administrative decisions aimed at improving the quality of administrative processes (for example, tools adopted to balance service demands).

Source: Gastaldi, Corso, 2012.

A review of current research directions indicates a growing interest in the smart concept (Mikucki, 2021; Miller, 2015). This is due to the need for adaptation to operating conditions in a smart future, referred to as a smart world (Ning et al., 2016). The idea achieves many benefits mainly due to a trait known as resilience, which is defined as "the organizational ability to develop in a complex and unpredictable environment" (Khan, Halem, 2012). Smart concepts gain recognition in the field of public management (Samih, 2019), but also in cultural institutions (Augustym et al., 2018; Ćwikła, 2021; Wójcik, Juszczyk, 2022), tourism enterprises (Czernek-Marszałek, Piotrowski, 2022), or health care (Kordel, 2022). The benefits of adapting medical service institutions to the realities and possibilities of the modern world are unlimited and touch every area of its operations (including monitoring patients' vital signs, analyzing medical diagnostic images, making clinical decisions or planning resource utilization or tracking bed occupancy) (Kerpedzhiev et al., 2019). It is worth noting that before implementing new, innovative technologies, a diagnosis of needs should be made, both among managers and expectations of medical staff. At the same time, the requirements of patients must not be overlooked (Gimpela et al., 2021). Only after a thorough analysis and prioritization can one successfully begin to implement solutions. A facility that uses modern technologies has a functional infrastructure as well as is effectively and efficiently managed, prevents risks, responds to crises, and on top of that also takes care of patients and employees, deserves to be called a smart hospital. In such a smart hospital, hospitalized patients can expect higher quality services and personalized care, medics can expect to be relieved of routine tasks and assisted in their clinical work. In a smart facility, managers can expect the created system of hardware and software solutions to promote the optimization of available resources (from scheduling and coordinating staff to controlling heating and lighting). The literature review shows that further development of the idea of smart organizations will require proactivity, innovation and creativity on the one hand (Kordel, 2018) and, on the other hand, extracting the essence from digital technology (Wolniak, Gajdzik, 2021) including: big data, artificial intelligence, machine learning, Internet of things, Internet of services, cloud computing, mechatronics, advanced robotics, machine-to-machine communication, digital twins and improved cybersecurity.

3. Research method

The study presents part of a survey that constitutes the entirety of a larger project. The aim of this study was to find out the opinions of managers on the characteristics of the future hospital. The results presented in the paper will relate to aspects of technology. Other attributes not related to them will be presented in subsequent studies. The research concerned perceptions, i.e. insights and views of respondents, and therefore it was decided, in this part of the study, to use a qualitative method. The research procedure included three stages. The first stage involved preparation for the study proper (including a literature review, construction of a preliminary research questionnaire and conducting preliminary research). At the second stage, a questionnaire was developed, a pilot study was conducted, and finally the questionnaire was created and the survey was conducted. The collection of research material (information from respondents) lasted from October to December 2022. The questionnaires were sent by post, then by e-mail. Another way to increase the returnability of survey forms was through telephone and personal contact. Once the expected sample size was achieved, the final (third) stage of the research was undertaken. This consisted of analyzing the results. Respondents were asked to write a short response presenting their own thoughts or reflections relating to the characteristics (attributes) of the future hospital.

The research sample was a purposive sample. The survey was addressed to respondents, holding the position of managers (directors) of facilities qualified for the system of basic hospital provision of health care services. The National Health Fund list included 585 hospitals. Responses were obtained from 124 respondents. The weaknesses of the presented research methodology were the high cost of reaching the respondents, the longtime of survey implementation, the long questionnaire, and the possibility of "interviewer effect".

The respondents belonged to a group of health care entities providing inpatient services (named hospitals). The vast majority of them have a form of ownership – public hospital. Respondents belonged to the group of Level I (55%), Level II (10%), Level III (20%) and other (15%) hospitals, including: specialized (oncology or pulmonology), pediatric, as well as clinical and clinical research institute. Some are listed as a surgical, multi-specialty or non-surgical hospital. Most of the respondents are ISO 9001 certified, and most often these entities have several buildings located in one space. There are also some that have several buildings located in several spaces, rare are those with a single building. The respondents have a number of laboratories, including radiology, ultrasound, CT scanner, endoscopic diagnostics, laboratory diagnostics and microbiological diagnostics. In addition, they have operating rooms, archives, drug supply, blood bank, sterilization room, emergency room or ED unit and other units.

4. Results

An immanent feature of hospitals is their permanent development. Innovation is one of the pillars of medical service providers belonging to the Polish health care system. The values followed by hospitals are centered around people and quality of treatment. The Act on Quality in Health Care and Patient Safety dynamizes pro-quality activities. The implementation of new technologies can support hospitals' stated values and the need for quality improvement, as long as the implementation of solutions is accompanied by decency (the well-being of people) and not by greed seen as a desire for excessive cost minimization. The overriding principle of responsible implementation should be the safety of patients, employees, bystanders, the facility and institutions belonging to the health care system. The risks posed by the possibility of excluding some patients unfamiliar with technology or the aspect of cybersecurity deserve special attention. Technology can support hospitals in adhering to values such as economy, professionalism, cooperation, respect, and transparency.

Among the respondents' statements relating to the attributes of future hospitals were statements relating to new technology. Some of the opinions were repeated or similar in their expression. According to respondents, the hospital of the future is, among others:

1. A facility that uses new technologies.
2. Innovative, safe, cutting-edge and environmentally friendly.
3. Modern and friendly (equipment, rooms, therapies, etc.).
4. Focused on innovation in management, treatment, diagnostics.
5. Takes advantage of the potential in strong informatization.
6. Features digitization.
7. Provides medical services using telemedicine.
8. Undertakes activities including digitalization in health care.
9. Collects and processes data in a secure manner, ensuring its anonymization.
10. Has LAN and WLAN installations in all hospital wards.
11. Uses biotechnology in treatment and diagnosis, with full electronization of medical records.
12. Uses all kinds of technology to improve the health of patients.
13. Open to new medical ideas and technologies for quality improvement.
14. Uses the latest technologies including robotics.
15. Relies on artificial intelligence to improve the patient care process; seeks to expand AI participation in hospital operating systems.
16. Can flexibly adapt to changing environment, attitudes, technology, etc.
17. A place where medical personnel have access to the most advanced technologies and tools.

18. Purchases modern equipment for patient diagnosis, as well as medical apparatus and computer equipment.
19. Optimally secures the budget for infrastructure that directly affects the medical services performed, among others, for the IT system.
20. Focuses its goals on various directions of activity by implementing multi-profile diagnostic and therapeutic activities, as well as scientific, research and teaching activities, and provides comprehensive, modern health care services based on the highest medical standards, while promoting innovation and creativity of employees by undertaking multi-directional activities to support their personal development.

The statements presented by the respondents clearly prove the importance of technology in the perception of future hospitals. A great deal of attention was paid to new technologies and innovations, which are perceived as opportunities, but there are also statements indicating awareness of the need for data security.

Reinforcing qualitative research with quantitative research not only enriches its value, but is often necessary, hence the authors suggested taking a look at the evaluation of the innovation level vs. the type of hospital. As representatives of the innovation evaluation, variables from the section that asked to estimate the maturity level of the hospital in the context of innovation (management, organizational, technological, service, social) were taken into account. Evaluation of the innovation level was measured on a five-point ordinal scale (from an evaluation of 1 – Practice is not established, has not been undertaken at all, up to 5 – Practice is implemented throughout the hospital, with basically no exceptions).

Table 2.
Evaluation of the variables that make up the level of innovation

Variable	Position scale summary				
	1	2	3	4	5
The hospital manager knows what innovation is for the hospital and what it can achieve with it	1,6%	1,6%	3,3%	23,0%	70,5%
The hospital manager set goals and objectives for new technologies	3,3%	0,0%	16,4%	37,7%	42,6%
The hospital manager has prioritized efforts to develop technology	3,3%	3,3%	18,0%	37,7%	37,7%
Employees have the right to be involved in the development and implementation of innovations	1,6%	0,0%	8,2%	44,3%	45,9%
Employees are given the necessary skills and competencies to be creative and open to new solutions	1,6%	1,6%	18,0%	42,6%	36,1%
Hospital constantly generates and collects monitored creative ideas from employees, patients and suppliers	1,6%	8,2%	27,9%	29,5%	32,8%
The hospital manager seeks trends to implement innovations	1,6%	3,3%	9,8%	41,0%	44,3%
The hospital manager creates multidisciplinary innovation teams	4,9%	8,2%	24,6%	39,3%	23,0%
The hospital manager implements solutions to capture and share experiences, ideas, insights and lessons learned	1,6%	1,6%	24,6%	49,2%	23,0%
The hospital manager fosters innovation in relation to environmental social, ethical activities	1,6%	4,9%	16,4%	37,7%	39,3%
The hospital manager assesses opportunities and risks associated with creative ideas and innovative activities	1,6%	1,6%	21,3%	34,4%	41,0%

Cont. table 2.

The hospital manager uses tools and techniques to develop innovative solutions aimed at improving service offerings	3,3%	4,9%	18,0%	34,4%	39,3%
The hospital manager allocates resources, people, finances, IT to support innovation	1,6%	3,3%	19,7%	36,1%	39,3%
The hospital manager measures the effectiveness and efficiency of implemented innovations	3,3%	6,7%	23,3%	33,3%	33,3%
The hospital manager measures employees' level of commitment to innovation	4,9%	11,5%	26,2%	31,1%	26,2%
Hospital measures patient satisfaction with new services and solutions	3,3%	4,9%	14,8%	36,1%	41,0%
Hospital uses health technology evaluation methods to identify effective and cost-effective technologies for clinical practice applications	4,9%	13,1%	23,0%	31,1%	27,9%

Source: Own elaboration.

Taking a look at the above table, it is possible to observe a certain consistency. Namely, low evaluations are characterized by a small percentage of indications and the percentages increase as the evaluation increases. It can also be noted that, with only a few exceptions, the percentages for each scale item for the variables considered are similar – consistent. Thanks to such a conclusion, it was decided to average the scores of all the variables and then recode them again on a five-point scale. This, in turn, allowed the use of correspondence analysis. Correspondence analysis is a descriptive technique for analyzing bivariate and multivariate tables that contain some related measures between columns and rows. The results thus obtained allow analysis of the structure of qualitative variables that create the table. At the same time, it should be clarified that the type other, included the following hospitals: specialized (oncology or pulmonology) pediatric, as well as clinical and research institute.

To analyze the configuration of points representing the innovation level in the factor space, it is necessary to look at figure 1.

The distances of points representing the innovation level of hospitals from the center of the coordinate system vary considerably. The furthest from the beginning of the coordinate system is the point representing the hospital's failure to establish such practices. It differentiates the hospitals relatively most strongly in terms of innovation level and thus has the greatest contribution to the formation of factor space. This is confirmed by the obtained result of the relative inertia value for this variable.

The points representing the evaluation of the highest (5) – the practice is implemented and average (3) – the practice is widely established, but not most of the areas are relatively far from each other. This means that the listed innovation evaluations differentiate the surveyed hospitals in different ways.

Figure 2 shows a plot of point configurations representing hospitals in a two-dimensional factor space.

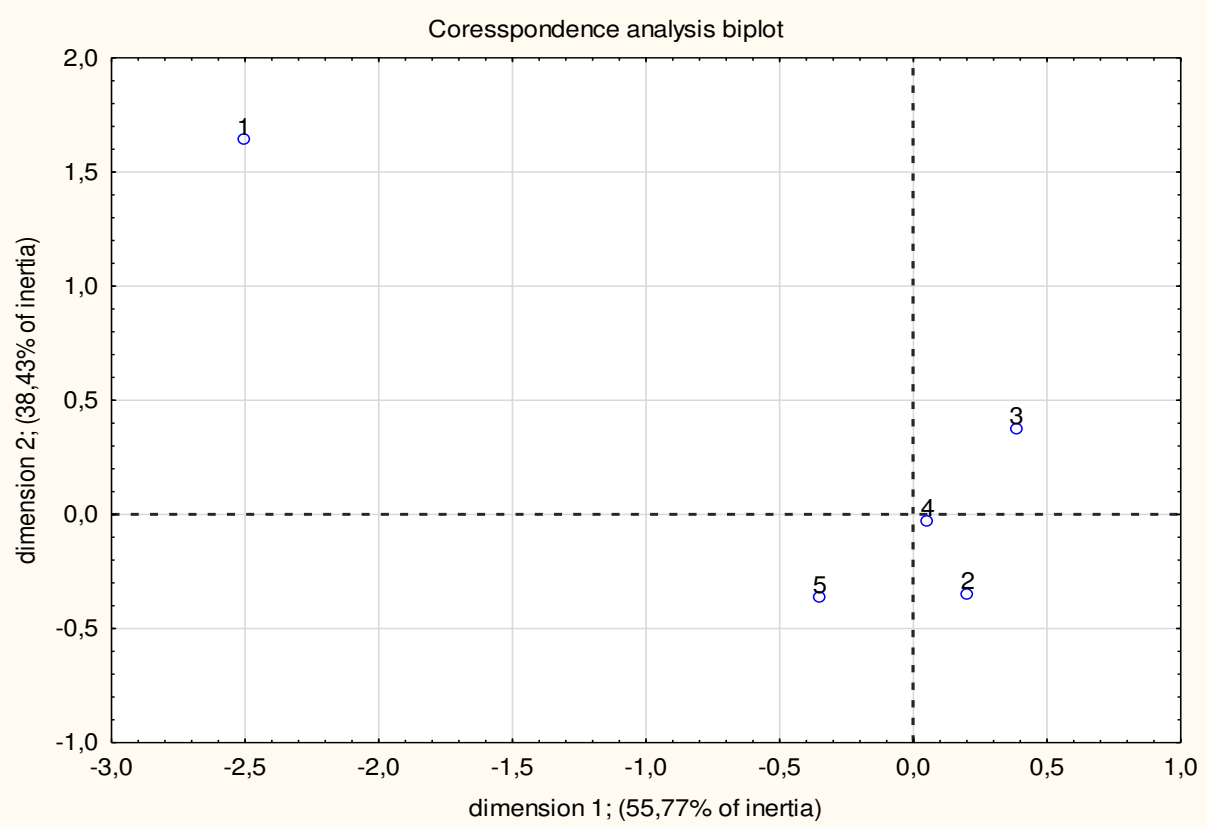

Figure 1. Configuration of points representing the innovation level in the factor space.

Source: Own elaboration.

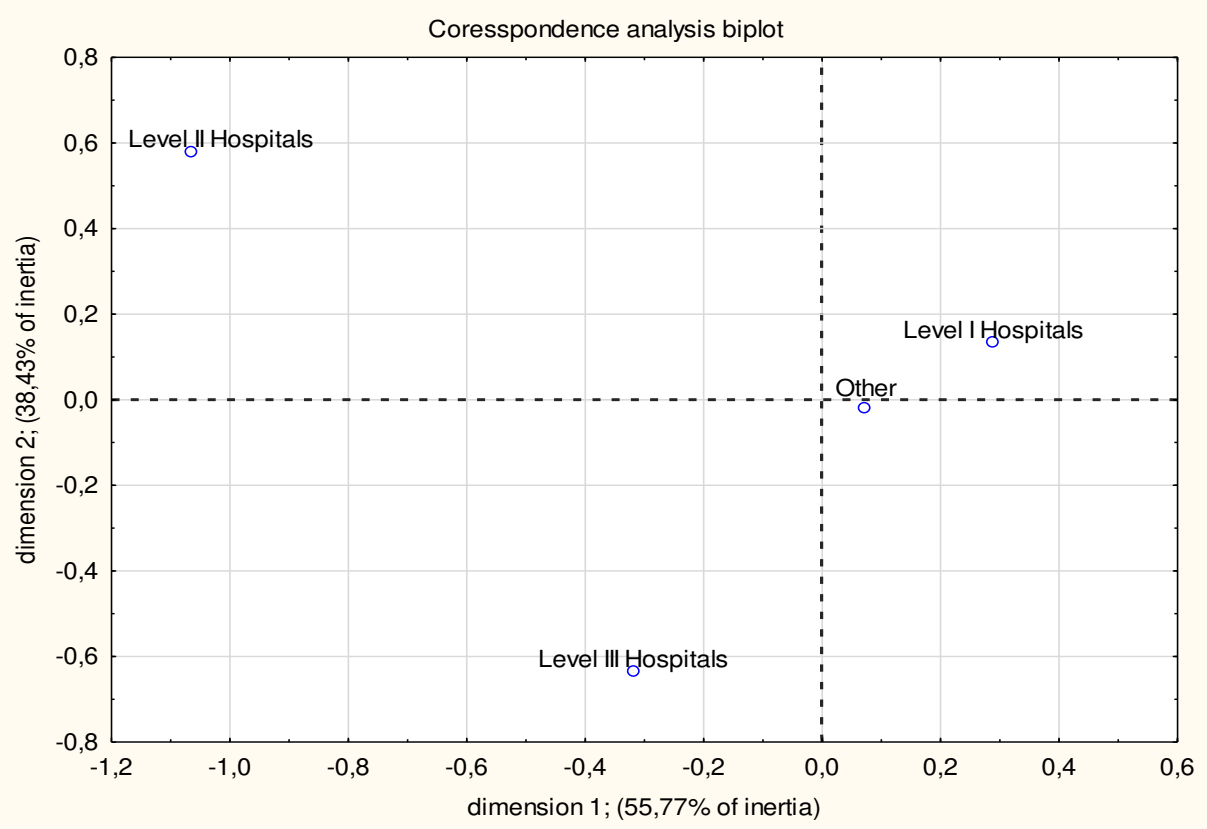

Figure 2. Configuration of points representing hospital types in two-dimensional factor space.

Source: Own elaboration.

Hospitals with the most typical innovation evaluation structure (closest to the average structure) are Level I Hospitals and those in the Other category – the corresponding points are relatively closest to the center of the coordinate system. They also form a group of facilities with a similar innovation evaluation structure. On the other hand, the hospitals with the most unusual structure of innovation evaluation values include Level II Hospitals and, to a much lesser extent, Level III Hospitals.

Finally, take a look at figure 3, representing the configuration of points for hospital types (factor 2) and innovation evaluations (factor 1) in a two-dimensional factor space.

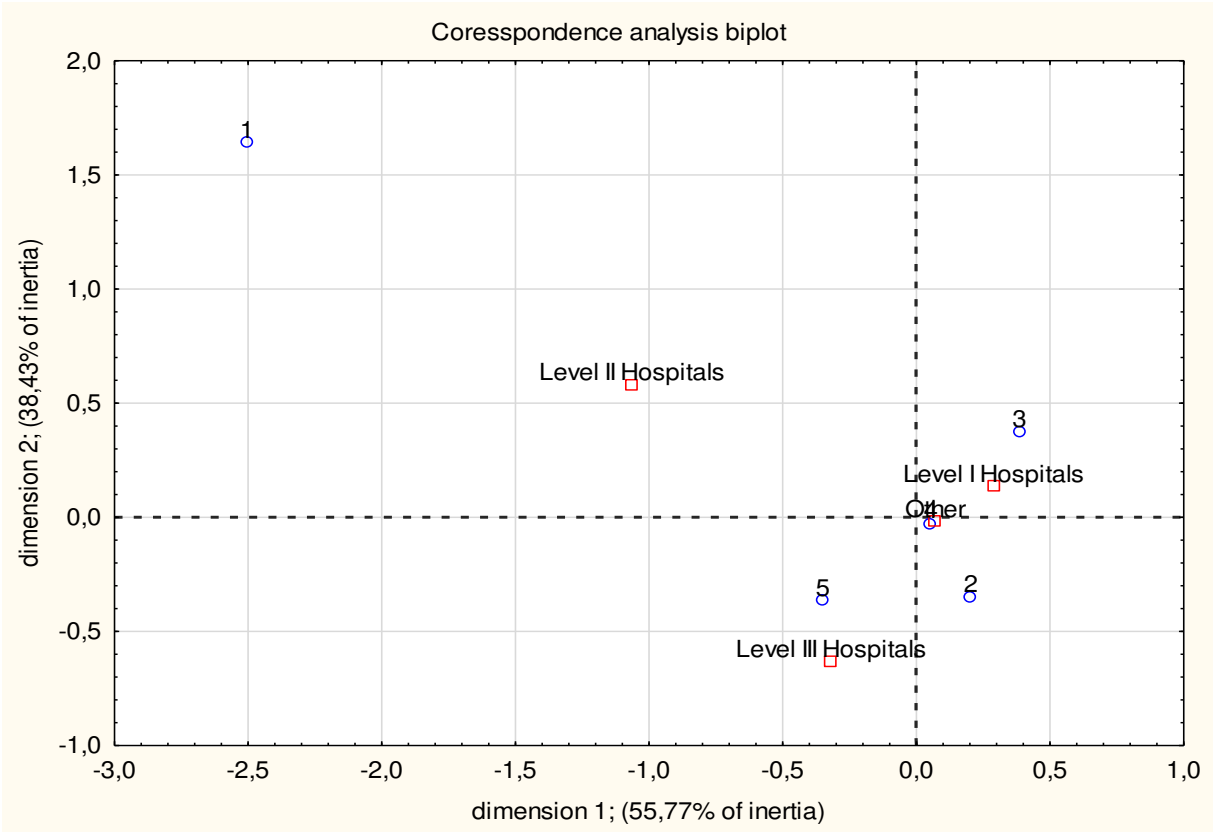

Figure 3. Configuration of points for hospital types and innovation evaluations in two-dimensional factor space.

Source: Own elaboration.

At the outset, it is explained that the first factor allows to reproduce 55.77% of the variation of elements in the input data matrix, i.e., total inertia, and the second factor the remaining 38.43%.

The close proximity of points representing evaluations of 4 and 3, i.e., practice is very typical (evidence of sustained improvement) and practice is widely established, but not in most areas only with some exceptions, to hospitals in the categories of Other (value 4) and Level I Hospitals (both value 4 and 3) indicates that it is because of these evaluations that the discussed group of Hospitals stands out from the rest. At the same time, these two groups of hospitals are the most similar to each other in terms of innovation evaluation. Another group characterized by different values of innovation evaluations from other facilities (relatively) are Level III Hospitals and Level II Hospitals. These facilities approach innovation evaluations in

different ways. Accordingly, Level III Hospitals are closest to an evaluation of 5: the practice is implemented throughout the hospital, with basically no exceptions, while Level II Hospitals are closest of the other facility types to an evaluation of 1: the practice is not established, has not been undertaken at all.

5. Conclusion

Managers should refer with particular caution to demands for which routine is the mother, and established patterns and mechanisms of action are the father. In a changing environment, it is important not to fall prey to cognitive inertia. Much attention is being paid to new technologies and innovations, which are seen as opportunities to improve the organization. Among the solutions being proposed and implemented are electronic patient records, hospital information systems, medical databases, expert systems, telemedicine systems, advanced analytical tools, futuristic systems: nanomedical, medical instruments and robots.

Hospital improvement is a challenge. A significant difficulty for those involved in shaping a picture of future hospitals is the conditions in which they operate, particularly the multifaceted and multidimensional circumstances in which they operate. As a number of authors point out, "today it is increasingly necessary to use qualitative research methods to a greater extent in order to describe and explain the changes taking place in economic life" (Dylewski, Marek, 2013, p. 10). Hence the need to present the development, anticipating the future hospitals using the open question contained in this paper.

It seems justified to carry out further explorations allowing to:

1. Study the strength of the impact of a dynamically changing environment (including the Quality Act) on the priorities of implemented innovation solutions.
2. Show the performative impact of technology on employees and patients.
3. Identify the biggest challenges and difficulties in the implementation of new technologies.

The proposed research suggestions can apply to hospitals, but also to other organizations.

This paper is a prelude to further in-depth research on the shape of relations and links between innovations implemented in hospitals and their type or capacity of management.

From the results obtained, it is possible to draw conclusions that Level III Hospitals and the Other category perform best with innovation, Level I Hospitals perform well, and Level II Hospitals perform worst. Although it should be noted that the distances of all evaluated hospitals do not significantly approach the weakest evaluation of 1, by which is meant the lowest level of maturity with regard to pro-innovation activities. The results shown in the survey are a positive prediction for the future.

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TRENDS IN DATA PROCESSING CONTROL IN CONTINUOUS PRODUCTION SYSTEMS

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Purpose: This paper presents application solutions related to the use of Fourth Industrial Revolution technologies in industry. The aim of the paper is including in a discussion about new trends in the development of information systems supporting monitoring, control and diagnostics of production processes. The objective was realised using the example of continuous production in steelworks.
Design/methodology/approach: The aim of the paper was realized in theoretical and practical part of the paper. The empirical part of the was the form of a case study – approach to mathematical model for predicting the enthalpy of foundry ladles.
Findings: The conclusion is simply: each industrial branch has to use own transformation path towards Industry 4.0.
Practical implications: Prepared approaches - based on analysis of trends in data processing control system in the continues production - can be used to build algorithm of predictive model in its system.
Research limitations/implications: The authors are aware of the limitations resulting from the excessive generality of the model, but they ensure that they will continue research on the implementation of Industry 4.0 technology in the metallurgical (metal) industry, with particular emphasis on the continuous course of manufacturing processes.
Originality/value: The value of the paper are prepared approaches to mathematical model for predicting the enthalpy of foundry ladles.

Keywords: data, process, control system, continuous production, steelworks, foundry.

Category of the paper: conceptual paper.

1. Introduction

The Fourth Industrial Revolution has led to improvements in computer systems for process control. The concept of 'Industry 4.0' signifies a new approach to manufacturing, henceforth supported by intelligent information systems in the area of planning, monitoring and control of technological and manufacturing processes and decision-making at strategic, tactical and operational levels. The beginning of the ongoing changes is digitization, on the basis of which new smart technologies are built (Kagermann, 2015). Modern industry is based on the integration, coordination and cooperation of autonomous machines, robots and different classes and generations of transactional and analytical systems (Kamiński, 2018). According to Skobelev and Borovik (2017) there are four key components in Industry 4.0: Cyber-physical Systems (CPS), Internet of Things (IoT), Internet of Services (IoS), and Smart Factory and six major technologies: the Industrial Internet of Things (IIoT) and Cyber-Physical Production System (CPPS), additive production (3D - the printing), Big Data, an artificial intelligence (AI), Collaborative Robots (Co-Bots) and the virtual reality. Smart factories are the integration of technical means of production (machinery, production lines, industrial infrastructure, means of transport) and cyber-physical systems to support operational and management processes, which will achieve full autonomy of control operations, monitoring and control of production through the direct exchange of data and messages between different machines and industrial robots and the application of a new generation of information systems using artificial intelligence solutions. At the heart of factories are cyber-physical systems (CPSs) with process control systems via industrial sensor networks and remote monitoring of these processes via a global digital network. Lee (2015) and Lee et al. (2015) wrote about the architecture of CPSs. Smart factories are the combination of key technologies of Industry 4.0 with information and computer systems, using in control processes with their visualisation and predictive analysis. In cyber-physical system is the continuous detection and localisation of signals from industrial sensor networks. Computer systems not only control processes, but will also support decision-making based on expert knowledge bases, as well as predictive functions (machine learning techniques) (Kamiński, 2018). Nowadays companies use integrated IT systems of the MES (Manufacturing Execution System) class. MES systems have been developed for the purpose of computer support of company processes. Production management systems have been around for almost two decades, so they are no longer something new. They emerged as a natural recognition of the fact that computer technology could be integrated with mechanical engineering to produce more, faster, more efficiently and with higher quality than ever before. MES bridges the gap in-between planning system (such as ERP) and controlling systems (such as sensors, PLCs, SCADA systems) and uses the manufacturing information (such as equipment, resources and orders) to support manufacturing processes (Mantravadi, Møllera, 2019; Mcclellan, 2001). In addition to the MES, companies use: Enterprise Resource Planning

(ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM), Product Lifecycle Management (PLM), Enterprise Asset Management (EAM) or Business Intelligence (BI). All the systems create the Enterprise Information Systems (EIS) (Romero, Vernadat, 2016).

No process, whether manufacturing or service, is perfect. Neither the product nor the service is completely repeatable. This is caused by disturbances, which determine the variability of process parameters and indicators. Process improvement should therefore focus on identifying the causes that cause special disturbances and try to eliminate them or at least reduce their impact. The most common method used to identify disturbances is statistical process control (SPC) based on Shewhart control cards (Szymszal et al., 2016). In addition to statistical control, predictive analytics and learning algorithms are used in Industry 4.0 technologies. Process control takes place in real time. With the development of ICTs, control systems have access to Big Data and cloud computing. Modern control systems cannot operate effectively without IoT. IoT connects things to their virtuality on the Internet. Automatic identification of physical objects on the network is done using RFID technology. With the help of sensors, it is possible to automatically detect the status of a device, read out process parameters in real time, transmit control signals, and exchange messages and cooperate with other devices connected via wireless networks (Vermesan, Friess, 2014; Wortmann, Fluchter, 2015).

In Industry 4.0, process control is transforming from static to dynamic and anticipatory control. Process Control (PC) is a process-oriented method and has the character of active control, as its results are used to identify process disturbances that need to be eliminated. Process control is carried out in real time and its objective is to continuously improve the course of processes and achieve the best results. Modern technologies - process control systems - are highly autonomous, i.e. they are able to control the process without human intervention and make decisions for them (Benotsmane et al., 2018; Ahuett-Garza, Kurfess, 2018).

This paper focuses on trends in the control of production processes in the ongoing industrial transformation towards Industry 4.0 (I 4.0). The paper presents considerations for the development of control systems using the example of continuous production. In many publications, the authors describe control systems for discrete production. A popular benchmark is the automotive industry. In this work, the authors provide a conceptual consideration of continuous process control systems in metallurgical industry (metal industry).

2. Trends in data processing control system in Industry 4.0

In 1909 Henri Fayol, in a book entitled L'exposee des principles generaux d'administration, distinguished 5 basic functions of management by listing: planning, organising, coordinating, leading, controlling. Up to the present day, successive studies and elaborations do not indicate

that other functions of organisational management are possible. However, over the course of more than a century, the way in which these functions are carried out in companies has changed significantly, which is primarily linked to the development of civilisation and globalisation. With the progress of mechanisation and later computerisation of manufacturing processes, the ways in which management functions were performed changed. Human beings have been supported by information and computer systems and AI. Computers and AI can make decisions to increase process efficiency and reduce costs. In Industry 4.0, new opportunities for effective management control emerged.

An enterprise's control system is the range of standards, principles, methods and forms of control available at its different organisational levels. When constructing an enterprise's management control model, it is necessary to understand its essence and context based on the models and tools developed by practitioners. By applying these standards, a tailor-made model of control processes can be created for each enterprise. Control systems support the achievement of the enterprise's strategic and operational objectives. The right choice of computer-based control systems will enable efficient collection of process data. Control helps to optimise processes and continuously improve them. Systems use KPIs, or simply comparing set targets with the current result. In industrial transformation we can monitor the processes that are change towards smart manufacturing, observe the production lines, departments, or machines that are benefiting from Industry 4.0 technologies, and guide decision-makers towards Industry 4.0 technologies (Braglia et al., 2022).

Automation and collaborative robots have given manufacturing companies the ability to deliver quality products and services more efficiently while reducing overall operating costs. However, employees still need to interact with automated systems and make the right decisions based on the data generated. Without the right industrial process visualisation system or production process monitoring software, a company may struggle to fully utilise resources. There are a growing number of systems and software platforms on the market, developed by IT companies, with the aim of overcoming standard visualisation and control challenges, so that production processes can be better understood and more easily controlled (Tezel, Koskela, 2009).

In recent years, with the rapid development of smart ('smart') measuring devices that are easily integrated into the network, the amount of data (Big Data) has been growing exponentially. Collecting large amounts of data is relatively easy technically (devices equipped with the ability to make various measurements and with extensive communication functions with other devices and with the user form the Internet of Things). What becomes problematic, however, is the effective use of the collected information and quick and intuitive access to the information that is needed at any given time (Werner, Woltsch, 2018).

In Industry 4.0, efficiently maintaining or scaling operations requires solutions that enable better and more reliable remote monitoring and control of critical process parameters in a secure manner. Manufacturing environments and supply chains can respond more dynamically to

changes in demand with the help of edge processing. IIoT-enabled devices, such as sensors and programmable logic controllers (PLCs), improve manufacturing processes when combined with modern monitoring and control software powered by edge devices. This combination enables real-time data to be transformed into actionable insights that result in specific actions with little human interaction. It also opens up the possibility of connecting edge devices to the enterprise and, if necessary, to the cloud. The increased use of IIoT devices in edge computing architectures can introduce security vulnerabilities if not properly secured. The risks associated with software vulnerabilities and system tampering reinforce the need to invest in systems that provide self-monitoring and diagnostics, as well as built-in physical and cyber security. Edge processing platforms are by design and proven to be secure. They can protect data collection and analysis points and enhance the effectiveness of process control programmes (https://www.plantautomation-technology.com/…). Edge computing platforms collect, organise and analyse sensor data and process data on-site in real time, without worrying about latency, connecting critical applications to critical hardware or enabling advanced and remote monitoring and control. Distributed computing automates core processes and helps ensure availability. This enables manufacturers at the local plant or factory level to remotely increase operational efficiency and productivity.

Reis and Gins in their paper (2017) present such trends in data processing: (i) from Univariate, to Multivariate, to High-Dimensional ("Mega-Variate") (ii) from Homogeneous Data Tables to Heterogeneous Datasets, (iii) From Static, to Dynamic, to Non-Stationary, (iv) from Monitoring the Mean, to Dispersion, to Correlation (v) From Unstructured to Structured Process Monitoring.

The exploitation of emerging Industry 4.0 technologies in the pharmaceutical industry de-scribe Ntamo et al (2022) from University of Sheffield. Paper presents integrated digital architecture consisting of an Advanced Process Control system (APC), mechanistic model platform, industrial IoT platform for data analytics and visualisation. using Siemens cloud service called MindSphere. MindSphere is an open operating system and cloud solution for the Industrial Internet of Things, which is used to connect various devices to the cloud and collect data in real time. The combined solution aligns with the concepts of Industry 4.0 by providing a digital twin, cloud integration, sophisticated statistical, as well as hybrid and mechanistic models. The models are in turn, used for soft-sensors, model predictive control and optimisation algorithms to predict and control product Quality Attributes.

The application of the Industry 4.0 concept to the management of production processes requires overcoming several barriers also. A detailed analysis based on the study of secondary data is presented by Ślusarczyk (2018). According to Ślusarczyk survey, the most important challenge to implementing Industry 4.0 is a lack of digital culture and training, lack of support from managers, ambiguous economic advantages from investments in digital technology, cyber-physical security and significant financial investment needs are all major considerations, and the fear of losing control over the company's intellectual property.

Data processing control is a part of company control system. Steel plants are constantly improving computer support and process control systems. Digitalization of the steel industry (Gajdzik, Wolniak, 2021). Digitization has entered the metallurgy gradually, covering subsequent processes. Digital technologies are used, among others, to monitor the operation of devices in selected sections of production, technological maintenance services (MS), control of parameters of the production environment, control of equipment operation, tracking of processes. In the industrial transformation, steel mills invest in smart sensors, compiling IT and communication solutions and CAx systems, combining process technologies into compact structures as part of common OT and IT applications. The actions being taken now will create a cyber-physical steelmaking system in the future. Data from the installation of production lines enable the coordination of the parameters of the entire process of manufacturing steel and steel products. Steel smelting technology (e.g. blast furnace) is automatically controlled by computer and IT systems. Devices in steel mills and rolling mills are equipped with intelligent sensors that provide data on the course of processes in real time and support operators of technological installations in controlling operations. The data concern not only the operating parameters of the equipment and the conditions in which steel production takes place, but also the consumption of raw materials and energy media. Data from devices are transferred to the decision center system, which is the central center for ongoing process monitoring. Each production process has its own decision-making center, and information from individual decision-making centers reaches the central center (Gajdzik, 2021, 2022).

According to Peters (2016, 2017), metallurgical processes are entwined with many IT (computer) systems. Examples include: material planning system (MRP) or its extended version, i.e. ERP, support system (CAx), project management system (Project Management), production planning and scheduling system (APS), document management system (DMS), document exchange (EDI), product documentation management (PDM) and other systems. The IT systems available in the steelworks are constantly being developed and improved. All cooperating systems create an integrated IT and computer environment of the enterprise or capital group to which the steelworks belong.

The latest versions of MRP and ERP systems have an application for predicting problems that may arise at different levels of resource use (Śliwczyński, 2015). Monitoring of stocks using the latest generation of IT and computer systems makes it easier for mills to ensure continuity of deliveries and timeliness of production. SAP class solutions are the multi-process system used in steelworks. The following services are also useful solutions: Google Cloud, Microsoft Azure. Data from machines, installations, facilities and products are collected in the MES (Manufacturing Executing Systems) system. Both MES and ERP build a vertical system of process links. The result of the cooperation of ERP and MES systems is the sharing of information between objects in the implementation of common processes. Data from devices are used to analyze the rationality of resource management and process optimization (Gajdzik, 2022; Torn, Vaneke, 2019).

Current trends in data management in production processes are addressed in the article Raptis, Passarella and Conti (2019), which surveys the recent literature on data management. The paper can help the readers to deeply understand how data management is currently applied in networked industrial environments. For data management in Industry 4.0, the following key areas have been identified for further analysis: industrial data management for dedicated applications, cloud manufacturing, industrial wireless standards, data-driven manufacturing (including machine learning and deep learning), data from IIoT technologies, scheduling and synchronization of multiple factories. With Industry 4.0, the paper focuses on four data properties: data volume, data variety, data traffic and data criticality. The future of the steel industry in the digital transformation can change in next ways (Peters, 2016; Berger, 2015; Neff et al., 2018; Cheng, Westman, 2020; Vernersson et al., 2015):

- machine learning could simplify manufacturing processes while streamlining steelmaking operations,
- virtual reality (VR) could enable virtual operations in plants, allowing for the creation of new business models,
- blockchain could enable tracking of verified materials in purchases, such as recycled steel, steel production in net zero technologies – deep decarbonisation in steel industry,
- smart technologies with machine communication (M2M) in steel supply chains could strengthen the structures of business networks and at the same time increase their flexibility (quick response to market needs, shorter delivery time, customization of steel (metal) products etc.),
- technologies replace the work of people in hard work conditions, workers are operators of metallurgical technologies.

3. Industry 4.0 specifics in data processing control system for continuous production

There is a basic categorization of production control systems according three fundamentally different types of production: discrete, batch and continuous. These control systems differ fundamentally according to the type of production - the key tasks are different for each type. Discrete production is primarily based on work with the identification of a specific product and monitoring its life cycle. A key role in Batch processing is working with batches, from the supply chain to the trade channels to the end consumer. In continuous production, the output is not a specific identifiable product, but a certain volume of produced material. Key to management is maintaining the quality required by customers and ensuring the stability of the production process. This leads to the requirement to store large amounts of production data and then implement advanced tasks from trend analysis, quality analysis to forecasting.

A production organisation in which the technological process is carried out continuously (24/7) requires the development of dedicated control systems. The production area in this case requires multidimensional support and management must be based on reasonable assumptions. A number of quality requirements for manufacturers must be taken into account when designing a management support system. In this process, the product may be the final product, but may also be an input to another process. It is also characterised by irreversibility, which distinguishes this type of manufacturing from the discrete processs. The nature of continuous production requires the system to be flexible. This includes, for example, the scalability of production. Another example is the multiplicity of units of measurement. Raw material may be received in stock in square metres and issued for production in kilos and sold in running metres. The system must support the handling of this aspect (Durlik, 2019).

4. Case study: Steelworks – approach to mathematical model for predicting the enthalpy of foundry ladles

An example of the control system for continuous processes control is a production control system at Liberty Steel Group steelworks located at Ostrava, Czechia (formerly ArcelorMittal). The MES system for the steelworks was designed and put into operation by company R.T.S. cs Ltd (1993-present). It is a comprehensive system consisting of a wide range of modules and components, such as process data collection, dispatch control, technology monitoring, balance calculations, and data transfer to the corporate ERP system. One of the modules is responsible for controlling the operation cycle of foundry ladles. Prior to tapping the foundry ladles are heated to the desired temperature by high-temperature heating. During an operation cycle the foundry ladle goes through the following operating steps: high-temperature heating, tapping, transporting the molten steel, processing in ladle furnace, casting, open air cooling (before tapping or after casting the steel) and cooling below the lid. Ladle state diagram is at Fig. 1. Ideally, after casting the steel, the ladle does not need to be repaired in any way and can be used immediately in the next cycle. When operating foundry ladles the temperature control is crucial in order to avoid undesired cooling-down. If the ladle contains molten metal and the temperature falls below a certain threshold, solidify may occur which can cause damage to the ladle.

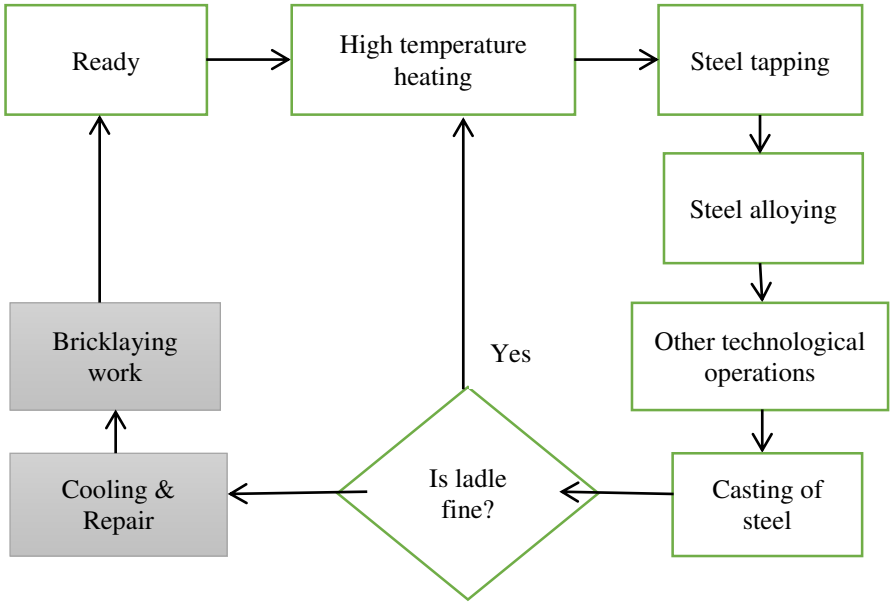

Figure 1. Foundry ladles state diagram.

Source: own elaboration.

Within Industry 4.0, for all of these states of the ladle a mathematical model was constructed to calculate the enthalpy. An enthalpy is a quantity expressing the thermal energy stored in a given material/substance. The automated control system of the steelworks contains partial technological models monitoring the entire operating cycle of foundry ladles, namely the thermal state of the ladle lining. From the analysis of experimental measurements of surface and internal temperatures of the ladle and concurrent measurements of steel temperature during all operation steps with a filled ladle, model constants were created for ladle thermal state assessment. The basis of the enthalpy calculation is the autoregressive analysis of time series. Enthalpy information available to the dispatchers describes temperature conditions in the ladle, allowing optimizing the production sequence. The heating time thus can be set to give the ladle sufficient enthalpy for tapping, and the ladle operation cycle can be optimized so that the ladle heat loss is minimized and at the same time the conditions for operation of alkaline ladle linings are met. The calculation of the ladle enthalpy showed that it is unnecessary to heat the ladle for the whole time while it resides at the high-temperature heating station before the next tapping. To preserve the heat accumulated in the ladle lining it suffices to cover the ladle with a lid as soon as the casting is finished. Using the model calculating and forecasting the foundry ladle thermal state in controlling the high-temperature ladle heating led to the considerable savings of fuel gas.

In order for this calculation to work reliably, the entire control system must be solved as a fault-tolerant. This means it is resilient to any outages and failures. The key part of a fault-tolerant solution of a system that works with data in the form of time series is the continuity of operation of the database system. A database mirroring technology was used in the described steelworks control system (Danel et al., 2016).

The predictive part of the model is designed to calculate the estimate enthalpy in the following technological operations, based on the duration of the previous operations. This makes it possible to control the state of the technological process so that there is no danger of unwanted cooling of the ladle. Prevention against the cooling of the foundry ladle at the moment when it contains molten steel to a state where it can solidify and subsequently damage is absolutely essential. In that case, the minimum temperature of the ladle must be maintained by electric heating to avoid solidification, which means huge energy losses.

The enthalpy calculation is started periodically after a certain time and also when the state of the ladle changes, which is indicated by the steelworks information system. The calculated enthalpy is displayed to dispatchers, who can adjust the current cycle accordingly.

In the future, it is expected to expand the model by an optimization function based on a larger number of parameters with the aim not only to prevent damage to the ladle but also to optimize (to a minimum) the consumption of electricity.

5. Conclusion

Technological changes in steelworks are necessary for the European steel industry to compete with the cheap steel industry from Asia (Industry-Report, European Commission, 2018). The modern digitization of industry is a set of opportunities to improve business processes by creating efficient interfaces and data exchange, as well as by IT systems for process management and support (Branca et al., 2020; Bogner et al., 2016, Vernersson et al., 2015). Modern production equipment with a wide range of wireless controllers participate in streamlining processes. Computer systems enhance the efficiency of technology (Pichlak, 2020; Kiel et al., 2017). In the conditions of the Fourth Industrial Revolution, steelworks in industrial processes are increasingly using the Industrial Internet of Things (IIoT) and the latest generation of IC technologies. The digital technologies used enable the integration of processes in steel mills and value chains, from procurement through production and sales to reverse logistics. The introduced changes are aimed at creating the architecture of Cyber-Physical Steel Production Systems (CPSPSs).

In the steel industry, digitization combines technologies in production processes, focusing on advanced prediction models. Steel is produced in a continuous process, the specificity of which must be reflected in the designed models. The metallurgy is gradually implementing mathematical models to control processes.

The prepared discussion about the areas can support steelworks in the design of process control systems, which are continuous processes. The market still lacks publications on modeling continuous production as opposed to discrete production.

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PERSPECTIVES OF THE ANALYSIS OF ORGANISATION'S CONTEXT IN THE LIGHT OF THE ISO 9001:2015 STANDARD AND THE SUBJECT LITERATURE

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Purpose: The purpose of this publication is to examine approaches to determining the context of an organisation in light of the requirements of ISO 9001:2015 standard and the subject literature. The study aims to understand the essence of the analysis of the organisation's context.
Design/methodology/approach: The study used a systematic literature review method. The steps of the procedure included the selection of publications from selected Web of Science and Scopus databases, as well as a review of publications available on Google Scholar, the analysis of paper abstracts to select them for full-text analysis, the identification of the main lines of research, and the identification of three perspectives of the analysis of the organisation's context: (1) those stemming from the strategic management output; (2) those determined by a quality management-centred approach; and (3) the integrated one that takes both approaches into account.
Findings: The analysis of the organisation's context in the strategic management perspective focuses mainly on methods such as SWOT analysis and PEST analysis (sometimes extended by extracting additional factors for PESTEL analysis). The quality management perspective focuses on identifying customer requirements and substantiating stakeholders' needs. In contrast, the integrated perspective involves combining strategic and qualitative management methods for a comprehensive analysis of the organisation's context.
Practical implications: The study provides organisations with insights into the diversity of context analysis methods and provides a basis for recommending the use of the integrated perspective for effective quality management.
Originality/value: This work adds value by identifying and analysing different perspectives on the analysis of the organisation's context and demonstrating the potential for applying an integrated perspective. Promoting a better understanding of the organisation's context by management in light of the requirements of ISO 9001:2015 standard and the subject literature, can influence the alignment of quality management strategies with stakeholder and market needs.

Keywords: analysis of the organisation's context, strategic management, quality management, ISO 9001:2015 standard.

Category of the paper: Literature review, general review.

1. Introduction

Analysis of the organisation's context is a key element of effective quality management, particularly in light of the requirements of ISO 9001:2015 standard. This standard emphasises the importance of understanding organisation's environment, both internal and external, to achieve quality objectives. This paper focuses on discussing the essence of the organisation's context, using strategic management, quality management and integrated management perspectives. By reviewing the literature, the study contributes to a better understanding of the analysis comprehensiveness of the organisation's context.

This text is the first part of a series of papers. According to H. Snyder, due to the significant increase in knowledge and the need to keep up with the latest research, the literature review as a research method is now more important than ever (Snyder, 2019). This paper presents the results of a systematic literature review, the results of which indicated that there are few publications in the available databases comprehensively capturing the process of analysing the organisation's context taking into account both approaches derived from strategic management and determined by quality management practices. Most of the authors advocating an integrated approach use a limited range of methods and techniques possible in this area. Thus, directions for further research have been and are being identified.

Quality management systems can play an important role in shaping the market position of companies because, among other things, they can contribute to maintaining or improving customer satisfaction (Bugdol, 2018). The reasons for their implementation may vary (Wolniak, Sułkowski, 2016), but the benefits of their implementation are confirmed by empirical research (Fonceca, Domingues, 2018; Sułkowski, Wolniak, 2018). Although, it is still possible to identify some organisations that focus on implementing and maintaining such a system but pay little attention to improving it to achieve its benefits (Gębczyńska, Wolniak, 2018).

The ISO 9001 standard is evolving to respond to the current needs of the economy, also to meet the challenges of the increasingly volatile environment of modern organisations, which is manifested, among other things, by paying attention to their context (Łagowski, Żuchowski, 2016). Therefore, the 2015 edition of the standard focuses on the notion of the organisation's context. This is not entirely new to organisation management, as internal and external factors affecting the ability to achieve business goals and set strategic directions have long been of interest to organisations' boards (Natarajan, 2017). The ISO 9001: 2015 standard further emphasises the need to define the business strategy and objectives of the quality management system and to understand every aspect of it (Pacana et al., 2017).

2. Essence of Organisation's Context in the Light of ISO 9001:2015 Requirements

The ISO 9001:2015 standard is an international standard that contains requirements for a quality management system. One of the key elements of this standard is the analysis of organisation's context. According to numerous authors, it is the foundation of a quality management system (Matuszak-Flejszman, Pochyluk, 2016; Popiel, 2017; Midor, Tarasiński, 2016). It is also important for the proper establishment of processes related to the manufacture of products and provision of services (Chen et al., 2016). It enables an understanding of business conditions (Jedynak, 2015) and an understanding of the specifics of the industry (Kleniewski, 2016).

According to the provisions of the ISO 9001:2015 standard, an organisation should understand its environment, both internal and external, in order to effectively manage the quality of its products and services. Understanding the organisation's context refers to identifying the factors that affect the company's operations and can have a significant impact on the achievement of its quality objectives. The standard emphasises that the analysis of the organisation's context is intended to be a process, not a one-off act, which should enable changes in the organisation and its environment to be captured (Zymonik, 2018)

The ISO 9001:2015 standard, in section 4.1, requires organisations to identify external and internal issues that are relevant to achieving its purpose and strategic direction (Cholewicka-Goździk, 2016). Relevant issues can impact both positively and negatively on organisation's performance, so their identification and appropriate management is an essential element of an effective quality management system.

The external context of an organisation includes factors outside its boundaries that affect its operations. Factors such as legal, technological, competitive, market, cultural, social and economic conditions, at international, national, regional or local level, should be considered. The impact of these factors can shape customer requirements, market trends, competition and the overall economic climate. Understanding these factors enables an organisation to adapt effectively to the changing business environment.

According to the ISO 9001:2015 standard, the external context includes:

Political, legal and regulatory factors: Knowing the laws and regulations that affect organisation's operation is key to ensuring compliance with legal and technological requirements.

Market conditions: Analysing market competitiveness, consumer trends and customer requirements allows an organisation to adapt its quality management strategy to meet changing needs.

Social and cultural factors: Considering social and cultural aspects in the context of the organisation allows for more effective stakeholder and customer engagement.

The internal context of an organisation, on the other hand, concerns issues related to its internal conditions and activities. In this respect, the organisation's values, culture, knowledge and performance should be taken into account. A proper understanding of these factors is crucial for effective quality management.

According to the ISO 9001:2015 standard, the internal context includes:

The organisation's values, culture and knowledge: Knowing the values on which an organisation is based and the culture that characterises it is key to effective quality management.

Organisational structure: Knowing the hierarchy, division of duties and responsibilities within the organisation is essential to ensure consistency of operations.

Business processes: Understanding and optimising organisational processes contributes to effective quality management and continuous improvement.

Organisation's performance: Analysing the organisation's past performance helps to identify strengths and areas for improvement.

Understanding the organisation's context is an important step that enables the organisation to adapt its strategy, action plans and processes accordingly to respond effectively to the changing environment. Context analysis allows an organisation to identify its strengths and weaknesses, as well as threats and opportunities, and make better use of its resources and competencies.

Based on an understanding of organisation's context, organisations can identify quality objectives that are relevant to their situation and customer needs. In addition, context analysis identifies key stakeholders and their requirements, which is important for aligning the organisation's offerings with market needs.

The process of analysing the organisation's context should be systematic and well organised. According to the provisions of the ISO 9001:2015 standard, section 4.1, an organisation must monitor and review information relating to external and internal issues. The key steps in the process of analysing organisation's context are:

Identification of external factors: The organisation should thoroughly understand its environment and identify external factors that may affect its operations and performance. The focus should be on regulatory changes, market trends, competition and customer expectations.

Analysis of internal factors: The organisation must analyse its values, culture, resources, knowledge and performance to identify its strengths and weaknesses.

Identification of stakeholders and their requirements: It is useful to identify the organisation's key stakeholders, such as customers, suppliers, employees, owners or regulators. Understanding their needs and requirements allows you to tailor your organisation's offering to meet their expectations.

Using the results of the analysis: The ultimate goal of the organisation's context analysis is to use its results in quality management. The organisation should take appropriate actions and strategies to achieve its quality objectives.

Based on the analysis of the organisation's context, key aspects are identified that will influence further research and decision-making. Further phases of the study will focus on using the results of the context analysis to develop appropriate strategies and actions within the quality management system.

Key aspects to be considered include:

Defining quality objectives and quality policy: Based on the context analysis, the organisation defines the objectives it wants to achieve in terms of the quality of its products and services and formulates a quality policy that reflects its commitment to meeting stakeholder requirements.

Risk management: Context analysis identifies potential risks and opportunities that may affect the achievement of quality objectives. Risk management enables the organisation to effectively prevent problems and take advantage of opportunities, which contributes to efficiency and competitiveness.

Developing appropriate strategies and actions: Based on an analysis of the context, an organisation formulates strategies and actions that address key internal and external issues. These strategies will be the basis for the quality management activities undertaken.

Identification of performance indicators: The results of the context analysis allow the identification of appropriate performance indicators that, in turn, will allow an organisation to monitor its activities and measure its performance. These indicators form the basis for a continuous improvement process.

Stakeholder engagement: Context analysis enables an organisation to better understand the needs and expectations of its stakeholders. Stakeholder engagement is a key element of effective quality management, allowing their perspectives and needs to be taken into account.

The ISO 9001:2015 standard, in section 4.3, requires an organisation to precisely define the scope of its quality management system. This clause refers to a key aspect, allowing organisations to define the areas on which quality management will be focused. The introduction of this requirement aims to ensure that organisations set clear boundaries for their quality management system in order to effectively achieve defined objectives and meet stakeholder expectations.

Defining the scope of the quality management system is key as it enables organisations to focus their efforts on the areas most relevant to their business and their stakeholders. This scope includes both products, services and internal processes that affect the quality of the final results. Incorporating the 4.3 section into the quality management strategy helps organisations avoid ambiguity and ensure consistency of effort to achieve excellence in quality.

The process of scoping the quality management system should take into account the full context of the organisation. This means understanding the objectives, risk areas and stakeholder requirements. Scoping therefore includes an analysis of processes, functions, locations and external and internal interactions. It is crucial to consider all relevant elements that affect the final quality and meeting the requirements of the ISO 9001:2015 standard.

In conclusion, this section discusses the essence of the organisation's context according to the ISO 9001:2015 standard guidelines. The analysis of the organisation's context, taking into account both internal and external factors, plays an important role in the quality management process. It allows the identification of key aspects that affect organisations and the development of appropriate quality management strategies and actions.

3. Research Method

As part of the analysis, a systematic literature review method was used. The procedure was based on the methodological guidelines suggested by W. Czakon (Czakon, 2011) and H. Snyder (Snyder, 2019), allowing the review process to be replicated.

The procedure involved several steps. In the first step, three databases were selected: Web of Science, Scopus and Google Scholar. The next step was to extract papers with primary keywords and phrases in the selected databases. This was followed by an analysis of papers' abstracts, discarding those that were not relevant to the study. Detailed coverage was identified in the next step, which involved analysing the full text of the publications.

Through the detailed analysis of the texts, the main approaches to the analysis of the organisation's context were separated. This way, the systematic literature review method used provided a coherent structure for the analysis, covering a variety of sources and lines of research.

4. Results of the Survey of Perspectives on the Analysis of the Organisation's Context

The analysis of the organisation's context is a key element of effective quality management, as already mentioned in section 2. This section focuses on presenting the essence of the organisation's context in the light of the subject literature. An overview of the different perspectives and approaches to the analysis of the organisation's context found in the available literature is presented. The aim of this section is to identify various approaches to the analysis of the organisation's context and to enrich the understanding of this key aspect of quality management.

The research covered the period from the earliest available publications in various databases to 2023. The publication search was conducted in June 2023. During the analysis, using keywords and abstracts (where papers did not contain full or relevant keywords), an effort was made to identify dominant research perspectives.

The results of the quantitative text search are presented in Table 1.

Table 1.
Results of the quantitative text search

Search criteria	Number of results	
	Scopus	Web of Science
"ISO" AND "context of the organi*ation" AND "method*"	7	5
"ISO" AND "organi*ation context" AND "method*"	5	4
"ISO" AND "business environment" AND "method*"	19	17

Source: self-elaboration.

After merging the lists of publications identified from the searches in the Scopus and Web of Science databases, a list of 39 items was finally obtained and analysed for relevance to the aim of the study, i.e. to be able to provide information on applied approaches to the analysis of the organisation's context. Due to the small number of selected literature items, publications appearing in the Google Scholar search engine were also searched, resulting in additional 53 items. An analysis of the full texts indicated that, of all the texts, only 11 indicated that the subject matter addressed was consistent with the aims of the study.

A team of researchers from the Coimbra Business School in Portugal presents in their paper an approach to the organisation's context in the implementation of a quality management system in an organisation based on a case study. It takes into account methods specific to strategic management, namely stakeholder analysis, SWOT analysis and the Balanced Scorecard. It is one of the few publications that presents a strategic approach to determining the context of an organisation (Santiago et al., 2016). Similarly, V.I. Makolov and T.A. Levina in their publication devote much attention to strategic management methods for analysing the context of an organisation, such as SWOT, PEST and PESTEL analysis, scenario method and management analysis (Makolov, Levina, 2017).

The most numerous publications that emerged clearly indicate the dominance of a perspective strongly influenced by the requirements of the ISO standard. These include a text produced by a team from Cuba and Ecuador, which focuses on tools and techniques such as surveys, interviews and complaint analysis to identify the context of the organisation. However, this publication does not consider strategic management methods (Seborit et al., 2021).

L. Hrbáčková and D. Tuček devote much attention to risk management in quality management systems of companies of different sizes. Although they mention SWOT analysis, they do not refer to its practical use in analysing the context of an organisation (Hrbáčková, Tuček, 2019).

W. Pokora and M. Grężicki examine the context of the organisation in the light of the requirements of the ISO standard with regard to companies producing military equipment, which are at the same time obliged to take into account the requirements set by NATO in their quality management systems (Pokora, Grężicki, 2018).

In their publication, a team of researchers from the Slovak University of Technology in Bratislava compared the two standards, ISO 9001: 2015 and ISO 14001: 2015, also in the area of the organisation's context. They did so in terms of system integration possibilities and took into account the requirements specific to ISO standards (Novakova et al., 2016).

A. Matuszak-Flejszman and R. Pochyluk make a thorough analysis of both the concept of the organisation's context and the various internal and external factors that influence its functioning. In their stakeholder analysis, they consider the interrelationships between the factors and try to point to possible scenarios. Although firmly grounded in the requirements of the ISO standard, this publication attempts to point to an integrated approach to conducting an analysis of the organisation's context (Matuszak-Flejszman, Pochyluk, 2016).

I. Abuhav considers that the primary task of an organisation is to harmonise the strategies prepared for its different areas. Context of an organisation is required to identify and understand their business environment in which it operates. He suggests conducting an examination of the organization's context using PEST analysis (he also proposes a version of PESTELI) and SWOT analysis (Abuhav, 2017).

A. Dobrowolska, A. Kołodko also point to the possibility of using PESTEL analysis as a method to help determine the context of an organisation (Dobrowolska, Kołodko, 2023).

An author who considers an integrated approach to determining the context of an organisation is R. Wolniak. In his publication, he presents both the approach, typical of practical implementations of quality management systems compliant with ISO standards, based on the analysis of the needs of different stakeholder groups (although he does not focus only on customers), and also draws attention to the various factors that determine the functioning of an organisation by referring to PEST analysis (Wolniak, 2019).

The publication by E. Rimawan and D.S. Suroso also presents an integrated approach, considers the issue of risk management within an integrated management system, but takes into account PESTLE analysis, which is typical of strategic management and, when properly implemented, can also lead to outlining scenarios of change in the organisation's environment (Rimawan, Suroso, 2020).

The results of the study identified three main research perspectives that stand out in the discussion over the analysis of the organisation's context. These are the strategic management perspective, the quality management perspective and the last one is the integration of the aforementioned approaches to analysing the organisation's context, thus using both strategic and qualitative management methods to comprehensively understand one's environment and effectively manage quality.

Table 2 indicates the approaches identified from the analysis of the emergent texts for the implementation of the analysis of the organisation's context.

Table 2.
Research perspectives on the analysis of the organisation's context

Strategic Management Perspective	Quality Management Perspective	Integrated Perspective
Santiago et al., 2016; Makolov, Levina, 2017	Novakova et al., 2016; Pokora, Gręzicki, 2018; Saborit et al., 2021; Hrbáčková, Tuček, 2019	Matuszak-Flejszman, Pochyluk, 2016; Abuhav, 2017; Wolniak, 2019; Wahyudin et al., 2020; Dobrowolska, Kołodko, 2023

Source: self-elaboration.

One of the key approaches to analysing the organisation's context in the literature is the strategic management perspective. Strategic management methods allow organisations to consciously shape their future and achieve competitive advantage. Strategic methods widely described in the literature and used in business practice include SWOT (Strengths, Weaknesses, Opportunities, Threats) or PESTEL (Political, Economic, Social, Technological, Environmental, Legal) analysis, Porter's five forces analysis, and stakeholder analysis, which allow the identification of factors influencing organisation's activities and determining its position in the market.

The quality management perspective focuses on identifying and understanding customer requirements and analysing stakeholder needs. It uses quality tools to streamline processes and improve the quality of products and services. Quality management's analysis of the organisation's context provides a better understanding of the market and customer needs, which is key to delivering products and services that meet market expectations.

The integrated perspective, on the other hand, involves using both strategic and quality management methods to comprehensively understand the organisation's context. Organisations taking on this challenge seek a deeper assessment of their capabilities, risks and market and stakeholder needs. The authors' experience in strategic management and the implementation and maintenance of functioning quality management systems indicates that the integration of these perspectives allows for a more comprehensive approach to the analysis of the organisation's context, leading to better decisions and the ability to formulate sound strategies.

5. Conclusions

In summary, the analysis of the organisation's context is a complex process that requires an understanding of the various factors that influence organisation's operations. The literature provides general indications of perspectives and approaches to this issue. These are mainly derived from the body of work related to the fields of strategic management and marketing and extremely rarely take into account the functioning of quality management systems. This is confirmed by the small representation of such publications among those selected for the

study. Among the results of the analysis of the bases, the approach resulting directly from the requirements and provisions of the ISO 9001: 2015 standard is clearly visible. Unfortunately, it can lead to the omission of important factors and aspects of the organisation's functioning. This can be seen above all in organisations that focus primarily on maintaining a certified quality management system, which can lead to striving to meet mainly formal requirements. By drawing conclusions from the literature analysis, organisations can make informed decisions about which tools and methods are most appropriate for analysing their organisational context. Integrating the two identified different approaches to analysing the organisation's context, can contribute to better results and competitive advantage. The pursuit of continuous improvement and an informed approach to analysing the organisation's context are key elements of effective quality management in today's dynamic business environment. The ISO 9001: 2015 standard, in its latest edition, points to an important area that the management of any organisation should pay constant attention to in order to identify the changes taking place and the opportunities and threats arising from them.

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LABOUR MARKET EQUALITY POLICIES – THE SITUATION OF WOMEN AFTER PANDEMIC COVID-19

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Purpose: The analysis of the employment situation of Polish women after the COVID-19 pandemic and identification of measures in the area of labour market equality policy, both at the legal level, i.e. national and European Union regulations, as well as good practices in this area applied by enterprises.
Design/methodology/approach: This study is a review and attempts to analyse the professional situation of women on the Polish labour market after the COVID-19 pandemic, based on the latest Polish and foreign reports.
Findings: Current social and economic changes create conditions for a greater participation of women in the labour market, including in management. Gender equality measures concerning formal guarantees of equal treatment of women and men in the professional sphere should ensure the equal participation of women in the labour market. The problem of gender inequality in the labour market described in this paper needs to be looked at from a broader perspective than just legal or social justice. It should be seen as an opportunity to harness the potential of women as a force for economic growth and the development of businesses and entire economies. It is therefore worth pursuing and promoting all measures aimed at increasing women's participation in the labour market, including in management positions.
Research limitations/implications: The paper points out the benefits of taking pro-equality measures and supporting the conscious use of gender diversity as one of the organisational values. This should serve as a starting point for considering ways to avoid wasting the potential that makes up half of Polish society. Methods supporting gender equality in organisations were identified - both internal company regulations to ensure favourable working conditions for women, and those at the level of Polish socio-economic policy and European Union directives which make it easier to combine work and family responsibilities. Arguments are also provided for increasing the proportion of women in managerial positions with a view to gender diversity, which promotes the efficiency of companies and national economies.
Practical implications: the author presented good practices of companies in terms of gender equality policies.
Originality/value: Given the dynamic changes on the Polish labour market, which is already facing very strong supply pressures, seeking solutions to encourage as many people as possible on the labour market, including women, to remain economically active for as long as possible is a necessary condition for the development of the modern economy. Harnessing the potential of women brings tangible effects to economies and businesses, and therefore measures should be taken to redress the gender imbalance in various areas of the wider labour market.

Keywords: equality policy, gender equality, labour market, woman in business.
Category of the paper: The paper is a review.

1. Introduction

Over recent years, we can observe a number of initiatives aimed at ensuring equal treatment of women and men on the labour market, but despite this, there are still many challenges that Poland, like other European Union countries, will have to face in the coming years. The most important of these include increasing women's professional activity and equalising pay levels between men and women.

Changes in the labour market due to digitalisation, flexible forms of employment and remote working, bring new challenges for companies. This requires breaking down the stereotypes and barriers that characterise the patriarchal model of development and moving towards an equality model both at company level and in the labour market as a whole.

Many manifestations of gender inequality can be observed in today's labour market, which include wage inequality, the feminisation of certain professions and sectors of the economy, and the restriction of women's access to managerial positions, which is known as the glass ceiling phenomenon.

Discussions on the need to increase the proportion of women in management positions are currently being undertaken by politicians, academics and economists alike. The main advantage of more women in management positions is the achievement of better financial ratios in companies and, consequently, a higher market value for them, as evidenced by numerous authors and the research results of many reports (Devillard, Graven, Lawson, Paradise, Sancier-Sultan, 2012; Lisowska, 2010, pp. 3-12; Desvaux, Devillard-Hollinger, Baumgarten, 2007; Zwiększanie roli kobiet…). This approach also provides an opportunity to use all the skills and talents that both sexes are equipped with and ensures social justice.

Arguments in favour of increasing the proportion of women in leadership positions include (Zwiększanie roli kobiet…):

- diverse competences (education, experience and skills) enhance the quality of the management team,
- in gender diverse teams there is more social sensitivity and personal commitment to problem solving (people try harder),
- the company is perceived externally as ethical and financially sound,
- the company manifests a lower propensity for risk, which is particularly important in times of crisis,

- the company is oriented towards the needs of diverse target groups, including women, who are responsible for the majority of purchasing decisions,
- there is a better utilisation of the potential of employee teams at all levels of the company, and talent is valued and attracted,
- the world's highest valued brands have women on their boards.

The aim of this paper is to analyse the employment situation of Polish women after the COVID-19 pandemic and to identify measures in the area of labour market equality policy, both at the legal level, i.e. national and European Union regulations, as well as good practices in this area applied by enterprises.

2. Work situation of women after the COVID-19 pandemic

Poland is one of the countries struggling with the problem of a significant disproportion between the percentages of economically active women and men. The gender employment gap (Eurostat…) exceeds the EU average in our country, and the economic activity rate of Polish women (CSO…) has for years remained one of the lowest among EU citizens. These mechanisms can be considered particularly worrying in the era of an ageing population, when the number of working Polish women and men is decreasing year by year for demographic reasons.

Women in Poland are less economically active than men, however, they perform a lot of unpaid work, which results from the dominance of the traditional division of family roles, related to housekeeping and caring for children and family members in need of support. The excessive burden of domestic responsibilities is a major barrier to women's labour force participation. During the pandemic, women's unpaid care work increased, exacerbating the asymmetry in the combination of work-home responsibilities. Their incomes also fell as a result of the large price increase in 2022. Women have felt it more than men due to lower wages and pensions. Women's participation in the labour market is low and they are more inactive (especially 50+) (Report of the Women's Congress Association…).

Stereotypes in societies are also a barrier to women's participation in the labour market. These stereotypes make women themselves afraid to apply for attractive positions, underestimating the value of their competences. In turn, economically active women are confronted with stereotyped prejudices and direct discrimination, i.e. they are less frequently promoted, rarely hold the highest and best paid positions in the organisational hierarchy and, even in management functions, earn less than men with comparable competences. Unfortunately, no matter what position a woman holds, regardless of the industry, her earnings tend to be lower than a man's. If, in addition, she does not work full-time (women predominate

among those in part-time jobs), the wage gap (Sarata), taken as the difference in her total earnings compared to men, can be as high as 40% (https://www.europarl.europa.eu/…).

Table 1 outlines the main causes of inequality in access to promotion between men and women.

Table 1.
Causes of gender inequality in access to promotion

Women are sometimes overlooked for promotions by the Board of Directors, management and/or by HR staff as being:	**Women exclude themselves from promotion by not applying for management positions because:**
More 'problematic' because they get pregnant, take leave for the baby, etc.	They fear they will not be able to reconcile the career with childcare and home.
Having less aptitude than men for leadership positions: more emotional, less concrete, less organised, etc.	They assume that they are 'unsuitable' for management in 'typically male' industries, even though there is often no glass ceiling on promotions.
Difficult to accept as bosses by men working in positions of power executive, especially in male-dominated industries, teams dominated by men and/or in smaller towns/communities.	They find management jobs too stressful and/or time-consuming.
They fear that they will not be able to balance their careers with caring for their children and home.	
They assume that they are 'unsuitable' for management in 'typically male' industries, even though there is often no glass ceiling on promotions.	
They find management jobs too stressful and/or time-consuming.	

Source: Report of the Women's Congress Association, "Kobiety, rynek pracy i równość płac", https://kongreskobiet.pl//wp-content/uploads/2023/05/RAPORT.pdf, Warsaw 2023, p. 15, 15.07.2023.

According to Eurostat (Czy płeć ma znaczenie…), 44% of Polish women already hold managerial positions in the country. However, when we look at senior management, this share drops to around 25%. In turn, research conducted by the Polish Economic Institute among the largest companies listed on the Warsaw Stock Exchange shows that the share of women on management boards is 12.6% and on supervisory boards is 17.3%. Even in the financial sector, where women account for 60% of employees, there are only 13% of women on company boards (Increasing the role…).

According to the results of the Women's Congress Association's report, "Kobiety, rynek pracy i równość płac" (*Women, the labour market and equal pay*), 53% of those surveyed, including 60% of women and 47% of men, agree with the statement that it is mainly men who hold managerial positions. 38% of respondents disagree with this statement (Report of the Women's Congress Association…).

Currently, one of the manifestations of discrimination against women in the labour market is the problem of the wage gap. In the above-mentioned report, an overwhelming number of respondents (86%) disagree with the statement that women are less educated, so they earn less. At the same time, as many as 10% of men agree. The existence of such a belief is particularly

surprising given that women in Poland are much better educated than men. Similarly, as many as 76% of respondents (81% of women and 71% of men) disagree with the statement that women do not engage in work as much as men due to having children, so they earn less. However, almost one fifth of men believe that women do not engage in work to the same extent as men (so they earn less) (Report of the Women's Congress Association…).

3. Labour market equality policies

Measures aimed at providing equal opportunities for women and men on the labour market are an indispensable element on the road to increasing the competitiveness of the economy. Polish enterprises are currently facing a shortage of skilled workers and the growing costs of an ageing society. Without utilising the potential of women and diversity management policies, they will not be able to grow.

The Polish government's actions aimed at ensuring equal opportunities are often only a facade. The National Action Programme for Equal Treatment for 2022-2030 (National Action Programme…), contains announcements of, inter alia, supporting the professional activation of women, closing the wage gap and increasing the share of women on company boards. However, the programme has remained largely in the realm of declarations. There are no concrete measures for its implementation, no schedule for the work, and no sources of funding.

In Poland, several solutions have so far been introduced at the socio-economic policy level to facilitate the combination of work and family responsibilities (Table 2).

Table 2.
Polish legal solutions to support women's professional activity

Source	Content of the regulation	Benefits
Journal of Laws 2023.1465 i.e. Act in force Version from: 31 July 2023.	**Article 1821e. § 1.** An employee may combine the taking of parental leave with working for the employer granting this leave up to a maximum of half of the full working time. In such a case, parental leave shall be granted for the remainder of the working time. **Article 1821f**. **§ 1**. Where an employee-parent combines the taking of parental leave with work for the employer granting the leave, the duration of parental leave shall be extended in proportion to the amount of time worked by the employee during the leave or part thereof, but no longer than up to: 1) 82 weeks - in the case referred to in Article 180(1)(1); 2) 86 weeks - in the cases referred to in Article 180(1)(2-5).	Possibility combining parental leave with part-time work.

Cont. table 2.

Social Security regulations effective as of 01.01.2018.	The nannies' pension, disability and accident insurance premiums, calculated from a base which is no more than half the minimum wage, shall be financed by the State budget through the Social Insurance Institution. The premiums are financed by the state budget regardless of whether the nanny is subject to compulsory or voluntary pension insurance. The Social Insurance Institution pays contributions financed by the state budget, when the following conditions are all met: **1.** the nanny has been declared by the parent for social security and health insurance; **2.** parents or a single parent: - is/are employed (this should be understood as the performance of work on the basis of an employment relationship, a contract of employment, the undisputed performance of employment in a country other than Poland, and the performance of other forms of professional activity (...), - provide services on the basis of a civil law contract constituting a title to social insurance (this refers to all civil law contracts constituting a title to insurance, i.e. an agency contract, a contract of mandate or another contract for the provision of services to which, in accordance with the Civil Code, the provisions on mandate are applicable), - is/are engaged in non-agricultural activities, - is/are engaged in agricultural activities. **3.** the child is not placed in a creche, a children's club, has not been taken care of by a day-care provider and is not in pre-school education including the adaptation period.	Funding of insurance premiums for nannies from the state budget.

Source: Own compilation on the basis of: Journal of Laws 2023.1465 i.e. Act in force, Version from: 31 July 2023, https://sip.lex.pl/akty-prawne/dzu-dziennik-ustaw/kodeks-pracy-16789274/art-182-1-e, 8.09.2023; SSP, Nannies in Social Insurance, https://www.zus.pl/documents/10182/44493/nianie+ kompendium.pdf/cd66ef6e-ece8-416e- 8362-10154e5b20cc, Warsaw 2022, pp. 8-10.

The framework for equality policy is also provided by the new European Union Directives, which give directions and introduce tools for implementing equality policy in important areas for equal opportunities for women and men (Report of the Women's Congress Association…):

- WORK-LIFE BALANCE - Directive on work-life balance for parents and carers (Directive (EU) 2019/1158…).
- PARITIES IN BUSINESS - Directive on improving gender balance among non-executive directors of listed companies and related measures (Directive Of The European Parliament And Of The Council (EU) 2022/2381…).
- PAY TRANSPARENCY - Directive of the European Parliament and of the Council on strengthening the application of the principle of equal pay for men and women for equal work or work of equal value through pay transparency and enforcement mechanisms (Directive Of The European Parliament And Of The Council on enhancing…).

It should be emphasised that in order to realise the potential of women, it is necessary to introduce effective systemic solutions to counter discrimination in the labour market.

4. Good corporate practice in equality policy

Business has emerged as a leader in changing the introduction of good practices in equality policies. Model solutions are initiated especially by large companies, often with foreign capital. These organisations are taking more and more initiatives to eliminate barriers, creating inclusive recruitment policies and clear career paths, providing training on unconscious biases, making working patterns more flexible and increasing the transparency of remuneration policies. There is also a growing widespread awareness of one's rights and sensitivity to inequalities and companies are recognising that social change entails guaranteeing everyone equal opportunities for employment, a raise or promotion.

Examples of good practice from companies operating in Poland cover three main areas (Figure 1):

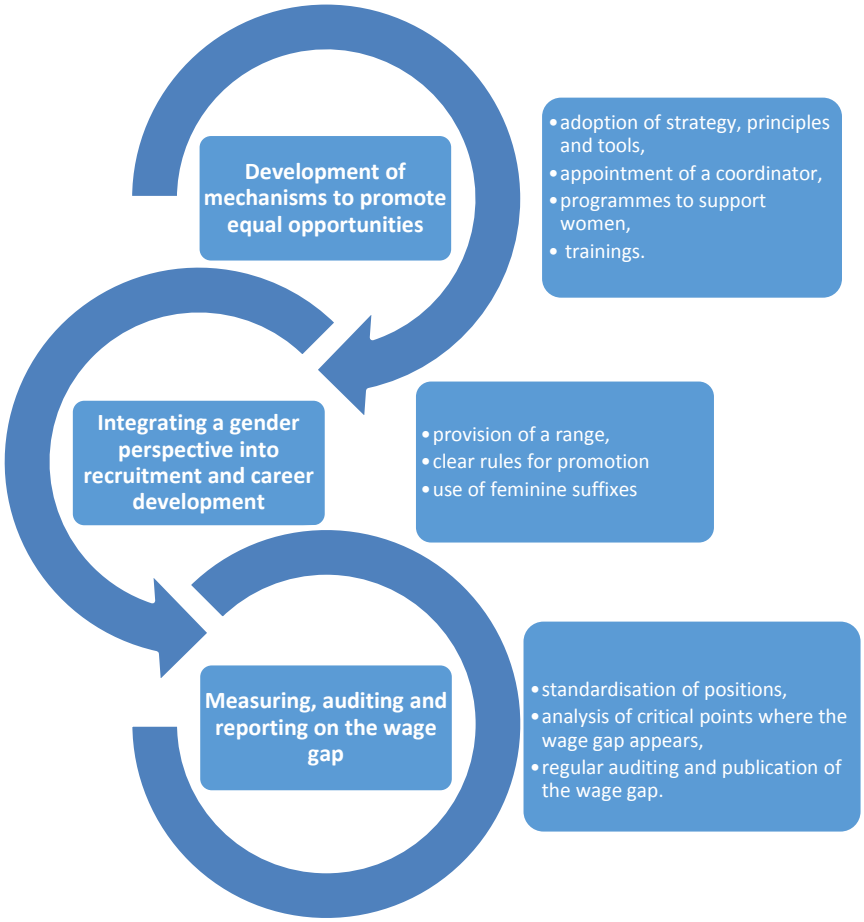

Figure 1. Corporate equality measures.

Source: Own compilation based on the Report of the Association of the Congress of Women, "Kobiety, rynek pracy i równość płac", https://kongreskobiet.pl//wp-content/uploads/2023/05/RAPORT.pdf, Warsaw 2023, p. 35, 15.07.2023.

As behavioural economists point out, prejudice against women is a significant barrier to making visible progress towards greater representation of women in decision-making bodies (Wolfers, 2006; Reuben et al., 2012). Women with identical qualifications and skills are perceived as less competent than men. In business, abilities and skills are underestimated in women and overestimated in men. This is confirmed by studies conducted in Poland: employers are not convinced of women's competences and qualifications (Niemczewska, Mrowiec, Paterek, 2007, p. 34). They explain women's lower professional position and their lack in managerial positions by their lower ability to manage subordinates, their inability to set goals and create visions.

Diversity - especially gender diversity at the highest levels of management - is nowadays seen primarily as a creator of higher profitability (Adler, 2001; The Bottom Line…, 2011; Women at the Top…, 2010; Lisowska, 2010, pp. 3-12) and company competitiveness (Griffin, 2004, pp. 15, 190; Wróbel, 2010, pp. 72-79). This is one of the drivers for which companies are increasingly implementing solutions to support the increased employment of women in management positions (shown in Figure 2), which primarily require:

1. allowing employees to flex their working hours,
2. the wider implementation of professional development programmes for women,
3. changing the organisational culture of companies to promote different management styles.

The inclusion of women in boards and top management is not a fashion imperative, but a logical business decision. A greater role for women in business management - and a diverse leadership team - can be elements of a company's competitive advantage (Wróbel, 2010).

A focus on diversity is conducive to attracting talent, especially women, who, as a significant group (half of every society), constitute a hitherto undervalued source of talent, including managerial talent. A feature of a diversity-oriented organisational culture is the respect of existing laws on equal treatment in the workplace and in relations with stakeholders, but also the widespread promotion of values, norms and customs that are part of building an atmosphere of acceptance and appreciation of differences, rather than merely tolerating them (Wojciechowicz, 2015, p. 711).

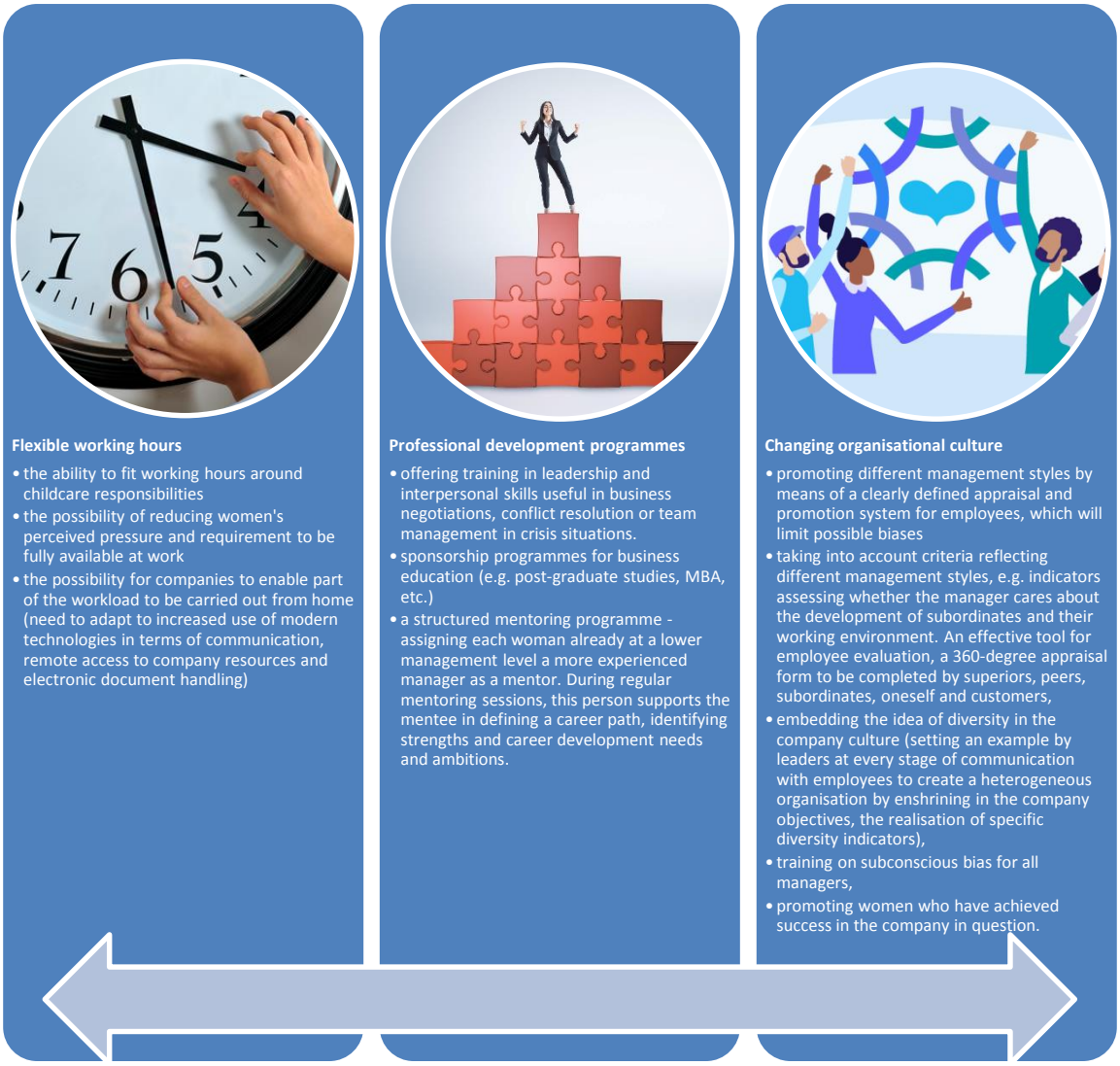

Figure 2. Initiatives by companies to support women in management positions.

Source: own compilation based on McKinsey&Company report, The Power of Equality. How and why to support women in their careers, 2017, pp. 23-25.

Realising the potential of women in the labour market largely depends on the employers themselves. Openness to flexible working hours, remote and part-time working, training, the creation of an appropriate organisational culture and the broader concept of diversity management serve to demonstrate the tangible benefits of these measures.

5. Conclusion

Gender is one of the most visible signs of diversity in the workplace. The diversity of human capital is a source of new opportunities for the company, and diversity management is a business strategy aimed at consciously harnessing the diverse potential of employees (Thomas, 2006, p. 103).

According to current research from the global report 'Women in Business and Management. Gaining Momentum' produced by the International Labour Organisation in 2015, achieving gender balance economically is a wise calculation. It is estimated that maintaining equal proportions could add US$240 billion to the UK's GDP, US$1,201 billion to the US GDP, US$526 billion to Japan's and US$285 billion to Germany's. The report's findings indicate that reducing the gender gap in business has been one of the factors that has significantly influenced European economic growth over the past 10 years (Słowik, 2017, p. R6).

Unfortunately, the perception of women through the prism of motherhood, questioning of competences or unconscious biases sometimes held by decision-makers in organisations continue to be an obstacle to equal opportunities for women and men in the labour market.

Current social and economic changes are creating the conditions for greater participation of women in the labour market, including in management. This subject continues to be the subject of much controversy, whether regarding the facts, the directions of change, women's opinions, legal solutions or factors determining women's success in management. The body of work on gender equality concerning formal guarantees of equal treatment of women and men in the professional sphere should ensure the equal participation of women in management (2009, p. 9). Reality, however, leaves no illusions that the situation is still far from desirable. The problem of gender inequality in the labour market described in this paper needs to be looked at from a broader perspective than just legal or social justice. It should be seen as an opportunity to harness the potential of women as a force for economic growth and the development of businesses and economies as a whole. It is therefore worth continuing and promoting all measures to increase women's participation in the labour market, including in management positions.

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INDUSTRY 5.0 AS THE UPGRADE OF INDUSTRY 4.0: TOWARDS ONE COMMON CONCEPT OF INDUSTRIAL TRANSFORMATION

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Purpose: Ten years after the introduction of Industry 4.0, politicians and scientists have started to promote the new concept of Industry 5.0. In this new concept, Industry 4.0 technologies are supposed to help companies achieve sustainability and resilience, and put people at the centre of technological change. This publication is based on a literature review. The topic of the analysis was Industry 5.0. The aim of the analysis was to present the research fields of researchers about Industry 5.0

Design/methodology/approach: Literature review was realized based on papers in data base Web of Science (WoS). The first paper was identified in 2016. After the year, there were more and more papers in the WoS data base. In the analysis, the method of SLR was used.

Findings: Based on realized analysis, the key research fields was identified. On the research fields, the discussion of Industry 5.0 was realized. The discussion was conducted in line with the three strategic directions for industrial transformation, which are written in the January 2021 EC document. These directions are: human at the centre of transformation, sustainability and resilience.

Originality/value: The key element of the paper is the matrix with research fields. In conclusion, the author states that due to the short period of industrial transformation, both concepts are industry changing. The concepts are difficult to separate from each other, so the author suggests using the term: Industry 4.0/5.0.

Keywords: Industry 5.0, Industry 4.0, Industry 4.0/5.0, industrial transformation, sustainability, humans, resilience.

Category of the paper: conceptual paper.

1. Introduction

The Fourth Industrial Revolution is popularising the fourth level of transformation - Industry 4.0 - the concept of using automation, digitisation, computerisation and smart manufacturing techniques in production processes and logistics. Industry 4.0 is an umbrella term for a number of techniques and principles for building smart solutions in companies and the value chain (Kagermann, 2015; Hermann et al., 2015). Enterprises 4.0 combines many technologies into cyber-physical systems with access to the Internet of Things (IoT). The result of Industry 4.0 is to be smart factories, with digital systems controlling production and logistics processes based on computer models. Over the Internet, the systems communicate machines with each other (M2M), machines with employees (M2P) and with business (M2B).

In the industrial transformation of companies towards smart manufacturing, influenced by the uncertain market situation in which companies find themselves after the pandemic period, politicians are calling on companies to improve their transformation approaches and tools. Introducing innovative thinking into companies and steering them towards the development towards Industry 4.0 has been complemented by the challenges enshrined in the new concept of Industry 5.0. This new concept sets out three key developments: the synergy of man and technology, sustainability and resilience (EC document, Jan. 2021). It can be assumed that both the idea of Industry 4.0 and the strategic challenges of Industry 5.0 are part of a common concept for the development of the industry (in Polish: *Przemysł Przyszłości* - the name of the Polish platform - przemyslprzyszlosci.gov.pl).

For some, Industry 5.0 is the result of next revolution (the Fifth Industrial Revolution), for others, an upgrade of Industry 4.0. Industry 5.0 is a concept addressed to manufacturers, as changes in factories are particularly visible, but also to many areas of human activities. The concept of Industry 5.0 is combined with the Japanese idea of Society 5.0, i.e. a society in strong synergy with high technologies and the global digitalisation of human activity – the strategy Japan's digitization (http://www.cebit.de/en/news-trends/news/society-5-0-japans-digitization-779). Society 5.0" - Super Smart Society - that was offered in 2016 by Japan's most important business federation, Keidanren and being strongly promoted by Council for Science, Technology and Innovation; Cabinet Office, Government of Japan (Nirmala, 2016).

The aim of this paper was to present the idea of the Industry 5.0 concept based on a literature review. The work consists of three parts. The first part is a consideration of the idea of Industry 5.0. In this section, strategic development directions are cited. The second part was based on the analysis of the Web of Science database on the topic: Industry 5.0. The scope of the analysis concerned publications about Industry 5.0 registered in the database in 2016-2022. The publications were organised according to the researchers' research fields. The result of the analysis is the matrix of research fields. The third part of the work is a scientific discussion of

the Industry 5.0 concept. The discussion was conducted in accordance with the three directions of transformation, as enshrined in the EC document (Industry 5.0 - ec.europa.eu, Jan. 2021).

2. Industrial transformation in the strategic directions of Industry 5.0

For more than a decade, there has been a discussion about the sense and substance of the next development concept, which the European Commission has called Industry 5.0 ('Industry 5.0' - ec.europa.eu). The discussion involves politicians, scientists and practitioners. In the course of the discussion, many arguments are raised in favour of popularising the next concept, as well as objections as to the sense of Industry 5.0 in the still-developing Industry 4.0. Some scientists assume that Industry 5.0 is a refinement of the Industry 4.0 concept, and some that it is the result of the Fifth Industrial Revolution (Skobelev, Borovik, 2017). According to Matthews (2018) "Industry 5.0 takes the automated and efficient concepts of Internet of Things and big data and injects them with a traditional, personalized human touch". In discussions, scientists and politicians mainly focus on the thesis that Industry 4.0 is all about technology and Industry 5.0 is a concept that sets (organises) the directions of industrial transformation (Gajdzik, 2023). Such a thesis is just a rather popular myth - a statement made by D. Kwiek (2022). In reality, the meaning of the Fourth Industrial Revolution is changes far deeper than technological, i.e. involving the improvement of organisations, the introduction of new business models and the placement of the employee at the centre of technological change. Nevertheless, the European Commission's concept of *Industry 5.0 towards a sustainable, human-centric and resilient European industry* has reminded companies of humanity, the environment and stability. After the COVID 19 pandemic, new thinking about industrial transformation began. According to Skobelev and Borovik (2017) "Industry 5.0 involves the penetration of Artificial Intelligence in man's common life, their "cooperation" with the aim of enhancing the man capacity and the return of the man at the "Centre of the Universe". In Industry 5.0, humans are strongly connected to technologies. Human collaborates and co-exists with Industry 4.0 technologies (Rada, Linkedin). According to Alves et al. (2023) Industry 5.0 is attributed to the Fifth Industrial Revolution. The transition from the Fourth Industrial Revolution to the Fifth is also being considered by Xu et al. (2021). Many researchers and practitioners agree that the technologies of the Fourth Industrial Revolution have not yet built Industry 4.0. The transformation of industry to Industry 4.0 is still ongoing (Xu et al., 2021). For many industries, adapting to the changes of the Fourth Industrial Revolution can still be challenging (Gajdzik, Wolniak, 2022; Gajdzik, 2021, 2022; Lorenz et al., 2015). Since the first industrial revolution began in the 19th century, however, progress has not come to a standstill. Centuries invested in new devices and more technologically advanced equipment have given rise to a new development concept called Industry 5.0. We are now in the midst of a cyber revolution, often

known as Industry 4.0 (Matuszak, 2022). Longo, along with co-authors (2020), considers Industry 5.0 as a new revolutionary wave that is emerging as the "Age of Augmentation", when man and machine will reconcile and work in perfect symbiosis with each other (2020).

The interesting concept of Industry 5.0 is commented on by the I-scoop website founded by J-P De Clerck. In the article entitled. 'Industry 5.0 - the essence and reasons why it gets more attention', we read: Industry 5.0 should not be combined with the next industrial revolution, that would be completely wrong (https://www.i-scoop.eu/industry-4-0/industry-5-0/). In the United States, the term Industrial Internet of Things (IIoT) is often used instead of Industry 4.0. In Japan, on the other hand, Industry 4.0 is embedded in the concept of Society 5.0. Carloty Perez states that everything is relative and that industrial revolutions today are a matter of vision. Since Industry 4.0 is sometimes perceived as a 'cool' concept of development, therefore attempts are being made to give it a more 'human' face.

Grabowska et al. (2022) emphasise that social aspects are regaining their rightful place in Industry 5.0. Industry 5.0 is the reintroduction of people into industrial infrastructure and production and logistics processes (Saniuk et al., 2022). Industry 5.0 is strongly linked to Society 5.0 (Soltysik-Piorunkiewicz, Zdonek, 2021). People and machines are reconnecting and collaborating to achieve new production efficiencies and quality of life. The 'human touch' has become an important strategic direction of Industry 5.0. In Industry 5.0, robots are to accompany humans and improve production processes The collaboration of humans and computerised machines will significantly improve the optimisation and automation of many enterprises. The concept of 'human touch' to industry is to increase the degree of collaboration between humans and intelligent production systems. Such a marriage is expected to bring together the best of two worlds - the speed and accuracy guaranteed by automation with the cognitive skills and critical thinking of humans (Nahavandi, 2019).

The development of Industry 5.0 is identified with artificial intelligence and the potential to significantly deepen the interaction between humans and machines. Advances in deep learning are bringing factories closer to realising the vision of smart factories (Friday, 2018). Collaboration between technology and people will result in new techniques and ideas and contribute to reducing waste and costs. Sustainability is a strong strategic direction for industrial transformation (Gajdzik et al., 2020). Unfortunately, Industry 4.0 does not have a strong focus on environmental protection, nor has it focused technologies to improve the environmental sustainability of the Earth, even though many different AI algorithms have been used to investigate from the perspective of sustainability in the last decade (Nahavandi, 2019; Alzoubi et al., 2019). In Industry 5.0 linking AI algorithms with environmental management is the new way of industrial transformation. Industry 5.0 leads to the better technological solution to save the environment and increase sustainability. Expanding on research about Industry 5.0, experts reiterate well-known assumptions about the circular economy, ecology, green energy, realising people's needs without compromising the same needs of future generations, and highlight the potential of AI in optimising the consumption of goods. According to A. Komoli

with Sumitomo Bordnetze (https://www.production-manager.pl/2020/02/03/industry-5-0-przyszlosc-ktora-juz-istnieje/): Industry 5.0 will be associated with more advanced analytics using machine learning, (again) artificial intelligence and new systems and blockchain. Also Z. Piątek (2018) in AutomationB2B argued that Industry 5.0 could possibly be attempted to be combined with the potential of AI and the deepening of human-machine interaction using machine learning. The common denominator of all these discourses is the hopes of leapfrogging AI affecting both data analytics and communication between workers and devices (in all configurations).

Technology is supposed to help companies acquire resilience. Researchers formulate the question: what can technology do for stability (Maija Breque, Lars De Nul, Athanasios Petridis: www.research-and-innovation.ec.europa.eu). Resilience is to be in the happening geopolitical changes, crises, pandemics and other changes due to the fragility of globalised production.

It can be assumed that the technologies building Industry 4.0 are the base in the changes taking place, and the strategic directions of development enshrined in the concept of Industry 5.0 are the superstructure over the technological changes already taking place. In Industry 4.0 there are usually identified four key components: CPS, Internet of Things (IoT), Internet of Services (IoS), and Smart Factory and six major technologies: the Industrial Internet of Things (IIoT) and CPPS, additive production (3D - the printing), Big Data, an artificial intelligence (AI), Collaborative Robots (CoBot) and the virtual reality (Skobelev, Borovik, 2017). Industry 5.0 there are three strategic directions of industrial transformation: human-centric, sustainable and resilient. The outcome of Industry 4.0 is CPSs, which will achieve autonomous in Industry 5.0 at the manufacturing level. In addition, personalisation will continue to develop to help consumers use products better. In Industry 5.0 there are a lot of technologies linked with personalization or creative production. Technologies are the best fit for applications or services where a personalized and human touch provides better customer experience (Ozdemir, Hekim, 2018).

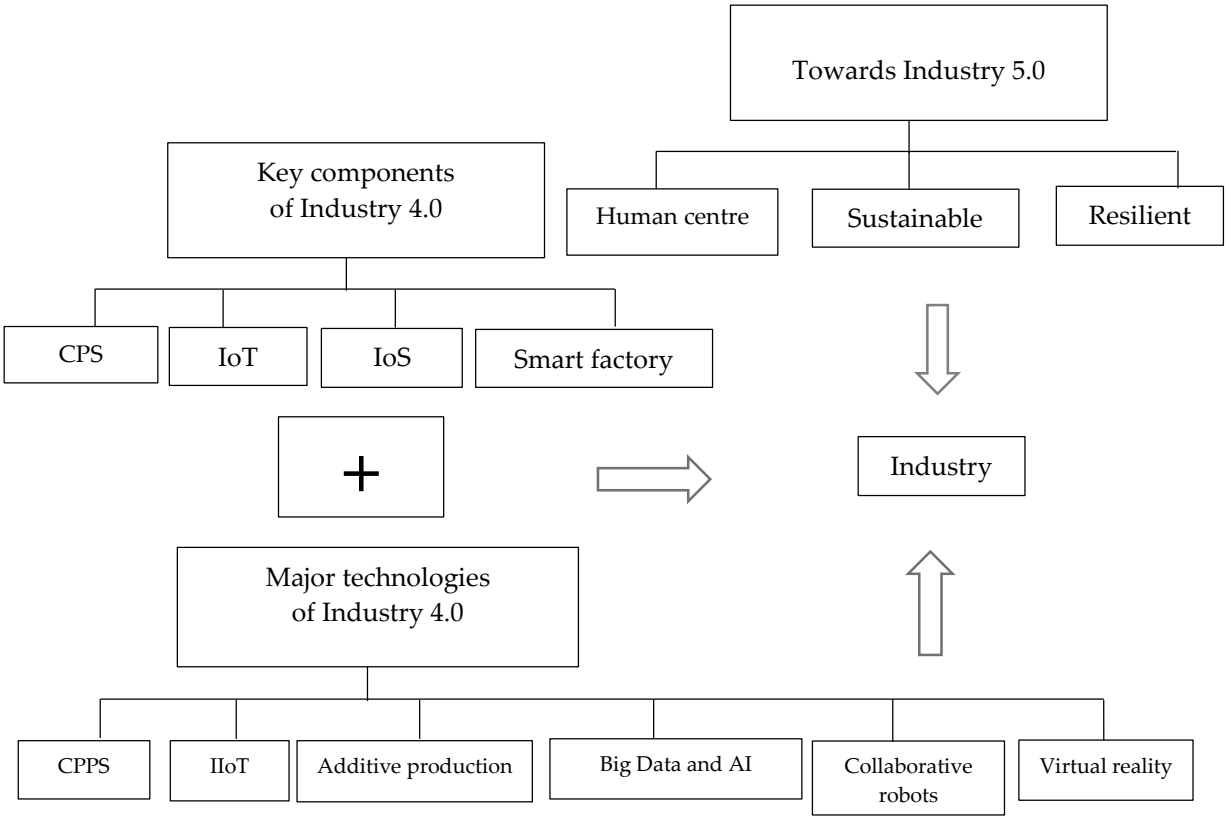

Figure 1. Towards one concept Industry 4.0/5.0.

Source: own elaboration (Gajdzik, 2023).

European Industry 5.0 is constantly being improved. In September 2020, the European Commission published a paper by J. Müller entitled: 'Enabling Technologies for Industry 5.0. Results of a workshop with Europe's technology leaders'. The paper contains an early proposal of the Industry 5.0 concept, describes the technologies relevant to this phase and identifies social, governmental, political and economic challenges. In turn, following the 'Industry 5.0' report of January 2021, the EC published even a year later yet another study 'Industry 5.0, a transformative vision for Europe. Governing Systemic Transformations towards a Sustainable Industry'. The document, created by 15 authors led by Sandrine Dixson-Decleve, is a step between a comprehensive definition with 'Industry 5.0' and the development of a roadmap for realising the concept. Industry 5.0 will be the era of machine learning and artificial intelligence, the era of data and learning from it. But it will also be a time of new systems.

Technological developments are already making it possible to create systems that will not be based on classic databases, but on interconnecting objects. Systems will only define connections that can be stored using the blockchain idea, which is gaining popularity in production systems. This will certainly be the next big revolution for businesses. As the current revolution is not yet properly implemented and utilised, it remains to be hoped that we will prepare much better for the next one and start the process of adapting businesses to new challenges much earlier (Komolka, 2019).In time, companies and people will better understand the idea of Industry 5.0 as a vision of development for a new quality of life and business.

3. Research fields of Industry 5.0 based on literature review

The methodology was carried out, based on scientific publications registered in the Web of Science (WoS) database, on the topic of the study on Industry 5.0 (the keyword Industry 5.0 was used to search for publications). The first publication on Industry 5.0 (2016) was taken as the start of the analysis. The analysis was closed at December 2022. The number of publications was analysed in each completed year. The result of the analysis was the matrix of research fields (Table 1 and Table 2).

Table 1.
Matrix of Industry 5.0 research fields based on papers in the WoS database

Year	Number of papers	Research fields	Source
2016	1	*Author keywords*: socio-economic development, industrial engineering, relevance virtual evolution	Sachsenmeier, 2016
2017	0	-	-
2018	2	*Author keywords*: Society 5.0, full automation, IoT, Big Data, ecosystem, embedded strategy, networks, social aspect, transformation, humanisation, ethical aspect, changes, development strategy, industrial policy, social governance, artificial intelligence (AI), technology policy.	Kang, 2018; Ozdemir, Hekim 2018.
2019	4	*Author keywords*: Society 5.0, technological development, cooperation robots and human, human-centre, digital processing, sensors, IoT, enabled data Smartphone, wireless data acquisition, signal processing, artificial intelligence (AI), advanced manufacturing.	Nahavandi 2019; Salimova et al. 2019; Hamdani et al. 2019; Fitzgerald et al., 2019.
2020	11	*Author keywords*: value, human-centric, technology engineering, COVID-19, innovation, IoT, manufacturing, ethical engineering, operator 4.0, Industry 4.0, Society 5.0, open innovation, value co-creation, big data, artificial intelligence, advance technologies, digital innovation, personalization, Absolute Innovation Management (AIM), design thinking, innovation management, strategy, innovation ecosystem, competitive advantage, economic development, implementing innovation, innovation framework, capabilities, manufacturing, complex adaptive systems, self-organization, digital platform, digital ecosystem; Multi-agent technology, smart services, resource management, fourth industrial revolution, sustainable development, sustainability, sustainable development goals –SDGs.	Longo et al., 2020; Javaid et al. 2020; Aslam et al. 2020; Javaid, Haleem, 2020; Aquilani et al., 2020; Gorodetsky et al. 2020; John et al. 2020; Monteiro et al., 2020; Sherburne 2020; Salimova et al. 2020; Nwogugu, 2020.

Cont. table 1.

2021	29	*Author keywords*: Society 5.0, balance, social aspects, changes, economic advancement, manufacturing, IoT, AI, enabling technologies, industrial revolution, Industry 4.0, technology, value, Corporate Social Responsibility (CSR); socially responsible economic advancement, social problems, industry, bioenergy, engineering, Sustainable development goals (SDGs), green IoT, IIoT, edge computing, edge AI, sustainability, digital transition, digital circular economy, smart society, digitalized society, fusion energy, open data, cluster analysis, visualization, evolution, RIFD, communication, technological competitiveness, emerging economies, digitalization, emerging technology use, Blockchain technology, automated analytics, Cyber-Physical Systems (CPSs), design automation, system synchronization, DVFS control, ccollaborative robotics, manufacturing, business intelligence systems, sustainability, data, common-sense capability, machine learning, 6G, blockchain, Cyber-Physical-Social Systems (CPSS), Internet of No Things, on-chaining, oracles, Robo-nomics, tactile Internet, human capital, employee assessment, labor performance, individual trajectories of professional development, organizational innovation, knowledge society, Cyberloafing, Industrial Revolution 4.0, Human-Robot Collaboration (H-RC), digital platform, ambient assisted living, ambient intelligence, enhanced living, environments, ecosystems, networks, communities, edge computing, advanced technologies, business models, value chain.	Top(*) Potocan et al., 2021; Xu et al., 2021; Maddikunta et al., 2021; Zengin et al., 2021; ElFar et al., 2021; Fraga-Lamas et al., 2021; Carayannis et al., 2021; Soltysik-Piorunkiewicz, Zdonek, 2021; Rupa et al. 2021; Di Nardo, Yu, 2021.
2022	87	*Author keywords*(*): digital, social innovation, Society 5.0, digital transformation, digital green innovation, manufacturing industry, cognitive evaluation, enterprise performance, human-centric manufacturing, industrial human needs pyramid, self-organizing manufacturing, human-machine relationship; Human-centric human-robot collaboration, 6G mobile communication, industries, optimization, automotive engineering, green transportation, backscatter communication, nonorthogonal multiple access (NOMA), vehicular networks, artificial intelligence (AI), smart manufacturing, big data, Internet of Things, human-machine coexistence, 21st century skills, engineering education, higher education, smart environments, knowledge circulation, innovation ecosystems, techno-centric and human-centric innovations, 6G, edge computing, enabling technologies, pervasive AI.	Top(*): Akundi et al., 2022; Maddikunta et al., 2022; Carayannis et al., 2022; Broo et al., 2022; Kaur et al., 2022; Khan et al., 2022; Lu et al, 2022; Yin et al., 2022; Carayannis, Morawska-Jancelewicz, 2022.

Top(*) only papers with the highest citations: time of citations in WoS, author keywords (*) only with Top list.

Source: own elaboration.

In the next table (Table 2), the research fields of the scientists from Table 1 are arranged according to four areas: (1) technological changes, (2) sustainable and digital development, (3) human-centric (4) resilience and CSR.

Table 2.
Segments of research fields about Industry 5.0

Segment	Research fields
Technology and industrial transformation	industrial engineering full automation, IoT, Big Data, networks, industrial transformation, artificial intelligence (AI), technology policy, technological development, digital processing, sensors, enabled data Smartphone, wireless data acquisition, signal processing, advanced manufacturing, technology engineering, innovation, Industry 4.0, manufacturing, advance technologies, digital innovation, personalization, Absolute Innovation Management (AIM), design thinking, innovation management, manufacturing, complex adaptive systems, self-organization, digital platform, digital ecosystem; Multi-agent technology, smart services, resource management, fourth, enabling technologies, industrial revolution, Industry 4.0, technology industrial revolution, IIoT, edge computing, edge AI open data, cluster analysis, visualization, evolution, RIFD, communication, technological, Blockchain technology, automated analytics, Cyber-Physical Systems (CPSs), design automation, system synchronization, DVFS control, collaborative robotics, manufacturing, business intelligence systems, machine learning, 6G, blockchain, Cyber-Physical-Social Systems (CPSS), Internet of No Things, on-chaining, oracles, Robo-nomics, tactile Internet, digital platform, ecosystems, networks, communities, edge computing, advanced technologies, self-organizing manufacturing, 6G mobile communication, industries, optimization, automotive engineering, backscatter communication, nonorthogonal multiple access (NOMA), vehicular networks.
Sustainable and digital development	socio-economic development, Society 5.0, ecosystem, embedded strategy, social aspect, changes, development strategy, industrial policy ,social governance, strategy, innovation ecosystem, economic development, implementing innovation, innovation framework, capabilities, sustainable development, sustainability, sustainable development goals –SDGs, balance, social aspects, changes, economic advancement, bioenergy, engineering, Sustainable development goals (SDGs), green IoT, sustainability, digital transition, digital circular economy, smart society, digitalized society, fusion energy, Cyberloafing, Industrial Revolution 4.0, business models, value chain, sustainability, digital and social innovation, Society 5.0, digital transformation, digital green innovation, manufacturing industry, cognitive evaluation, enterprise performance, green transportation, techno-centric and human-centric innovations, 6G.
Human-centric	humanisation, cooperation robots and human, human-centric, operator 4.0, human capital, employee assessment, labor performance, individual trajectories of professional development, organizational innovation, knowledge society, Human-Robot Collaboration (H-RC), human-centric manufacturing, industrial human needs pyramid, human-machine relationship; human-centric human-robot collaboration, human-machine coexistence, 21st century skills, engineering education, higher education, techno-centric and human-centric innovations.
Resilience and responsibility	relevance virtual evolution ethical aspect, responsible value , COVID-19 ethical engineering ,open innovation, value co-creation, competitive advantage, Corporate Social Responsibility (CSR); socially responsible economic advancement, social problems, competitiveness, emerging economies, digitalization, emerging technology use, common-sense capability, ambient assisted living, ambient intelligence, enhanced living, environments, smart manufacturing, smart environments, knowledge circulation, innovation ecosystems, edge computing, enabling technologies, pervasive AI.

Source: own elaboration.

In future studies, these research fields will be analysed using computer programmers. The future analysis will focus on the ordering of fields for Industry 5.0. After further ordering, the author intends to continue conceptual research about Industry 5.0.

4. Discussion

The Industry 4.0 view is the implementation of various new technical solutions into business entities especially in production to increase their level of innovativeness and effectiveness. But as we can observe in many companies not always the effectiveness on tactical level is connected with effectiveness on strategic level of company (Miyake, 2022; Sultan et al., 2021). Sometimes the company can implement new technological solution but it's effectiveness will not increase in long term due to lack of strategical view, strategical thinking and strategical approach. The tactical level is something between Industry 4.0 and Industry 5.0 – on this level we can observe many activities connected with both of those conceptions. Fig. 2 presents the place of Industry 4.0 and Industry 5.0 from level of management point of view.

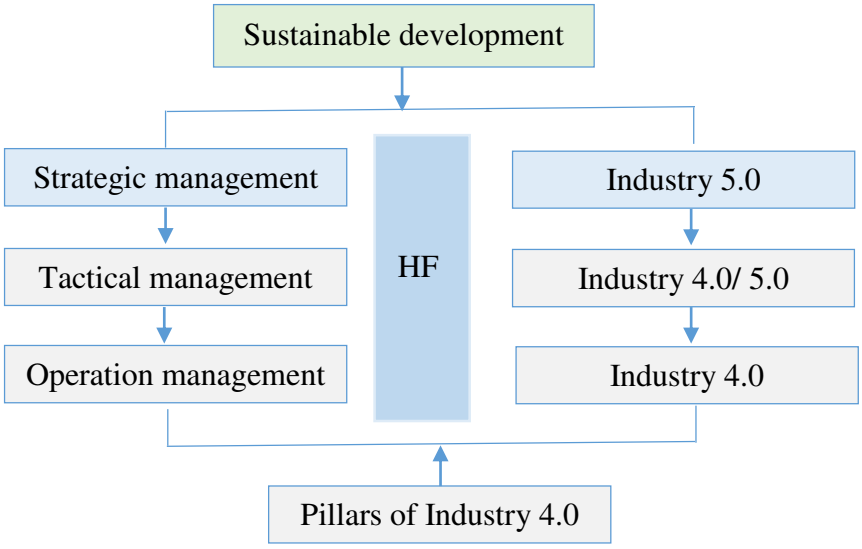

Figure 2. The model of relation Industry 5.0 and Industry 4.0 with management levels.
Source: Wolniak, 2023.

The first new aspect connected to Industry 5.0 is the human approach to business problem. All business today should take into account problems connected with human (Carayannis et al., 2022). This approach means that organization should take into account the cultural aspect of business like the type of country and organizational culture, the type of leadership, etc. Organization should promote diversity, talents and empowerment in business. Some researches point out that diversity could be for example very beneficial for innovation point of view and boast level of innovativeness of organization (Adel, 2022).

Many of Industry 4.0 pillars are strictly connected with human centric strategic approach of Industry 5.0. For example the people in the company and their attitude and behavior plays important role in achieving the appropriate level of cybersecurity within the company. According to Pawlicka (2022) the human aspects are one of most important when we analyze cybersecurity problems. Authors thinks that cybersecurity can be achieved using appropriate human management. The main problem with cybersecurity is connected with lack of thinking

about human factors in security and eradication of human related issues. According to him the educational system should concentrate on increasing the value of human factors among informatics working in cybersecurity area. Organization should adopt culture towards cybersecurity by boasting appropriate behaviors of people (Pollini, 2022). Upadhyay (2022) has found that the better cybersecurity needs people with personality traits which can positively impact on this phenomenon. Finding and managing peoples with those traits is very important task for human resource department in Industry 5.0 condition.

Also there is a need to learn humans how to collaborate with robots – in some companies we can observe increasing role of so called cobots – autonomous robots working with humans (Spatz, Langstrof, 2022; Ahmed et al., 2022; Weiss et al., 2021). The increasing role of cobots as Sorell thinks (2022) can replace the unskilled human labor but for now the artificial intelligence is lacking "soft skills". Those soft skills are specific for human beings and can give worker or manager comparative advantage in company. Agarwal and Chauhan thinks (2022) that creating co-working space for humans and cobots can be beneficial for the industry especially inn e-commerce.

The humans plays very important role in integration of all vertical and horizontal processes in company. Without the broad strategic, human centered approach the integration is not possible. The increasing complexity of management processes in Industry 5.0 conditions needs system approach. The integration of technical and human aspects of the company is a key to organizational success in today market. This integration can be very beneficial for a company it can lead to better relation within organization, organizational culture better adjusted to Industry 5.0 and the decrease of wastes within organization (Cillo et al., 2022; Taverner et al., 2021).

Also the augmented reality is very closely related with human labor. The human using augmented reality solution will have possibility to increase its effectiveness knowledge and those solution will help works in many operations in business (Harborth, 2022). Using augmented reality can be a possibility to develop new interactive system which can increase the innovativeness of humans. Augmented reality can be used to achieve safe condition for human for example it is useful in chemistry industry (Bartra et al., 2022). To achieve the full potential of augmented reality we should to think about the adaptability of humans to new technology. It is not always easy process and needs learning the people new skills and preparing them to new working conditions (Wang et al., 2022).

The second pillar of Industry 5.0 is connected with sustainability. From the today business point of view the business should be focused not on short term approach but on long term sustainable business approach (Ivanow, 2022). In Industry 5.0, the sustainability is a coexistence of humans and machines (Johri et al., 2021). The sustainability is very closely related with Corporate Social Responsibility and Social Responsible Economics. All industrial organizations are connected with sustainable development. The concept is still connected with circular economy but now is supported by intelligent products, automation, autonomous robots,

blockchain etc. The sustainable approach needs integration of many aspects of the company according to pillars of Industry 4.0. Zeghda (2021) points out that in digital economy we need cybersecurity to control sustainability in production enterprises. The cybersecurity is needed to ensure correct operations of the entire system and it leads to ensuring safety of its components (D'adamo, 2021). Salam describes (2020) the relations between sustainability and Internet of things. The author says, that the sustainability of Internet of Things implementation should lead to better cybersecurity. The main problems related with sustainability of Internet of Thinks are connected with: reducing the amount of waste, reducing energy consumption and improving air quality (Mustonen, 2021). Internet of Things can improve the production processes by monitoring environmental indicators or operating towards decreasing of wastes (Maqbool et al., 2022; Blumenthal and Diamond, 2022). Also the widespread of simulation methods can lead to better sustainability. Simulations can lead to decrease of amount of waste, analyze of carbon footprint, raw material usage, energy intensity and other aspects of the processes (Visual, 2022; Moran et al., 2023; Bello et al., 2022).

The last pillar of Industry 5.0 is resilience. The resilience is connected with the better robustness of supply chain which will guarantee that the key infrastructure will function in times of crisis (Ivanow, 2022). Especially in times of COVID-19 pandemic it could be observed the value of resilience of supply chains (Ullah et al., 2022). Trust built up over years in supply chains (Gajdzik, Grzybowska, 2012) has proved insufficient during a pandemic, and people need to rely on the capabilities of technology, which should alert them and inform them of the symptoms of a pandemic. Many organizations, because of continuous lockdown have problems with the supply and should to stop their operation (Juan, Li, 2023; Adana et al., 2023). After COVID-19 pandemic the topic of resilience was not main topic among business science, but the crisis start to change in this view (El Baz, Ruel, 2021; Cuvero et al., 2021). Now the resilience can be viewed as one of main concept on the level of strategic management and because of that it is implemented in new Industry 5.0 approach.

5. Conclusion

The world of technology, mass customization and advanced manufacturing is undergoing a rapid transformation. Industry 4.0 is a high-tech manufacturing automation strategy that leverages IoT to create the Smart Factory. Industry 4.0, an initiative of Germany, has become a globally accepted term over the past decade. Many countries have introduced similar strategic initiatives, and significant research efforts have been devoted to the development and implementation of some Industry 4.0 technologies. On the tenth anniversary of Industry 4.0, the European Commission announced Industry 5.0. In the new development concept, Factories of the Future will be more strongly oriented toward people, values and ethics. Although

manufacturing companies are currently at a transition point between Industry 4.0 and Industry 5.0, a new age of industry is already emerging. Using the nomenclature of Longo et al. (2020) this is the "Age of Amplification" of the role of technology vis-à-vis humans and complex social, economic and environmental problems. Industry 5.0 will emerge when man and machine reconcile and work in perfect symbiosis with each other. Industry 5.0 is an upgrade for Industry 4.0. The two concepts complement and integrate each other. The time of change between Industry 4.0 and Industry 5.0 (one decade) is too short for each to be the result of a separate industrial revolution. For these reasons, Industry 4.0/5.0 was used in the topic of the paper. Combining the two concepts makes sense because Industry 4.0 technologies are the basis for the development of Industry 5.0, which points to three key strategic directions for industrial transformation: human, sustainability and resilience.

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ORGANIZATIONAL LEARNING AND ORGANIZATIONAL EFFECTIVENESS IN FAMILY AND NON-FAMILY FIRMS

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Purpose: The aim of this article is to attempt to answer the question of how organizational learning affects organizational effectiveness and whether there exists a mediating role of organizational slack in this relationship. Additionally, an effort was made to identify differences that may occur between family-owned and non-family-owned firms in the studied research area.
Design/methodology/approach: Survey research was conducted in a group of 363 firms (197 family businesses and 184 non-family businesses). In the analysis of the results, the first step involved assessing the reliability of the questionnaire used, and subsequently, the PLS-SEM method was employed to verify the hypotheses proposed in the study.
Findings: The conducted research has revealed the existence of a significant relationship between organizational learning and organizational effectiveness, with the presence of organizational slack playing a mediating role to some extent. Importantly, no differences were observed in this regard between family businesses and non-family businesses.
Research limitations/implications: The utilization of survey research is associated with the presence of subjectivity in assessments by respondents.
Originality/value: This article is intended for researchers specializing in family-owned businesses and scholars interested in organizational learning and organizational slack, as well as their interrelationship. For management practitioners, the positive correlation between organizational learning and effectiveness may be of particular significance.

Keywords: organizational learning; organizational effectiveness; family business; organizational slack.

Category of the paper: Research paper.

1. Introduction

The rigorous and systematic learning within organizations may contribute to their continual and rapid adaptation to an evolving and increasingly complex environment. Numerous arguments posit that the organizational learning of enterprises plays a pivotal role in establishing competitive advantage (Lien, Ha, 2019). It is also recognized as one of the key strategic sources for attaining long-term organizational outcomes and contributes to the growth and innovation of firms (Hussain et al., 2023). Furthermore, research findings underscore the significance of organizational slack in sustaining competitive advantage in firms characterized by a dynamic environment stemming from institutional transformations (Głód, Raczyńska, 2022). Additionally, a relationship has been observed between organizational slack and organizational innovation (Ćwiklicki, Wodecka-Hyjek, 2014). The combination of these two concepts, both in the international and Polish-language literature, remains marginal. Interestingly, there is a lack of studies concerning the role of organizational learning and organizational slack in comparing the performance of family and non-family firms. The presence of a family contributes to the alignment of the owners' goals with those of the firm, as well as an emphasis on long-term objectives. Family members engaged in running the business accumulate experiences over generations and share their acquired knowledge with younger generations, and their high involvement in the firm can lead to increased motivation for learning (Zahra, 2012). It is worth noting that family and non-family firms differ in several areas (Ingram et al., 2022). A review of the existing knowledge regarding organizational learning, organizational slack, and organizational outcomes has revealed a research gap in this domain. Therefore, the research results presented in this article may constitute a significant contribution to theory development.

2. Organizational learning

The inherent characteristic of organizations should encompass the capacity for learning, information acquisition, and development. Especially in the contemporary era of Industry 4.0, which is grounded in information technology, artificial intelligence, and the Internet of Things, the issue of organizational learning appears to be of paramount importance (Lenart-Gansiniec, 2019). Research pertaining to organizational learning initially stemmed from researchers' interest in human learning processes within enterprises (learning in organization) and subsequently shifted focus toward organizational learning processes (learning by organization) and learning organizations (Jaskanis, 2016). A closely related concept to learning is knowledge management (Olejniczak et al., 2012). These terms are interdependent and are frequently

intertwined in both definitional and practical contexts, mutually reinforcing each other in organizational research (Farooq, 2019).

Organizational learning comprises a set of activities such as knowledge acquisition, information distribution, its interpretation, and encoding within an organization, both intentionally and unintentionally influencing organizational well-being. It constitutes a collective ability rooted in experience and cognitive processes, encompassing knowledge acquisition, sharing, and utilization (Noruzy et al., 2013). Organizational learning occurs at four levels: the individual employee, the team, the organization as a whole, and the external environment (Wiśniewska, Wiśniewski, 2020).

The relationship between organizational learning and business outcomes is embedded within the very definitions of organizational learning (Lien, Ha, 2019). Mai et al. highlight that organizational learning is regarded as a fundamental source of information for organizations to achieve superior performance and maintain competitive advantage. The research findings cited by the authors confirm a positive correlation between organizational learning and firm performance, as well as innovation. The acquisition of knowledge contributes to improved organizational efficiency, as it enables companies to discover new solutions and develop products that meet market demand. Knowledge distribution can lead to a culture of knowledge sharing, ultimately enhancing organizational profitability (Mai et al., 2023). Meanwhile, Gonzalez-Padron et al. have validated the impact of knowledge interpretation on innovation, learning efficiency, customer performance, and internal processes (Gonzalez-Padron et al., 2010). Studies conducted by Bontis et al. have demonstrated a positive relationship between learning at individual, group, and organizational levels and firm performance (Bontis et al., 2002). It is argued that knowledge is a valuable asset, and organizational learning is essential for the discovery of new knowledge and the construction of competitive advantages. Furthermore, organizational learning, by increasing environmental sensitivity, contributes to enhanced organizational efficiency (Hadi, 2023).

Zahra draws attention to family-owned businesses, which, unlike non-family firms, often prioritize longevity, exhibit conservatism, and may isolate themselves from stakeholders, potentially impeding the acquisition of new knowledge. However, the results of Zahra's research indicate that family ownership positively impacts the scope and pace of learning. The presence of family within the firm becomes a motivating factor for engagement in organizational learning (Zahra, 2012). The existing literature serves as a starting point for further exploration of the relationship between organizational learning and firm performance.

3. Organizational slack

The precursors to the concept of organizational slack, particularly as it pertains to organizational learning, were elucidated by R. Cyert and J. March in their seminal work in 1963, which initially identified the foundational connections between these two concepts. Organizational slack is a pivotal component of organizational learning, as it is defined as a reservoir of resources that exceed the minimum necessary for conducting operations (Vanacker et al., 2019). The resource-based perspective emphasizes that slack can emerge intentionally or unintentionally (Błach, Gorczyńska, 2017) and can be utilized according to the needs or strategies of the organization. Leveraging organizational slack for the purposes of organizational learning can yield numerous advantages for the enterprise, with literature indicating associations between organizational slack and organizational renewal, effectiveness, productivity, efficiency, and innovation (Głód, Raczyńska, 2022). The link between organizational slack and innovation, as well as the processes occurring within the organization, cannot disregard the concept of learning (Suzuki, 2013). It is also worth noting the positive impact of organizational slack on organizational creativity and learning (Bratnicka-Myśliwiec, Ingram, 2022). However, it is fallacious to assume that a higher level of organizational slack is invariably beneficial for the organization. Organizational slack exhibits a U-shaped relationship, wherein it confers an advantage to the organization only up to a certain point (Chiu, Law, 2009). An excess of organizational slack does not positively affect an organization's capacity for learning, although it remains essential for the learning process.

Organizational learning often serves as an intermediary between slack and specific desired outcomes, such as innovation (Jin et al., 2015). A typology of resources influencing the level of organizational slack takes into account available, renewable, and potential resources (Gabryś, Bratnicki, 2015). Another categorization of slack distinguishes between absorbed and unabsorbed slack (Gabryś, 2015). Unabsorbed slack serves to facilitate learning, aid in adaptation, and enhance the benefits derived from organizational learning, whereas absorbed slack might increase the risk of bureaucracy, resistance to change, and the costs associated with organizational learning (Qian et al., 2023).

The multitude of connections between organizational learning and organizational slack presents an intriguing avenue for research, which remains inadequately explored, and can be identified as a research gap. Often, innovation serves as a common denominator between these two concepts (Wang et al., 2017). Undoubtedly, a compelling approach would involve a direct analysis considering organizational learning and the mediating role of organizational slack. This article examines the role of slack in the relationship between organizational learning and organizational effectiveness, thereby enriching our knowledge in this domain. Based on the literature review, two research hypotheses were formulated:

H1: There is a relationship between organizational learning and organizational effectiveness.

H2: Organizational slack mediates the relationship between organizational learning and organizational effectiveness.

Additionally, the analysis explores the identification of differences that exist between family-owned and non-family-owned firms within the studied research area.

4. Research method

The discussed empirical studies constitute one of the threads in broader research concerning the competitiveness of family and non-family businesses in Poland during the global economic crisis. These studies were conducted at the Department of Entrepreneurship and Innovative Management at the University of Economics in Katowice.

The research was carried out from July to November 2022 among 363 companies, of which 179 were family businesses and 184 were non-family businesses. Tables 1-3 present the quantitative distribution of the surveyed enterprises in terms of market, activity profile, and size.

Table 1.
Quantitative division of surveyed companies by market

	Local market	**Regional market**	**National market**	**International market**	**Global market**
Family businesses	71	40	47	15	6
Non – family businesses	36	44	75	24	5

Source: Own based on research results.

Table 2.
The quantitative division of surveyed firms by their business profile

	Commercial	**Service**	**Manufacturing**	**Mixed**	**No definition**
Family businesses	29	82	26	35	7
Non – family businesses	37	75	26	40	0

Source: Own based on research results.

Table 3.
Quantitative division of surveyed firms by company size

	Micro	**Small**	**Medium**	**Large**	**No definition**
Family businesses	73	80	16	7	3
Non – family businesses	50	77	41	16	0

Source: Own based on research results.

The measurement scales used in the empirical study were based on the subject literature and employed seven-point Likert scales (1 = strongly disagree, 7 = strongly agree). To investigate organizational learning, the operationalization proposed by Jerez-Gomez, P., Céspedes-Lorente, J., & Valle-Cabrera (2005) was utilized, consisting of 10 statements. In the analysis of organizational slack, two statements from Khan and Mir (2019) were employed. Furthermore, to assess organizational effectiveness, the operationalization proposed by Schilke, comprising 6 statements, was employed.

To verify the hypotheses formulated in this study, the PLS-SEM method (partial least squares structural equation modeling; Jöreskog, Wold, 1982; Hair et al., 2021; Hair et al., 2022) was employed. This method enables the estimation of parameters in multivariate models containing latent variables, even with a relatively small number of observations, and also in cases where constructs are identified by single indicators. The computations were conducted using the PLS-SEM package in Stata 17 (Venturini, Mehmetoglu, 2019).

5. Results of the empirical research conducted

In the first instance, an analysis of the measurement part (outer model) was conducted. The assessments of factor loadings are presented in Table 4 below.

Table 4.
The results of estimations pertaining to the magnitudes of factor loadings for the foundational model

Indicator	Organizational learning	Organizational slack	Organizational effectiveness
Learning of employees is considered more as an investment than a cost.	0.694		
The management of our company looks favorably upon implementing changes in any area to adapt and/or stay ahead of environmental changes.	0.776		
The ability to facilitate employee learning is considered a pivotal factor within our company.	0.733		
Innovative ideas that prove effective are rewarded within our organization.	0.794		
All employees possess a general understanding of our company's objectives.	0.637		
All constituent elements comprising our company (organizational units, sections, work teams, and individuals) are acutely aware of their contributions toward achieving overarching goals.	0.648		
All organizational units constituting our company are interconnected, collaborating in a coordinated manner.	0.649		
Experiences and ideas sourced from external entities (consultants, clients, training firms, etc.) are regarded as valuable tools for our company's learning.	0.720		

Cont. table 4.

It is part of our company's culture for employees to express their opinions and suggestions concerning established procedures and task execution methods.	0.747		
Employees have the opportunity to engage in discussions about new ideas, programs, and actions that could benefit our company.	0.691		
In comparison to our competitors, our organization possesses greater financial resources that can be invested in services and operations.		0.934	
We face fewer budgetary constraints than four years ago (in 2018).		0.637	
We have attained a strategic advantage over our competitors.			0.739
We hold a significant market share.			0.793
Overall, we achieve greater success than our primary competitors.			0.835
Our EBIT (earnings before interest and taxes) consistently exceeds industry averages.			0.848
Our ROI (return on investment) consistently surpasses industry norms.			0.834
Our ROS (return on sales) consistently exceeds the industry average			0.842

Source: Own based on research results.

The factor loadings for the utilized three constructs in most cases exceed the critical threshold of 0.708 (Hair et al., 2021, p. 77). Simultaneously, the results presented below do not indicate the necessity of eliminating items for which the factor loading values are slightly lower. Subsequently, an assessment of the basic model's quality was conducted (Table 5), utilizing the Cronbach's alpha coefficient for reliability evaluation, as well as alternative reliability indicators: Joreskoga (1971) (ρ_c) and Dijkstra (2014) (ρ_a). Cronbach's measure is considered a conservative estimate of construct reliability, while Joreskoga's version typically yields noticeably higher values. Dijkstra's measure is often regarded as a reasonable compromise (see Hair et al., 2021, p. 78).

Table 5.

The measures for evaluating the quality of the measurement component of the model

Measure	**Organizational learning**	**Organizational slack**	**Organizational effectiveness**
Reliability			
Cronbach	0.899	0.484	0.899
ρ_C	0.910	0.773	0.923
ρ_A	0.935	0.673	0.903
Convergence			
AVE	0.505	0.639	0.666
Distinctness			
		Organizational slack	**Organizational effectiveness**
HTMT	**Organizational learning**	0,178	0,328
	Organizational slack		0,542

Source: Own based on research results.

Regarding the assessment of convergent validity of the basic model, the Average Variance Extracted (AVE) coefficient was employed, while for assessing discriminant validity, the criteria of HTMT (Heterotrait-monotrait ratio) were applied.

The assessment of the quality of the basic model yielded positive results due to the following reasons:

1. The values of the ρ_a coefficient for organizational learning and effectiveness exceed 0.9, indicating a high reliability of the measurement of both constructs. In the case of slack, the value is noticeably lower but still above the critical threshold of 0.6, which is acceptable for exploratory analyses.
2. The AVE coefficients assume values above 0.5 in all cases.
3. The HTMT coefficient should be below 0.9, which is met and indicates a clear differentiation of constructs.

Based on the above results, it can be concluded that the proposed model exhibits satisfactory reliability, convergent validity, and discriminant validity. Consequently, we can proceed to the analysis of the structural (internal) part of the discussed model, as characterized in Table 6.

Table 6.
The results of the estimation of the structural component of the model

Independent variable	**Dependent variable**	
	Organizational slack	**Organizational effectiveness**
Organizational learning	**0,150*** **	**0,257*** **
Organizational slack		**0,505*** **
R^2	0,020	0,356

Note. The statistically significant results were denoted by asterisks. (*** p < 0,01).

Source: Own based on research results.

The analysis of the above results indicates a weak but statistically significant relationship between organizational learning and slack. Conversely, a strong relationship exists between organizational learning and organizational effectiveness, as well as between slack and organizational effectiveness. From the perspective of the article's theme, the most crucial aspect is confirming the significant relationship between organizational learning and organizational effectiveness (Hypothesis 1).

Additionally, a comparison of the analyzed relationships was conducted for family and non-family firms. Estimates of the structural part of the model, broken down by family and non-family firms, are presented in Table 7. However, the differences in the estimates were not significant enough to be statistically meaningful.

Table 7.
Estimations of the structural components of the model broken down by family and non-family businesses

	Family businesses (assuming that response 1 signifies a family firm)	**Non-family businesses**	**Difference**	**p-value**
Organizational learning -> Organizational slack	0,154	0,158	0,004	0,971
Organizational learning -> Organizational effectiveness	0,220	0,308	0,088	0,332
Organizational slack -> Organizational effectiveness	0,562	0,433	0,129	0,147

Source: Own based on research results.

The objective of verifying the second hypothesis pertaining to the role of organizational slack as a mediator in the relationship between organizational learning and organizational efficiency involved estimating the magnitude of the indirect effect (as presented in the table below). The standardized value of the indirect effect (0.076) is relatively modest when compared to the magnitude of the direct effect (0.257; see Table 7 in the structural component estimates). This suggests the presence of partial mediation. Nevertheless, it is statistically significant (p = 0.007).

Table 8.
The results of hypothesis verification concerning mediation

Statistics	**Organizational learning -> Organizational slack > Organizational effectiveness**
Mediation effect	0,076
Mean estimation error	0,028
p-value	0,007
90% confidence interval	(0,024; 0,133)

Source: Own based on research results.

Based on this, it can be affirmed that a partial verification of Hypothesis 2 has been conducted in a positive manner.

6. Conclusions

The conducted research indicates a significant relationship between organizational learning and organizational effectiveness, as previously cited by other authors (Gonzales, Padron et al., 2010; Hadi, 2023). Furthermore, it has been demonstrated that organizational slack plays a mediating role in the relationship between organizational learning and organizational effectiveness. Similarly, as found in the literature, the conducted research suggests that having organizational slack (specifically in the financial construct used in the study) somewhat strengthens the impact of organizational learning on organizational effectiveness (Zhao, Yan, 2023). Additionally, no significant differences were observed between family-owned and non-

family-owned firms in the analyzed area. Typically, these firms differ from each other due to the interplay between the company and the family, manifested in organizational structure, the preference for family members in stakeholder care, self-financing of initiatives, the preservation of capital within the family, and "familiness". However, in the examined area, no significant differences were found.

It must be said that the surveys carried out, have limitations due to a certain degree of subjectivity. In the future, the research carried out could be complemented by research of a qualitative nature. In addition, other ways of measuring organizational slack could be used with alternative operationalizations of this construct and with specific quantitative data. In the case of organizational learning processes, effects emerge with a certain time lag and research in this area can be carried out over a period of at least several years.

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THE RECRUITER – HIS ROLE IN THE SELECTION PROCESS

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Purpose: The purpose of this article is to identify the expectations of IT employees towards the relationship with the recruiter in the selection process. We intended to establish their preferences in terms of selection methods and communication with the person leading the process.
Design/methodology/approach: The research focused on external recruitment. A survey method was used, in which most questions were closed questions. A five-point Likert scale was used in the responses. The research group is extensive but does not meet the condition of representativeness. Therefore, the research can be described as pilot studies. They do, however, provide an interesting insight into the recruitment process in the IT industry from the point of view of contact with the recruiter.
Findings: Job candidates place a high value on the relationship with the recruiter. They indicate that the recruiter is exceptionally well prepared to conduct the interview. However, it seems that there are still reserves and opportunities to improve the recruiter's knowledge. At the same time, our research indicate that the most desirable form of recruitment is the video interview further tests and tasks verifying the candidate's competencies.
Research limitations/implications: Research indicates an increasing role for the recruiter in the hiring process. A significant proportion of candidates prefer contact via video interview with the recruiter, which implies that recruiters have 'soft' skills. The research was carried out among employees in the IT industry, which is characterised by a significant differentiation and dominance of the employee position.
Practical implications: The aim of the article, from the perspective of the practical application of the survey results, is to identify good practices from the responses obtained that can be applied by recruiters and Hiring Managers to guide candidates positively through the recruitment process.
Originality/value: Our article draws attention to the need to analyse the recruitment process from the perspective of the candidate and his/her relationship with the recruiter. We show that recruitment, as a communication process, can be a deterrent for candidates to decide to change jobs, despite the real (objective) attractiveness of employment and working conditions in a specific company. In this context, our findings may be useful for recruiters - those making the first contact with a potential candidate.

Keywords: job advertisement; employee recruitment; external recruitment; IT.

Category of the paper: research paper.

1. Introduction

Recruitment in companies is not only a way of hiring new employees but also influences the branding of an organization (Dolot, 2014; Ławicka, 2012; Sobocka-Szczapa, 2014; Wojtaszczyk, 2012). The recruitment process is not only used to find suitable candidates for a specific position and select the best among them. It is also a way of shaping opinions about the company, as all the experiences of those recruited influence what candidates think about a particular company or brand (Bieniak, 2015).

The importance of the role of the recruiter in the selection process is also pointed out by Marta Pawlak-Dobrzańska (2018) in her research on candidates' experience of recruitment. As many as 62% of the candidates surveyed by the author were dissatisfied with the recruitment process; they indicated that the recruiter did not want to create a relationship with the potential candidate.

These results clearly indicate that candidates, for a significant proportion, want to be convinced of some kind of positive relationship with the recruiter (Finn, 2017). In a negative sense, this may mean that a poorly managed relationship by the recruiter with the candidate may be associated with the failure of recruitment efforts (Kowalczyk, 2008).

The recruiter's work in staff selection can be considered from two perspectives. The first relates to his or her role in the recruitment process, i.e. reaching out to target groups of candidates and encouraging them to submit application documents (Mahjoub, Kruyen, 2021). The second relates to the ability to conduct at least preselection of candidates (Daniecki, 2015; Ingram, 2014; Wieczorek, 2012), which includes interviews, testing and/or presenting tasks to be solved. The ability, throughout the selection process, to maintain contact with the candidates and keep them informed of the progress of the recruitment process is important; and, in the case of a negative selection, inform what was the obstacle to obtaining the vacant position. Delays in communication are interpreted as negative signals regardless of the ultimate standing of the applicant; expecting the recruiter to be responsive is not dependent on whether the applicant is receiving positive or negative feedback from the organization regarding his/her status (Ryan et al., 2017). The importance of feedback for candidates is also the subject of ongoing research (Chawla et al., 2019). Recruitment competence models take into account technical competencies, behavioural competencies, soft competencies (traits and skills that have a particular relationship with personality, which are difficult to measure due to their subjective nature), knowledge, experience and performance. Selection and recruitment based on the above-mentioned competencies are extremely effective. The selection of the best candidate for a given position is based not only on his/her competencies but also on the competence and training needs of the company. Performed in this way (Ciećwierz, 2021), competency-based human resource management influences greater employee engagement and productivity.

IT recruiters are aware of what positions are most in demand at any given time and what qualities should define potential candidates. For the process to be successful, in addition to technical skills, IT recruiters should also examine soft traits, such as teamwork skills, efficient communication skills and, perhaps most important in the IT industry, the ability to solve problems and remove their causes and effects. However, for a job offer to be sufficiently interesting, companies need to meet the requirements of the candidates. For the effectiveness of recruitment processes, it is also important whether candidates accept the methods and tools used in recruitment (Woźniak, 2019; van Esch, Black, Ferolie, 2019; van Esch, Black, Arli, 2021). Amy Fin (2017, p. 239) argues that „a bad candidate experience will hinder talent attraction, especially in a tight market, when talent is at a premium. In addition to the work, salary and culture, candidates evaluate opportunities based on how they have been treated during the process". Simply attracting attention is not enough; employers and recruiters should ensure that long-term contact is maintained.

The object of this study is to analyse the interviewees' recruitment processes in terms of the candidates' preferred selection methods and communication with the interviewer. The practical aim is to identify good practices from the responses that can be applied by recruiters and hiring managers in the business to guide candidates positively through the recruitment process. We have also attempted to identify possible directions for improving the work of recruiters in terms of the selection techniques used and the relationship with the candidate.

In this context, several research questions can be posed, with the content:

- Does IT staff place importance on the relationship with the person leading the selection process?
- Are recruiters properly prepared to conduct interviews?
- What are the preferred forms of selection of candidates for IT jobs?

2. Specifics of recruitment in the IT sector in Poland

In the technological world, there is a shortage of specialists and a growing demand for them. Therefore, IT recruiters have higher expectations of job offers than candidates from other industries. This is related to the unusual methods that recruiters and employers have to take to convince such a candidate of their offer or organization.

An incredible competitiveness is emerging among recruiters and companies looking to hire technology professionals. Well, it is a battle in which the winner is the one who attracts and retains the specialist. One of the important qualities an IT recruiter should have is speed, deciding whether a candidate will accept an offer or take a competitor's job offer. Most IT professionals do not look for a new career path on their own. Therefore, it is important to take the initiative, use a variety of methods to reach out to candidates and be proactive.

It is a good idea to improve one's soft skills and personal skills, as well as to broaden one's knowledge of specialisations, the technologies used, the specifics of the positions in question, and the ever-changing needs of IT talent and employees. A straightforward and concrete conversation is, for professionals in the technology world, one of the best ways to present the terms of an offer.

The Polish IT market manifests itself in a constantly growing number of offers for programmers, IT architects, testers, software engineers, etc. Based on Pracuj.pl's report "Specialist job market", in the first half of 2022, 36% of the offers posted on the portal were for digital specialisations, 24% of the offers were for IT talents, which gave the first place in the list and means that it was every fourth offer on Pracuj.pl. It is also worth noting that the IT specialisation was in the TOP 5 of the most searched offers. For comparison, in Q3 2021, the number of offers for digital competencies was 25%, which is 11% less. The huge interest in technology specialists demonstrates the growing role in the labour market, as well as the wide range of offers for people wishing to develop in this direction (Raport Pracuj.pl).

Table 1.
Percentage of job offers on the portal pracuj.pl in years 2018-2022

Sector	2018	2019	2020	2021	2022
IT	15%	15%	14%	22%	24%
sale	31%	30%	33%	27%	24%
customer service	22%	21%	18%	15%	13%
finance	14%	13%	13%	9%	12%
engineering	12%	11%	10%	10%	10%

Source: Raport Pracuj.pl, *Rynek Pracy Specjalistów H1 2022*, https://media.pracuj.pl/presskits/rynek-pracy-specjalistow-h1-2022, 14.07.2022.

3. Methods and results

Results of a survey conducted on a sample of IT professionals. The respondents belonged to an audience that was professionally active and had experience of the recruitment process. The survey used a quantitative method. The technique used is a questionnaire.

The number of respondents was 100, of which 25 were women and 75 were men. The respondents' place of residence (in terms of population), age range and education were also taken into account. The largest group of respondents were men aged 18-35, living in cities with more than 500,000 inhabitants and with a university education.

An online survey (Andrałojć, 2006) is a form containing questions that are made available via the Internet and used to collect information and opinions from participants. Web surveys are often used for market research, social surveys and other research purposes. They can be created and made available using special web-based tools, such as online survey creation tools. Zdzisław Szyjewski and Grzegorz Szyjewski (2017) define an online survey as a social research

technique related to the questionnaire interview method; this technique is increasingly widely used due to its simplicity of execution (numerous publicly available tools to support the construction of the questionnaire and the process of collecting and counting responses), low cost, the possibility of easily reaching a large number of respondents and the speed of obtaining a result.

The choice of the research technique, in the form of an online survey, was primarily due to the easy access to the target research group and the very nature of the research problem posed. The online survey was distributed on social networks, including LinkedIn, as well as within the structure of the organisation where one of the authors works. To carry out the survey, questions were arranged to select the respondents to obtain the target research group. The rest of the questions were designed to assess the impact of the way the person in charge carried out the recruitment process in which the respondents took part. Mainly the evaluation of the relationship between the person in charge of the process and the potential candidate was taken into account, as well as the selection methods that the respondents think are effective and preferred by them.

Firstly, the method of reaching the candidates was examined, i.e. how the candidates found out about the new job opportunity. It can be seen that the vast majority of respondents (76) found out about the new job offer through social networks such as LinkedIn, GoldenLine et al.

In second place is the category "Other", which conceals in each case that the respondents obtained information about the offer from their friends. The items with the lowest number of responses are 'telephone contact' and 'via email'. The high positioning of social media among the methods of reaching candidates demonstrates the important role they play in the recruitment process. Listing and contacting candidates via social networks is extremely effective and therefore highly desirable for all technology recruiters. From their own experience, the authors can conclude that it is the activities on LinkedIn, conducting searches and contacting via a professional account, that yield the best results.

In addition to social media, a good way to reach a candidate is through a recruiter's network, building your brand as a recruiter and organization.

Next, the respondents' level of satisfaction with the last recruitment process they participated in was assessed. The survey was conducted using a Likert scale from 1 to 5, where 1 means very bad and 5 means very good. Figure 1 shows the results of the survey. The majority of respondents (50) rated their most recent recruitment process as highly satisfactory. 47 rated it at level 4 and only three rated their most recent recruitment process at level 3. The average score was 4.47. The respondents' high satisfaction with their most recent recruitment process is mainly due to their good and very good relationship with the recruiter.

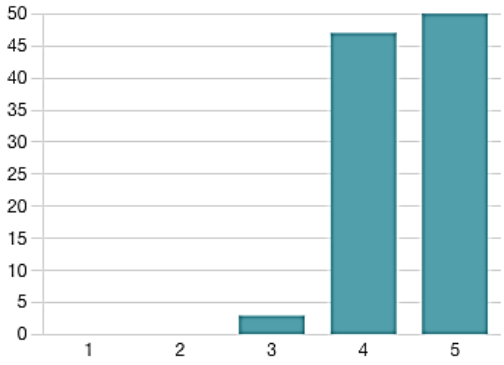

Figure 1. Respondents' satisfaction with the recruitment process – 4.47.
Source: own elaboration.

Another thing investigated was the receipt of feedback from the recruiter by the interviewees. 93 people confirmed receiving feedback after the recruitment process, while 7 people did not remember this information. This form of contact with the candidate allows information to be passed on after the process has been completed but also builds up opinions about the organisation's brand and the person themselves on the market and in the work environment. By informing the candidate during and after the recruitment process, the recruiter surrounds the candidate with care and professionalism.

Next, an assessment was made of how important it was for respondents to receive feedback, following the recruitment process, from the person leading the process. The survey was conducted using a numerical scale from 1 to 5, where 1 means not very important and 5 means very important. Figure 2 shows the results obtained. The vast majority of the respondents (72) stated that receiving feedback was very important to them, and the remaining people (28) rated the importance of receiving information at 4. The average score obtained was 4.72.

Feedback is seen as important and highly relevant by candidates as it allows them to better understand their position in the labour market and enables them to identify and improve weaknesses. Feedback also helps candidates in future recruitment processes by enabling them to understand how they are perceived by employers.

The next survey consisted of respondents' assessment of their contact with the recruiter. The survey was performed using a numerical scale from 1 to 5, where 1 means very bad and 5 means very good. Figure 3 shows the results obtained. All respondents rated the contact with the recruiter, to a similar degree, with a score of 5 (51) and 4 (49). The average score was 4.51.

The high ratings confirm the respondents' high satisfaction with their recent recruitment processes. Communication with the candidate plays a hugely important role here. The recruiter's openness allows the candidate to feel safe, and to know where they stand. All of this determines a positive recruitment outcome.

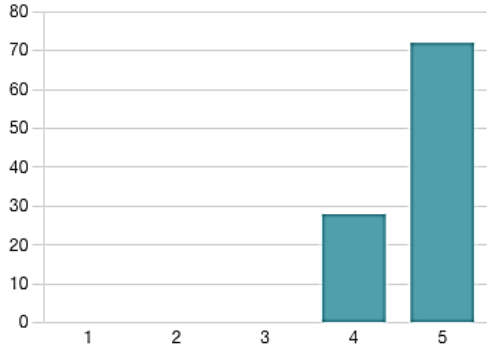

Figure 2. Degree of importance of receiving feedback from the recruiter – 4.72.

Source: own elaboration.

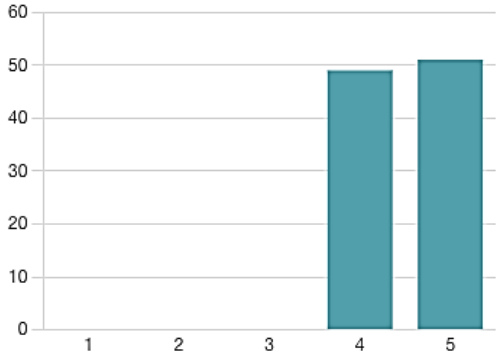

Figure 3. Evaluation of the contact with the recruiter – 4.51.

Source: own elaboration.

The importance of respondents maintaining contact with the recruiter was also assessed. A numerical scale from 1 to 5 was used for the survey, with 1 indicating low importance and 5 indicating high importance. The results are shown in Figure 4. The vast majority of respondents (62) rated the importance of maintaining contact with the recruiter at 4.29 said it was very important, with the remainder (9) rating it 3. The average score was 4.20.

Keeping in touch with the recruiter is important for candidates as it gives them a better understanding of the progression of the recruitment process and enables them to better prepare for the next stages. Keeping in touch with the recruiter also allows candidates to ask questions and find out more information about the company and the position, which can help them make better career decisions. It can also help candidates build a positive relationship with a prospective employer and strengthen their position in the recruitment process.

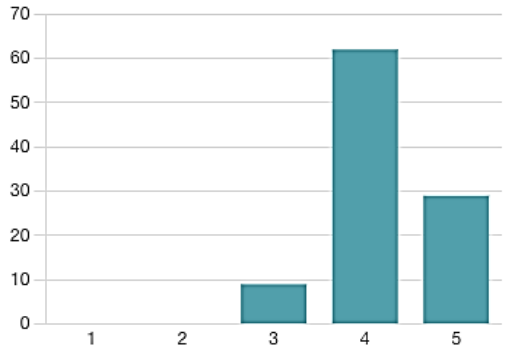

Figure 4. Degree of importance of maintaining contact with the recruiter – 4.2.

Source: own elaboration.

Subsequently, the questions asked by the recruiter towards the respondents were assessed in terms of correctness and relation to the required skills for the position offered. A numerical scale from 1 to 5 was used for the survey, where 1 means very bad and 5 means very good. The results obtained are shown in Figure 5. The vast majority of respondents (64), rated the

correctness of the questions asked at a level of 4. The highest rating was given by 30 respondents and the remainder (6) gave a rating of 3. The average score obtained was 4.24.

The results, which are presented in Figure 5 and Figure 6, show that almost all respondents felt that the questions asked by the recruiter were appropriate and, through them, the competencies and skills of the respondents were adequately explored.

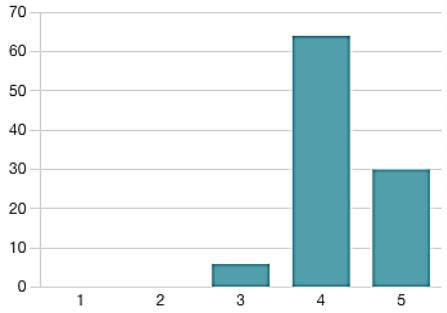

Figure 5. Evaluation of the recruiter's questions relating to the required skills – 4.24.

Source: own elaboration.

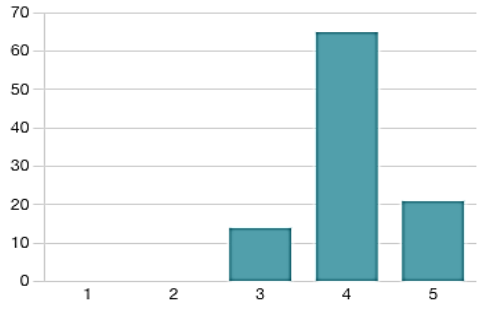

Figure 6. Assessment of the correct examination of candidates' skills in the recruitment process – 4.07.

Source: own elaboration.

It was also assessed whether, according to the respondents, their skills were correctly tested, during the recruitment process in which they participated. A numerical scale from 1 to 5 was used for the survey, where 1 means very bad and 5 means very good. The results obtained are shown in Figure 6. The vast majority of respondents (65), rated at level 4 the correctness of the examination of their skills. The highest rating was given by 20 respondents and the remainder (14) gave a rating of 3. The average score obtained was 4.07.

One of the most important issues of the survey that was carried out was the selection by the respondents of the selection methods in which they participated, and in order, the selection methods that the respondents prefer. The results are shown in Table 2.

The most popular selection method proved to be a telephone interview and an interview, conducted via video conference. 90 people took part in both. Recruitment tests came second (73), followed by an interview conducted at the organisation's headquarters, then the Assessment Centre (40) and references (25).

The most preferred selection method by respondents turned out to be an interview conducted via video conference (73), followed by recruitment tasks (64), then recruitment tests (63), then an interview conducted at the organisation's premises (59), Assessment Centre (34), the least preferred being references, which were chosen by only 2 people.

Interviews allow candidates to showcase their skills and qualifications directly and explain their work experience. Recruitment tasks and tests allow candidates to demonstrate their specific skills and knowledge, which is important for many IT positions.

All of these methods give candidates the opportunity to present their qualifications and skills in the best light and prove their value to a potential employer, which is crucial for a positive recruitment outcome. At the same time, it is worth noting that through these recruitment methods candidates receive feedback on their career potential, which is important for their future development.

Table 2.
Result of the selection survey of the selection methods in which the respondents participated and which are preferred by them

Selection methods	Selection methods in which respondents participated (number of persons)	Selection methods preferred by respondents (number of persons)
Telephone interview	90	19
Interview via video conference	90	73
Interview conducted at the organisation's headquarters	63	59
Recruitment tests (linguistic, psychological, content-related, etc.)	82	63
Recruitment tasks	73	64
Assessment centre	40	34
References	25	2

Source: own elaboration.

4. Discussion

Based on the survey and analysis of the literature on recruitment in the IT industry, it can be concluded that this process is particularly important for the success and growth of companies operating in this industry. To ensure effective and efficient recruitment, companies need to use proven methods and tools, such as analysing candidates' qualifications, conducting interviews and tests, and providing feedback to candidates.

The recruitment process in the IT industry is crucial to the success of businesses and should be treated with care and attention. By using effective methods and tools, companies can find and hire the best talent (Walford-Wright, Scott-Jackson, 2018; Pillai, Sivathanu, 2020), which will translate into future success and growth.

The study showed how important it is for candidates to maintain contact with recruiters (Giannantonio et al., 2019) and to receive feedback from them. The results show that candidates expect constant contact with the company and that a lack of relationship may lead to a negative opinion from the candidate and a failed recruitment process. At this point, it is worth recalling Leigh Carpenter's (2013, pp. 203-204) statement that “candidates expect a return on investment, and time invested will become the currency that fuels their expectations. Their key expectation/ requirement will be timely, accurate and transparent communication. Organizations which do not recognize the importance of providing good candidate experience practices will find it

increasingly difficult to source the right talent". Equally important is the appropriate selection of recruitment and selection techniques, methods and testing of competencies and skills. Additionally, organisations wishing to recruit IT professionals should keep up with prevailing trends and be prepared for the ever-changing technology market by being flexible, and open to candidates' expectations. This will allow companies to remain competitive.

Nowadays, telephone interviewing and videoconferencing have become the most popular selection methods (Basch et al., 2020; Kim, Heo, 2022) for several reasons:

- Time-saving: Telephone interviewing and video conferencing make the selection process faster and more efficient than, for example, a traditional face-to-face meeting.
- Accessibility: thanks to widespread access to the internet and mobile devices, telephone interviewing and video interviewing are easily accessible to most candidates, allowing for more contacts in the selection process.
- Allowing you to see the candidate: A video conference interview allows recruiters to get to know the candidate, their behaviour and communication better than just a telephone interview.
- Cost reduction: Both of these selection methods reduce the costs associated with travelling to meet the recruiter.
- Support for remote working: In an era of pandemonium and the increasing trend of remote working, telephone interviewing and video conferencing have become even more popular as they allow recruitment processes to be carried out without the need to meet in person.

5. Summary

In conclusion, the IT industry is characterised by a high demand for technology workers, which results in a struggle between employers and recruiters to find an employee. Hence, there is the problem of building the recruitment process in such a way that it does not scare away potential candidates. The study concluded that it is necessary to build a relationship with the recruiter, which requires recruiters to have the right soft skills. The results also indicate that some reserves of process improvement lie in the substantive preparation of recruiters for the interview. In contrast, the most preferred form of recruitment is the video interview. In other words, candidates would like the selection process to use video interviewing possibly with tests and qualification tasks conducted by complete people with whom they can easily relate and who are friendly. It is also an interesting observation that recruiters have their databases of contacts (pools) that they use in the selection process. This indicates that employees are adopting a passive attitude in their job search, waiting for good offers to be made to them, preferably by a recruiter they know. This is somewhat reminiscent of the phenomenon

of athletes, musicians, and actors being guided by agents. The significant recruitment fees charged by recruitment companies also contribute to this phenomenon.

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JOB APPLICANTS' EXPECTATIONS OF THE RECRUITMENT PROCESS IN THE IT SECTOR

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Purpose: The purpose of this article is to identify the expectations of IT employees towards the recruitment process. We intended to establish their preferences in terms of the forms of recruitment and the type of information that arouses their interest in a job offer.
Design/methodology/approach: The research focused on external recruitment. A survey method was used, in which most questions were closed questions. A descriptive research and observation method was also used. The research group is extensive but does not meet the condition of representativeness. Therefore, the research can be described as survey research. However, they provide an interesting insight into the recruitment process in the IT industry.
Findings: Job candidates adopt two strategies. The first is a passive strategy, which consists of waiting for an offer from the recruiter. The second strategy is characterized by an active candidate who undertakes a search with specific companies. Above all, candidates expect information that will enable them to assess the match between their technological competencies and those required by the employer. In addition, an offer that draws the candidate's attention should include information on: the project, salary range, location, and form of employment. An effective recruiter needs to know the employer and characterize it attractively in terms of the company's development prospects, future challenges for the employee, potential promotion path, as well as the working atmosphere (team of colleagues).
Research limitations/implications: Research indicates an increasing role for the recruiter and innovative tools in the employee sourcing process. A significant proportion of candidates prefer telephone contact with the recruiter, which implies that recruiters have 'soft' skills. Future research should recognize the mechanism of the recruiter's work with the candidate but also identify contemporary e-recruitment methods that are constantly changing and improving.
Practical implications: The practical value of the article lies in the possibility of using the research to design a candidate-friendly recruitment process, which can further improve the number of candidates recruited. The results of the research have led to the formulation of some important tips that can improve recruitment effectiveness in the IT industry.
Originality/value: The research and its interpretation are conducted from the perspective of a company seeking an employee for a specific position. Our article highlights the need to analyze the recruitment process from the candidate's perspective. We show that recruitment,

as a communication process, can be a deterrent for candidates to decide to change jobs, despite the real (objective) attractiveness of employment and working conditions in a specific company. In this context, our findings may be useful for recruiters - those who make the first contact with a potential candidate.

Keywords: job advertisement; employee recruitment; external recruitment; IT.

Category of the paper: research paper.

1. Introduction

In modern companies operating in the knowledge and innovation economy, a great deal of attention is paid to the employee recruitment process. However, a great deal of research is oriented towards employer needs, refining the recruitment process from this perspective. There are, however, markets in which the skilled worker dominates, and attracting and retaining him or her determines the achievement of company goals, the generation of significant revenues, and ultimately, the survival of the company. We can count the entire ICT sector among such sectors. It is in this market that we see many vacancies for skilled and experienced personnel, of course. It is therefore important to maintain a balance between the employer's expectations of the recruitment process and the candidates' expectations of the process (Finn, 2017). This inspired the authors to attempt to investigate the expectations of IT job candidates towards the recruitment process itself. By knowing these expectations, it is possible to delineate recruitment processes that will increase their effectiveness, improving the ratio of the number of candidates recruited to the effort spent on recruiting them. In the case under analysis, it is a matter of influencing the numerator and denominator of this measure, by increasing the number of employees recruited for the same expenditure and/or reducing the expenditure on recruiting the same number of candidates. Ultimately, the cost of acquiring one employee should decrease. The content of this article focuses essentially on external recruitment, i.e. targeting candidates from outside the organization.

2. The specifics of recruitment in the IT industry

According to Michael Armstrong (after Ciećwierz, 2021, p. 21), the main objective of the staffing process should be to ensure - at the lowest possible cost - that there are enough employees to meet the company's human resource needs. It is most often assumed that the staffing process consists of three stages, i.e.: recruitment, selection, and adaptation (induction to work) (Król, Ludwiczyński, 2006, p. 197; Sobocka-Szczapa, 2014). Recruitment refers to the process by which potential candidates are sought and encouraged to apply for a current or

future vacancy. The essence of recruitment is to communicate to a defined labour market the desire to hire a specific type of employee (Mahjoub, Kruyen, 2021; Muduli, Trivedi, 2020). Recruitment activities aim to attract a quantitatively and qualitatively defined group of candidates who can apply for a given job position. In this sense, recruitment does not include tasks related to the selection of a specific employee from among the candidates who have declared their willingness to work for a given company. The process of identifying the person with the required competencies to fill a vacant position is the second stage of the sourcing process. The term 'selection' connotes placing the right person in the right position. Selection is a process in which various strategies and tools are used to decide which candidate is best suited for the position.

Recruitment should fulfil four functions (Kawka, Listwan, 2010, p. 115; Wojtaszczyk, 2012):

- Informational – the content communicated during recruitment should address the requirements for potential candidates and the terms and conditions of employment in the organization.
- Motivational – generating interest in relevant professional groups and encouraging the best candidates to apply.
- Preselection – recruitment should discourage people whose competencies significantly differ from the requirements of a given position from applying.
- Image-related – recruitment activities may significantly impact a company's reputation and image as an employer (employer branding).

Several types of recruitment can be distinguished according to different criteria (Lipka, 2000). Taking into account the type of labour market, we can distinguish between internal and external recruitment. Internal recruitment takes place among people currently employed in a given company, while external recruitment is the identification and attraction of candidates from the organization's environment, i.e. the external labour market. As the article is essentially concerned with external recruitment, forms of external recruitment are outlined below. These may include (Branowska, 2021; Dolot, 2014; Mahjoub, Kruyen, 2021; Wolniak, 2019):

- advertisement in the media,
- advertisement on the company website,
- advertisements posted on online portals and vortals,
- job fairs,
- cooperation with employment agencies,
- cooperation with universities and other training centers,
- cooperation with specialized personnel consultancies (headhunters),
- adexpress, i.e. sending a recruitment advertisement by e-mail to a selected group of candidates - matching specific parameters - from a database of registered users (such a service is offered by specialized personnel consulting companies and Internet portals),
- cooperation with local authorities,

- search among people known personally and/or through friends, among people they recommend (recruitment using so-called informal contacts),
- searches among people known personally to employees (recommendations made by employees),
- advertisements posted on the company's Facebook fan page,
- samodzielne poszukiwanie kandydatów przez inicjowanie kontaktu z nimi, networking (m.in. przez portale typu LinkedIn).

Most often, external recruitment involves the preparation of a job advertisement, which has different forms, depending on where it will be disseminated. In the case of e-recruitment, it must comply with the standards of the individual recruitment portals. When a company uses its website, there is a limitation due to the specific technological nature of the site and the functionalities introduced. Often such advertisements take the form of a downloadable file or a rather simply structured advertisement. The situation is different for specialized online portals.

IT (Information Technology), is the business sector dealing with information technology, including computer hardware, software, telecommunications, and generally anything related to the transmission of information or systems that facilitate communication. IT covers many areas. The technology and telecommunications industry is growing rapidly, resulting in a steady increase in demand for professionals. Table 1 shows the share of each industry in the offers posted on the pracuj.pl portal. The share of job offers in the IT industry is growing; in 2022, one in four advertisements concerned employment in this industry.

Table 1.
Percentage of job offers on the portal pracuj.pl in years 2018-2022

Sector	2018	2019	2020	2021	2022
IT	15%	15%	14%	22%	24%
sale	31%	30%	33%	27%	24%
customer service	22%	21%	18%	15%	13%
finance	14%	13%	13%	9%	12%
engineering	12%	11%	10%	10%	10%

Source: Raport Pracuj.pl, *Rynek Pracy Specjalistów H1 2022*, https://media.pracuj.pl/presskits/rynek-pracy-specjalistow-h1-2022, 14.07.2022.

There is a shortage of specialists in the IT industry with increasing demand for their work. This results in high expectations of candidates. The labour market analysis of the IT sector also indicates that the labour market focuses on employees who currently have a job. This means that the job offer must be competitive in terms of the working conditions that the potential candidate is provided with by the current employer.

In addition to classic forms of recruitment, new ones are emerging such as sponsoring non-IT-related events and publishing values for rising salaries. Some of the activities related to building a culture and organizational climate focused not only on improving working conditions but also on shaping the employer's image. Another form of recruitment is programs aimed at young people, women, or people who have had a break in service. These programs are often training programs that allow specific groups of candidates to complete their professional

qualifications. Only after the training and placement process do those with the best qualifications receive a job offer. This extends the scope of recruitment to new social groups, and this requires recruitment channels tailored to them.

Increasingly, recruitment models are emerging that combine the idea of industry social networks with the implementation of a recruitment and selection function in the selection of employees. The key to the success of such a combination is to offer something that will attract IT talent. An IT community is therefore created to which job offers can be directed. Competitions, knowledge and skills competitions in the IT sector with cash prizes can be used as a magnet.

It should also be noted that the IT labour market is characterized by a high level of competitiveness. There is a battle for employees in this sector.

The efficiency of recruitment is threatened by a phenomenon characteristic of the IT sector, known as counteroffers. Agata Dzierlińska, IT recruitment specialist at Grupa Pracuj, even states that some people take part in recruitment just to argue to negotiate with their employer. It is also common for people who want to change jobs to be offered new more attractive employment conditions by their manager. A situation arises where it is not uncommon in the final selection phase for a given candidate to decide to stay with the previous company (Rekrutacja i budowanie zespołów…, 2019).

The vast majority of IT professionals, according to the author's experience in this area, do not look for a new job on their own, adopting an attitude of passively waiting for new job offers. In this context, innovative and diverse tools for reaching out to candidates and the activity of the recruiter play an important role. Two directions in the development of HR selection issues in the IT sector emerge from this. The first concerns the creation of new tool solutions. The second concerns the development of recruiters' competencies in terms of the expectations set by candidates, in this respect. At the same time, interviews with recruiters indicate that for IT professionals, a simple and concrete conversation is a good way to present an offer.

To summarize: the analysis of the IT labor market, the following characteristics of this work that determine the specificity of the recruitment and selection process can be identified. These include:

- greater number of job offers than new job seekers,
- the passive attitude of IT workers in the labour market,
- verifiable technological qualifications of candidates,
- publication of salaries offered,
- very high level of digitalization of the work process (remote and hybrid working),
- the dominant role of e-recruitment,
- counteroffer phenomenon,
- strong position in recruitment portals.

Building an appropriate job offer should respond to the information needs shown by potential job applicants. Hence the need to look at this very issue from the perspective of potential job candidates.

3. Methods and results

An important aspect of conducting an effective recruitment process is to propose such a course of action and the application of recruitment tools which, on the one hand, will suit potential candidates and, on the other hand, will ensure the appropriate level of competencies and skills required for the positions to be filled and the number of applications. The research posed several research questions of content:

- What are the most important reasons for seeking a new job (reasons for wanting to change jobs)?
- What recruitment channels do candidates use for IT jobs?
- What information is most important for candidates to arouse their interest in a job offer?
- Which communication channel do job candidates prefer?

The research was conducted in 2022. As part of the research, a survey was conducted with 50 people involved in the IT industry. The survey was fully anonymous and contained 19 questions. The first four questions included data (gender, age, place of residence, etc.) to determine the demographic diversity of the survey participants. According to the survey data, the majority of respondents were male 64%. The respondents were in three age groups: 18-26 years, 27-40 years, and 40-65 years. The largest number of respondents were in the 27-40 age bracket, with the smallest bracket accounting for just under ¼ of respondents. Almost half (48%) of the respondents lived in a city of more than 100,000 inhabitants, with the other half mostly in cities of up to 50 (20%) or up to 100,000 inhabitants (28%). Only 4% of the respondents resided in a rural area.

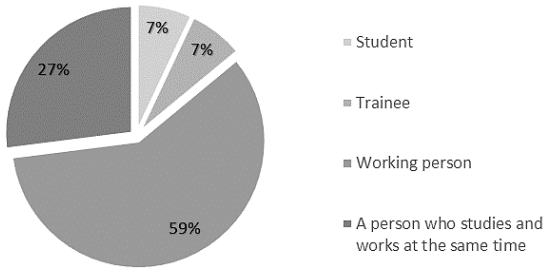

Figure 1. Professional status of survey participants.

Source: own study based on the questionnaire.

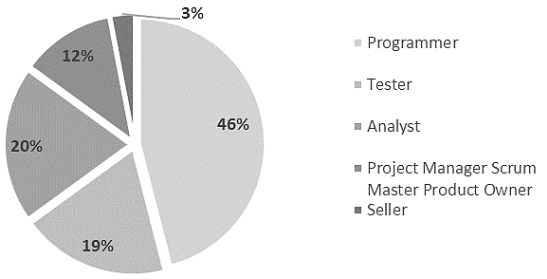

Figure 2. Positions occupied by survey participants.

Source: own study based on the questionnaire.

More than half (58.5%) of the respondents are employed, while 26.8% are both employed and studying. There are no respondents who are unemployed or on parental leave. Figure 2 shows the positions held by the respondents in the companies where they are employed. Almost half of the respondents hold the position of programmer. The other positions indicated (tester, analyst, project manager/scrum master/product owner) are held by 12-19.5% of the respondents.

We assumed that expectations of recruitment are related to the evaluation of the current workplace, so we also surveyed respondents on their job satisfaction and salary. Figure 3 indicates the level of satisfaction with salary.

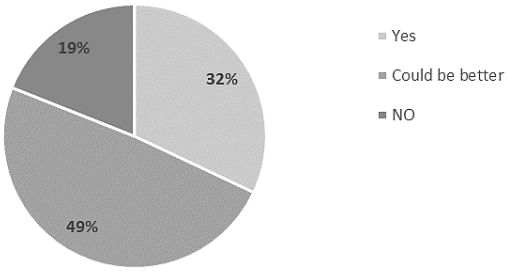

Figure 3. Survey participants' level of satisfaction with salary.

Source: own study based on the questionnaire.

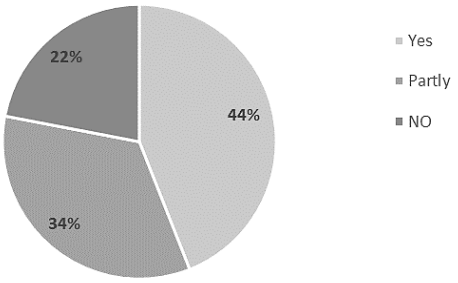

Figure 4. Level of satisfaction with current job.

Source: own study based on the questionnaire.

Almost half of the survey participants feel that their salary could be better and just under 20% explicitly state that they are not satisfied with their salary. Only 31.7% find the salary satisfactory. Figure 4 shows the respondents' level of satisfaction with their current job. Over 40% indicated that they were satisfied and 34% expressed partial satisfaction. 22% felt that they were not satisfied with their current job. These results indicate that around 20% of the respondents are dissatisfied with their current job. It can therefore be assumed that this is a group that would be happy to change to a better job. These results overlap with the proportion of people who are dissatisfied with their salary. This is therefore the group for whom the most motivating factor to change jobs is the level of remuneration.

The next series of questions asked respondents to identify their preferences in using recruitment channels. Respondents found their last job 66% through recruitment portals, 24% through direct contact with a recruiter, and 7% through IT groups on Facebook. Respondents were least likely to have used an advertising-driven incentive. This may indicate that, for the most part, respondents are not active in the labour market, some expect activity from recruiters and therefore adopt a passive attitude.

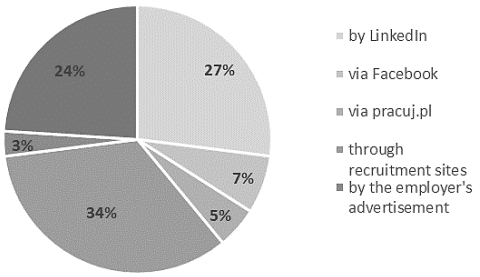

Figure 5. How survey participants found their last job.

Source: own study based on the questionnaire.

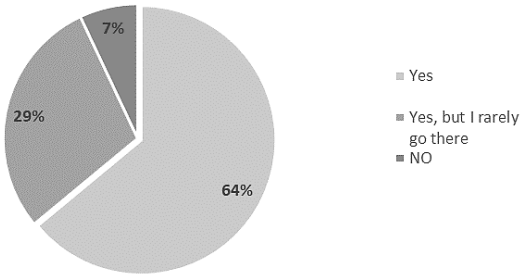

Figure 6. Level of use of LinkedIn by study participants.

Source: own study based on the questionnaire.

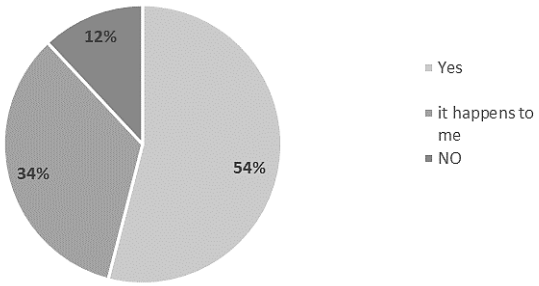

Figure 7. Level of use of recruitment platforms by survey participants.

Source: own study based on the questionnaire.

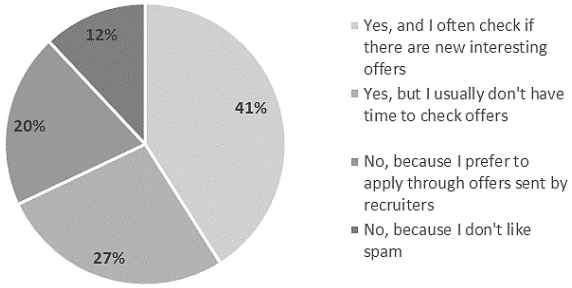

Figure 8. Participation of people surveyed in groups with job offers on Facebook and LinkedIn.

Source: own study based on the questionnaire.

Figures 6, 7, and 8 show the level of use of recruitment platforms and social networks, among others, by recruitment companies. The vast majority of respondents are using, or have used, some form of recruitment portal, be it job board-type sites or Facebook and LinkedIn-type sites. They are also the first step to finding a new job. More than half of those surveyed use recruitment platforms, with just over 30% admitting that they also happen to use one. LinkedIn is already used by more than 60%, with an additional less than 30% using it infrequently. More than 68% use Facebook and LinkedIn groups related to the IT industry, with as many as 41.5% frequently checking these groups for new offers. Using portals may not only mean looking for a new job, but it may also mean wanting to compare one's working conditions with market offers.

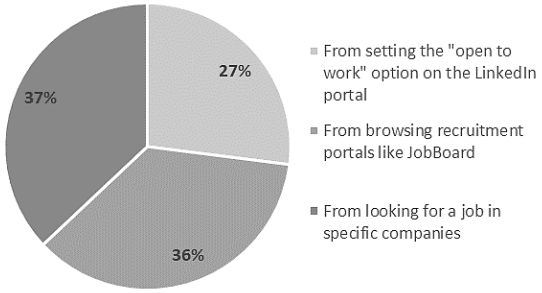

Figure 9. Job search methods used by survey participants.

Source: own study based on the questionnaire.

The next question concerns the respondents' activity in searching for a new job. Figure 9 presents how the respondents would start looking for a potential future job. More than one-third of the respondents would look for it in specific companies. The same number of respondents would start browsing recruitment portals like Job Board. However, previous results indicate that a certain proportion of respondents adopt a passive attitude, as their last employment was the result of direct contact with a recruiter. Some of the activity on recruitment portals involves the "open to work" option.

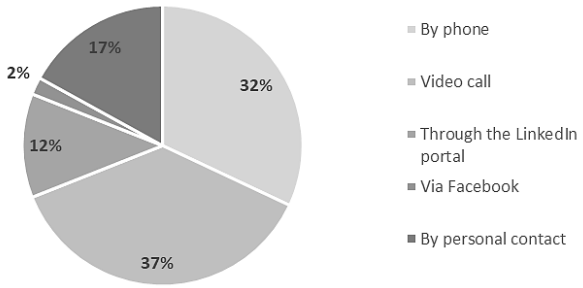

Figure 10. Preferred form of contract with a recruiter.

Source: own study based on the questionnaire.

Figure 11. The preferred form of recruitment.

Source: own study based on the questionnaire.

The next figures, i.e. 10, 11, illustrate the respondents' preferences as regards the methods of recruitment. More than 1/3 of the respondents prefer a video interview as a form of recruitment. Slightly less, but still more than 30% would prefer a telephone interview. Only 17.1% preferred personal contact. More than half of those surveyed prefer to take part in online recruitment challenges on platforms that allow them to progress to the next stages of recruitment. One-third, on the other hand, prefer to submit the tasks "after some time".

A further question reveals the issues that job candidates pay attention to when presented with an offer (Figure 12). The most important is the match between their technological competencies and the competencies indicated in the offer, the so-called tech stack (73.2%), followed by the type of project (70.7%), salary range (68.3%), location (65.9%) and form of employment (63.4%).

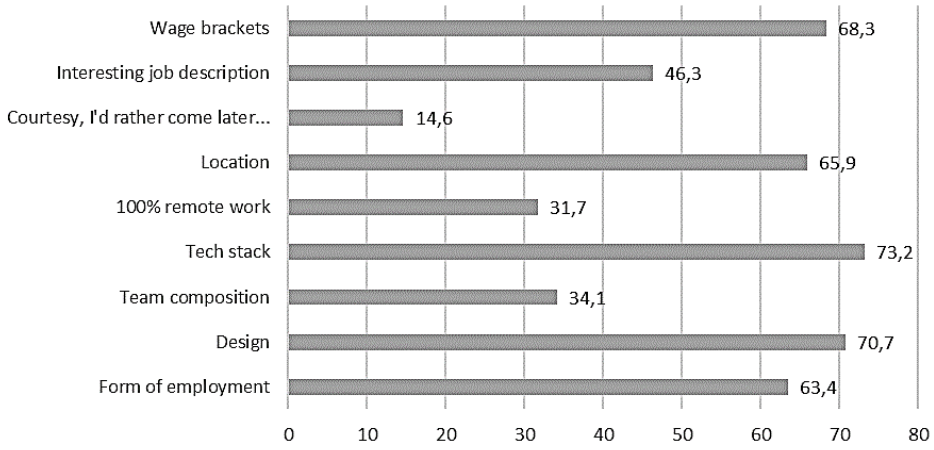

Figure 12. Elements of the job offer that draw respondents' attention.

Source: own study based on the questionnaire.

The data in figure 13 shows that the survey participants' decisions to apply for a given company are most influenced by: better salaries (82.9%), promotion to a position higher than the one held (65.9%), and the form of employment (51.2%). In addition to information about the working conditions of the position offered, recruits are interested in information about future opportunities with a particular employer. This is illustrated in detail in Figure 14; respondents indicated: interesting projects (75.6%), flexible working hours (73.2%), career advancement opportunities (68.3%) and super team atmosphere (61%).

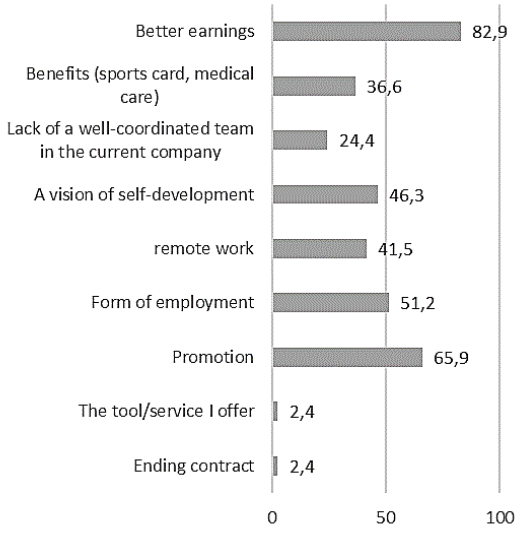

Figure 13. Factors influencing willingness to apply for a particular company.

Source: own study based on the questionnaire.

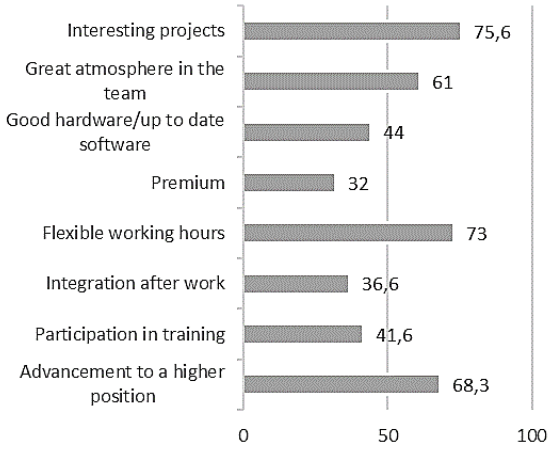

Figure 14. Expectations from the future company.

Source: own study based on the questionnaire.

4. Discussion

IT employees mainly come from large cities and are mainly men. There are no great differences between the age ranges, although those between 27 and 40 are slightly dominant. The vast majority of respondents held a position as a programmer. The survey results show that the important aspects of working conditions are not necessarily salary (although these are still important), but also flexible working hours, team atmosphere or interesting and engaging projects. Only one-third indicated satisfaction with their salaries, while 40% indicated satisfaction with their work overall. It can be concluded that the prospect of receiving higher salaries is an important reason for the decision to change jobs.

One can see a definite digitalization of IT work and recruitment in this segment of the labour market. Respondents mostly prefer to work remotely or in a hybrid form. It can be said that the issues that attract their attention to a given offer concern the comfort of work, but the most

important question candidates ask themselves is: Can I handle this position/project? Is the offer for me? These indications are important for building the offer and determining the order in which information will be communicated to candidates during, for example, a telephone interview.

As far as the forms of recruitment are concerned, video and telephone interviews dominate. This may be related to the pandemic that has dominated the job market and forced it to make changes to reduce face-to-face contact.

An important conclusion that emerges from the research is the need for the recruiter to guide the candidate individually. It can even be said that candidates expect the recruiter to carry out tasks that are characteristic of a manager of a competitor, such as in sports, music, etc. This manifests itself in expectations of fast communication with the recruiter, etc. Research conducted by Marta Pawlak-Dobrzańska (2018) indicates that 62% of the candidates surveyed by the author were dissatisfied due to a lack of willingness on the part of the recruiter to build relationships. This means that candidates want more personalized treatment so that the recruiter has a good understanding of the candidate's needs (Bieniak, 2015; Chawla et al., 2019; Finn, 2017; Kowalczyk, 2008).

The need for the recruiter to quickly provide detailed information about salary and other working conditions is also confirmed by a survey conducted by LinkedIn (Bednarz, 2023). They indicate that candidates expect detailed information about a job offer when a recruiter first contacts them. Survey respondents indicated that they expect detailed information about the job and the company. Among the most important information they expect are details about the position and salary. In this case, this is the same result that was obtained in the research presented in the article.

When considering the decision to apply, respondents also assess the attractiveness of a given job offer in terms of the employer's development prospects. To the highest degree, candidates want to participate in interesting projects implemented by teams with a 'super atmosphere', flexible working hours, a vision (development path) and the possibility of career advancement. In practice, this means that the recruiter must be prepared to answer questions about the future and the prospects of being employed by the new company. It is therefore not enough to know the offer alone, but it is also necessary to know the organization, both in terms of project challenges, promotion opportunities, and the organizational culture of the future employer itself.

5. Summary

Research clearly shows that candidates for IT jobs adopt two strategies. The first is a passive strategy of waiting for an offer to be made by a recruiter in the form of an email, post, phone call, or video interview. To meet the candidates' expectations of a good relationship with the recruiter, a phone or video call deserves attention. A certain passivity of candidates has been created by the specifics and functionalities offered by recruitment portals, social media groups or the high sourcing fees required by recruitment companies. This is causing an intensification of recruitment activities and the emergence of new models for the operation of recruitment companies. This means that the role of the recruiter and the demands placed on them are increasing significantly.

The second strategy is an active one, where the activity is undertaken by the job candidate, essentially seeking employment with specific companies. In this case, particular importance must be given to the presentation of the offer in question. It must be concise containing mainly the job title, the technological skill requirements of the position, the salary range, the form of work (remote and hybrid preferred), the location, and the project.

One of the most important clues for future research is to know the mechanism of how a recruiter works with a job candidate. Another important issue is the scale and scope of selection methods used such as Assessment center, knowledge tests, and simulation methods. Another issue that arises that has not been considered is the problem of the impact of the mode of selection on recruitment outcomes. To what extent does the method of selection influence the decision of candidates to apply for a particular position. An interesting dimension that should be explored is the relationship of the impact of motivating factors to change jobs depending on the management level at which the candidate is located. Research also points to the increasing role of the recruiter in the recruitment process. A significant proportion of candidates prefer telephone contact with the recruiter, which implies that recruiters have 'soft' skills. An important aspect that can be researched is the new business models of recruitment companies in terms of sourcing and building an information base about potential candidates and their competencies.

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INNOVATIVE FORMS OF EMPLOYEE SELECTION

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Purpose: This article aims to identify contemporary and innovative models of recruitment companies operating in the IT sector.
Design/methodology/approach: The research focused on external recruitment by specialised recruitment companies working for IT companies. A case study analytical method was used, focused on conducting a detailed analysis of the proposals of innovative recruitment portals. For this purpose, the websites of these portals and the details of their offerings were analysed.
Findings: The research found an increasing effort by recruitment companies to reach out to young IT talent, building a community of young IT professionals to whom job offers can be directed. Increasingly, recruitment companies are using Social Media. In addition to recruitment, companies are carrying out part of the selection process using the 'Skill Challenges' method, among other things. Increasingly, the pre-selection of candidates and the assessment of competencies, e.g. programming, is being carried out using artificial intelligence AI.
Research limitations/implications: Research points to the increasing role of innovative tools in the staffing process. Contemporary e-recruitment methods are constantly changing and improving. The staff selection phenomenon, especially in the IT sector, requires constant monitoring of the changes taking place.
Practical implications: The practical utility of the research refers to the effectiveness of conducting the personnel selection process using different e-recruitment methods. It therefore enables a more rational choice of individual methods. The article raises awareness of the possibilities offered by some recruitment platforms.
Originality/value: The research conducted identifies the variety of employee selection techniques used in the e-recruitment process. Often the models offered by innovative recruitment companies are not widely known, but carry great potential for development.

Keywords: job advertisement; employee recruitment; external recruitment; IT.

Category of the paper: research paper.

1. Introduction

The far-reaching digitalisation, characteristic of the knowledge and technology economy, is reflected in recruitment and selection processes; it results in the emergence of new (innovative) tools to support these processes. The HR industry is undergoing dynamic changes related to modern technologies. Phenomena that contribute to the development of the industry include increasing investment in HR-Tech start-ups. New VC funds and accelerator programmes dedicated to such solutions are springing up all over the world. The number of conferences dedicated to this topic is also increasing. The HR-Tech industry is rapidly developing towards the automation of information retrieval tools (specialised algorithms, use of NLP) to build corporate databases of employees and candidates to whom job offers can be targeted. Investment in HCM - Human Capital Management - is also increasing. A fundamental problem in the implementation of the HR selection function is the building of a suitable database of job candidates. Each employer wants to attract candidates with high competencies and qualities that match the needs of a specific position or position in a project team. It is then easier to try to select the most predisposed person for the position from among many competing applications. However, it should be noted that maintaining an active candidate base requires a large organisational and resource effort. An active candidate base is a community, in this case of IT professionals, focused on a specific problem, challenge, competition, knowledge base, training programme, i.e. people who actively participate in the life of the community, proving their competence. Running such a base involves resources and is therefore costly. Consequently, the predominant approach is to maintain inactive databases, where we have collected information about individuals their qualifications, experience, etc., i.e. the traditional approach to the recruitment process. The traditional approach implies a sequence of the following activities: identification of the needs of the vacant position, sending information about the vacancy to the labour market, waiting for the flow of applications, initial selection, further selection stages, and establishment of the employment relationship. E-recruitment largely follows this traditional approach, only instead of a notice board, there are: job offers on the company's website, and recruitment portals that optimise communication and conduct a kind of pre-selection by finding candidates with the competencies expected by employers. Thus, the employee selection process has been partly automated (Mamatha, Kumar Thoti, Professor, 2022; Koivunen et al., 2022). Of course, if a candidate has inadequately marked his or her competencies then offers in which he or she would be interested may not reach him or her. Recruitment portals make it considerably easier to find a new job. Candidates, on the other hand, can browse job offers in different keys, optimising their job search activity.

The purpose of this article is to attempt to identify new methods of staff selection used in the IT industry.

2. Selection of personnel

2.1. Permeability of the recruitment and selection function

Staff selection consists of three key stages: recruitment, selection and induction (Kawka, Listwan, 2010). Recruitment refers to the process by which potential candidates are sought and then encouraged to apply for a current or future vacancy. Selection is the process of assessing the skills and competencies of candidates who have been selected in the first stages of recruitment, with the aim of finding an individual who matches the organisation's expectations (Dale, 2001).

The selection of employees from outside the organisation (so-called external recruitment) is relatively often outsourced to specialised companies. The traditional cooperation model is based on a relatively strong separation of the recruitment and selection functions. In such a model, the external company searches for candidates who meet the client's expectations and the selection process is already carried out internally by the target organisation. The function of the contracting company is to provide information to the defined labour market about the desire to hire a specific type of employee.

Today, the activities of many recruitment companies' business models are not just focused on issuing or brokering job offers, or even on finding specific individuals and targeting them individually. Companies are trying to build new solutions to ensure they have constant access to talent in the industry, and this will allow them to run an effective employee selection programme. In many cases, the integration goes further and the recruitment process is combined with the initial and/or final selection of employees, particularly in the area of skills in the use of specific technologies.

2.2. Staff selection in the IT sector

Improving processes, creating systems, programmes, applications, websites are necessary for an organisation to function and still be competitive. In order for such activities to be carried out, qualified staff is needed, including systems engineers, programmers, and developers who, with their acquired and trained skills in operating tools and programming languages, are able to fulfil some of the most important roles within a company. Since IT systems cover most aspects of a company's operations, so to speak, guaranteeing the continuity of its activities, people with IT competencies are a valuable human resource. The aforementioned issues lead to the fact that the problem of finding and hiring employees in the IT industry is definitely different from others. The IT labour market has, with the passage of time, the development of technology and the widespread use of IT solutions, become an 'employee market'. This leads to a high demand among a significant proportion of companies for people with Information Technology qualifications, experience and skills; in essence, companies are competing for candidates rather than the other way around. The demand for specialists in the technology market is greater than

the number of people who are actively seeking career progression by changing their place of employment. Of course, this situation results in high expectations of candidates compared to other industries. The employee selection process in the IT industry is increasingly being carried out by external companies. Often this does not just involve recruitment alone, but increasingly enters the area of selection, not just initial selection.

2.3. Popular ways of selecting employees

Organisations are increasingly turning to new ways of reaching the best candidates. Traditional forms of recruitment are no longer attractive - especially for representatives of generation Y (Branowska, 2021). There are three major trends in the market for recruitment services regarding ways of selecting employees, i.e. networking (including direct search), e-recruitment and Neuro-Linguistic Programming (NLP) (Olszak, 2014).

Networking is networking, relevant to business in the broadest sense. Network marketing is, therefore, literally marketing based on building networks, in this case, two types of networks: a network of customers and a network of colleagues. Networking, or networking, is therefore central to recruitment processes. Networking is based on relationships that are nurtured so that there can be a two-way exchange of information and advice so that one can recommend and support each other (Tullier, 2006, p. 23). Ewa Olszak (2014) states that on a daily basis, especially in the Polish reality, we have to deal with the stereotype of networking, saying that acquaintances (i.e. networks of contacts) will take care of any matter, such as finding a job, enrolling a child in kindergarten or writing a prescription. So the key to professional success, stereotypically thinking, is knowing people in high positions. Networking, on the other hand, emphasises a wider network of contacts, e.g. middle managers and rank-and-file employees. From the employer's and recruiter's point of view, the greater the number of contacts, the quicker it is possible to reach the desired candidates from the so-called recommendation, thus reducing time and expenses related to, for example, the publication of an advertisement in the press or on web portals. Essentially, networking is about using your network of contacts and the direct search method in the recruitment process. This involves a direct search in a defined environment (specific professional groups, companies with a similar profile) for candidates who meet the requirements.

E-recruitment is, in the simplest terms, conducting staff selection online. The term is very broad and concerns not only the recruitment process but also selection. Selection can take place in two ways. The first uses the Internet as a medium to facilitate communication in interviews, tests, competitions and so on. The second analyses the activity of candidates on social media or on their websites and blogs, building their personality, worldview and competence profiles. Some of the advantages of e-recruitment include: talent pool management, reaching potentially new candidates, and brand building (Sołek-Borowska, Wilczewska, 2018). Each selection method and tool should be chosen for its effectiveness in identifying candidate skills and

competencies (Wozniak, 2020), but empirical research on the adequacy and effectiveness of different e-recruitment tools is scarce (Koivunen, Ala-Luopa, Olsson, Haapakorpi, 2022).

Neuro-Linguistic Programming is a body of knowledge about how our brain works, uses, exploits and develops in collaboration with our body, which is a receptor (seeing, hearing, tasting, smelling, feeling) of reality. NLP is both a system of theoretical models to understand the structure of human experience and action, and a set of practical methods to support constructive change and development (Olszak, 2014; Etuka, Athota, Kearney, 2021). NLP can support recruitment activities by, among other things, guiding the candidate's behaviour and emotions during the recruitment interview. A recruiter can use methods to influence the interviewee's emotions, interpret the interviewee's non-verbal behaviour and recognise whether the candidate is telling the truth or using manipulative methods (Olszak, 2014). NLP can help verify a candidate's motivation, credibility and sincerity during the selection process. Against the background of Tomasz Witkowski's (2010) findings, this direction in the development of selection methods may raise some objections; for example, the manipulation of a potential employee's expectations may be considered as one of the controversial aspects of using NLP.

As the subject of the article is staff selection in an online model, further consideration is given to the issue of e-recruitment.

2.4. The role of social media in the e-recruitment process

According to one definition (Lupa, 2016), social media are online platforms that are used for the creation, processing, sharing, receiving, playing and commenting on visual and audio content (e.g. images, games, videos, music, texts) by individuals or institutional entities (e.g. businesses). Social media have in recent times dominated the daily lives of people from all over the world. They are a source of entertainment and information and are a form of interpersonal communication that allows contact over long distances.

Social media are increasingly used by recruiters to either search for job candidates or to supplement information about potential future employees (Hosain, 2023; Balcerak, Woźniak, Zbuchea, 2023; Rahman et al., 2022). The analysis of social networks is most often used by them to confirm the reliability of the information and competencies contained in the submitted CVs (Jacobson, Gruzd, 2020). Very popular portals used for this purpose include LinkedIn and Facebook (Chmielecki, 2013; Gzowska, 2016; Wolniak, 2019). Social media provide an opportunity to introduce more and more interesting solutions related to the implementation of the HR selection function. For example, we are talking about the use of AI in the process of searching for candidates and verifying competencies (Hunkenschroer, Luetge, 2022; Tippins, Oswald, McPhail, 2021; Zacny, Kania, Sołtysik, 2019). Social media-based solutions focus on how 'first contact' information is communicated. In the case of specialised recruitment portals, the issue is much broader and is an area of innovative proposals, which is the subject of the research presented in the article.

3. The methodology and results of the study

The essential form of the research was case study analysis. The nature of the subject matter of the research indicates that only a detailed analysis of the specific operating models of recruitment companies allows the key questions for the research to be answered. These questions include: What forms of recruitment and information channels do job candidates prefer? How is the candidate base built? Several recruitment portals and IT companies were analysed in terms of how they conduct the selection process. Each observation has been described in some detail, giving rise to an attempt to systematise them.

3.1. Challenge model

Recruitment companies use a number of methods to reach out to potential candidates; the most commonly used methods include:

- posting on Facebook,
- searching via LinkedIn for profiles of people who meet the selection criteria and making them offers appropriate to their qualifications and/or experience,
- posting various tasks to be completed on the company's website, where the incentive is not only to be offered a job in a particular IT position but also to receive cash prizes, the opportunity to prove oneself against the competition,
- conducting email conversations with suitable candidates,
- telephone contact to present the company's offer and to advertise,
- telephone contact with interested candidates,
- forwarding CVs, other application documents and details of interested applicants to relevant (specific) companies looking for new employees.

The online recruitment platform is one of the most widely used ways to source employees. It enables IT professionals with programming, technical or analytical skills to be verified. The online recruitment platform offers:

- posting of job vacancies with the client employer,
- posting of a CV by the interested candidate,
- conducting so-called recruitment challenges ('Skill challenges'),
- organising and promoting Hackathons.

The platform offers the posting of job vacancies, which contain all the details of the position. Also, an interested candidate can upload a CV on the platform. This allows the client's HR department to verify and decide if the person is suitable. This is a quick way for companies to attract and hire IT professionals. The final stage of recruitment is to invite candidates to a technical interview, which allows for a final check of skills and experience. The technical interview is only conducted if companies post jobs on the platform without a 'Skill challenge' attached.

During the 'Skill challenge' - linked to job advertisements - candidates demonstrate their skills at the time of application. Challenges are, for example, text tasks for selecting answers and coding tasks, whereby the candidate tests his or her coding skills while taking part in the online recruitment. These tasks determine the candidate's level of knowledge and whether they are the right person for the job. Candidates get automatic online feedback - they know immediately if they are in the next round of recruitment. This solution helps to discover developers at an early stage of their career path (current students, young graduates), and enables automated relationship building and direct sourcing. It can be said to be the new standard, giving, among other things, a very positive 'candidate experience' with the employer brand.

Hackathons are events aimed at developers that take place on a specific day. This method helps participants to collaborate and solve technical design challenges in a limited amount of time.

Companies can use several models, which include:

- developing a talent pool around your brand,
- recruiting directly from the community created on the portal.

In this model, the platform operator will focus on building its recruitment bases, i.e. pools of candidates with the company's desired skills that can be engaged in open recruitment processes for current or future demand. Having an engaged talent community around your brand allows you to effectively meet your internal recruitment needs and free the flow of candidates. Using the platform, companies are provided with a tool to automate the building, development and evaluation of a technology community, which can be achieved by launching a series of dedicated programming challenges. The programming challenge formula (available on the platform) effectively attracts programmers and allows companies to discover new people and pre-automate the assessment of their practical skills.

The portal enables a series of programming challenges. The challenges engage the community and allow new talent to be discovered and their skills measured. During a challenge, developers are faced with the task of solving a specific design problem. Their goal may be to write code that solves the task or to improve existing code. Many of the tasks are designed to reflect a real-world working environment, where IT professionals develop existing team projects and have to rely on other developers' source code. The AI system evaluates the developers participating in the challenges automatically, makes it easy to monitor their skills development and invites the best to join their organisations.

Developers join the platform to polish their coding skills, compete, showcase their talent and advance their careers. As part of its business model, it enables the hiring of candidates directly from the community - providing companies with access to people who were previously unattainable to them (passive candidates) and providing information about their skills (speeding up the assessment process in further stages of recruitment). Working with the platform brings benefits for developers and employers. The platform addresses the needs of programmers in the following areas:

- the need to learn in practice and improve their skills,
- desire for career development,
- motivation and ambition need (to show that I am the best, better than a colleague),
- additional financial incentive in selected challenges with prizes.

The platform addresses the following needs of companies:

- the need to expand the team with new, creative developers,
- building employer brand recognition and prestige,
- the related need to implement effective sourcing and to attract the most valuable candidates (being a 'first choice' company).

3.2. Training programmes

Another method of recruitment observed is the running of training programmes for different social groups from which new professionals can be recruited. These programmes are generally targeted at young people, current students and/or graduates. There are also programmes with the participation of government institutions aimed at activating women, for example, in the IT sector. In this case, we are not only talking about recruitment but also about training employees in a specific profile needed by the company.

3.3. Groups on social media

Another form of active recruitment that has been observed is for recruitment companies to set up and animate groups on social networks in the fields in which they specialise. A recruitment company must therefore have the right competencies to pursue such a model, but this enables the availability of a candidate base with well-defined technological skills.

The research investigated the effectiveness of conducting a recruitment campaign using Facebook, LinkedIn and *organic direct.* Facebook posts attracted the most interest followed by ads on the portal/employer's page (organic direct) and then ads on LinkedIn. A similar pattern was followed when analysing the share of applications submitted to the number of entries. These results may have been slightly distorted because some of the organic direct entries were made later and directly to the bidder's website.

4. Discussion

The research carried out analysed the recruitment tools used by recruitment companies. Next to the interpersonal skills of recruiters, these are the key competencies determining the effectiveness of reaching the target group with a job offer. The research shows that Facebook posts generate the most traffic to individual job offers, followed by *organic direct* traffic,

i.e. by browsing offers on the portal, with LinkedIn in third place. The effectiveness of applications submitted in response to posts is similar.

Job marketing is a concept taken from marketing and stems from the phenomenon that, to attract a job candidate, it is no longer sufficient to simply traditionally present overall job offers. It is necessary to promote job offers. Therefore, we can speak of the need to define target groups, to identify their needs in terms of the relationship with the recruiter. It is also important to adapt communication channels to the offers. We will deal differently with people at the beginning of their careers, and differently with the search for candidates for managerial positions. There is a need to provide short and clear information that encourages deeper knowledge of the offer. Modern recruitment models are indicating greater integration between recruitment firms and businesses. From the sales perspective of recruitment firms, we see many parallels with classic marketing, hence the notion of job marketing is legitimate and organises elements of the recruitment process.

Contemporary models for recruitment companies focus on creating a community of IT professionals to whom job offers can be directed. This community can be created around broadly defined competence development (training), problem-solving (forums), challenge creation or Hackathons (Wang et al., 2022; Fig, 2023). Alongside the effect of talent selection comes the effect of upskilling and shaping problem-solving skills in a networked environment. These solutions especially at a time of ITC staff shortages seem very interesting. Some concerns, especially in a model oriented towards training and shaping young future employees, may be raised by the long-term perspective of the benefits obtained. This applies to the first period of offering the service before the first generation of trained workers enters the labour market.

Significant resistance to the introduction of new HR selection techniques seems to reside in HR departments and the lack of knowledge about them in HR departments and company boards. Very often the HR selection process is an essential function of these departments. This means that it is an existential function for them. Thus, the introduction of external actors performing a wide range of HR selection functions can be perceived as a threat. This is a topic worth addressing in future research. There are costs associated with the creation and maintenance of a talent pool. In this context, the question arises whether the utility offered at a certain price is significant enough to overcome the internal resistance of the organisation to use these services.

5. Summary

The increasing digitalisation of business processes is also transforming the way employees are selected. The article uses the case study analysis method. It was pointed out that in the IT market, recruitment companies are gaining in importance, as they implement not only the

recruitment phase but also, in part, the selection phase of personnel selection. The usefulness of the study relates to highlighting the potential of new forms of staff selection used in the IT industry. Recruitment firms and many employers are running their own 'talent pools' focused on training, confessions or problem-solving. This innovative solution has the potential for great growth. The prerequisite for this development, however, is that the customers of these companies perceive adequate utility beyond the equivalent of the price to be paid for the service.

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THE ROLE OF ORGANISATION'S PROMOTIONAL AND PREVENTIVE ORIENTATION IN CREATING A SENSE OF PSYCHOLOGICAL SAFETY IN THE WORKPLACE

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Purpose: to determine the relationship between the organisational orientation adopted and the sense of psychological safety among organisational members.
Design/methodology/approach: the study was conducted using the Regulatory Orientation Scale questionnaire and a questionnaire to measure Sense of Psychological Safety in Teams based on the A.C. tool. Edmondson. The survey included 205 members of public and private organisations. Responses were assessed on a five-point Likert scale. Correlation analysis was used to identify relationships between organisational orientation and sense of psychological safety.
The survey was conducted in May 2023 using paper and electronic versions of the survey instruments.
Findings: there is a clear and statistically significant positive correlation between the adopted promotional orientation of the organisation and the sense of psychological safety of the members of the organisation.
An organisation's prevention-based orientation shows a moderately weaker positive correlation with feelings of psychological safety,
Research limitations/implications: inability to fully objectify the research results obtained.
Practical implications: The study indicates that in order to foster psychological safety, organisations should promote a promotional orientation, foster an open and diverse organisational culture and exercise restraint in preventive measures based on monitoring compliance with procedures. Monitoring the sense of psychological safety can be used to identify areas for improvement.
Social implications: this research can contribute to improving the quality of employees' working lives. By promoting the organisational culture that fosters a sense of psychological safety, organisations can create a more satisfying working environment, which can contribute to the overall employee wellbeing.
Originality/value: the research brings new insights into the relationship between organisational orientation and employees' sense of psychological safety. It clearly identifies the relationship between an organisation's orientation (both promotional and preventive) and employees' sense of psychological safety. This is a new insight into the role of organisational culture in shaping employee wellbeing, as it suggests that risk and safety management need not exclude employee initiative, development and creativity. An additional point is that this research focuses on the sense of psychological safety as one of the key conditions for organisational functioning.

Keywords: psychological safety, promotional orientation of the organisation, preventive orientation of the organization.

Category of the paper: research paper.

Introduction

According to Higgins' regulatory orientation theory, all goal-oriented behaviour is regulated by two different motivational systems - a *preventive* and a *promotional* orientation (Higgins et al., 2001). For an individual, a promotional orientation towards goal attainment is associated with a striving strategy, that is, a developmental orientation, a willingness to take risks and a higher level of creativity; in contrast, a preventive orientation is associated with a desire for a sense of security. The individual undertakes assurance behaviour, monitors mistakes and avoids potential losses. Both orientations lead to different motivational, cognitive, emotional and behavioural consequences (Roczniewska, Retowski, 2014).

The organisation also adopts a specific way of achieving its goals. It may focus on continuous process improvement, standardisation of activities, introduction of procedures to regulate employee behaviour, or it may focus on perceiving new needs of the environment and finding unknown ways to address them. Therefore, it can be said that organisational culture can also be oriented towards prevention or promotion during the strategy implementation.

The strategic orientation adopted by an organisation is one of the conditions shaping certain organisational behaviours (Rutka, Wróbel, 2012). Organisations with a preventive approach to goal attainment require their employees to follow formalised rules, to specialise and fulfil their duties, to avoid risks. The employee is not expected to make independent decisions and go beyond the set scope of duties, rather to obey and fulfil the orders of superiors. Participants are required to ensure that their actions do not generate additional costs in the form of: losses and mistakes.

Promotion-oriented organisations, on the other hand, require participants to creatively implement quite broadly defined processes, to be innovative, to be ready for challenges, to take their own initiatives beyond their defined responsibilities and to continuously develop. The value is in seeking opportunities for the organisation, even if this involves taking risks for the organisation, competition between employees, being proactive and critical of existing solutions.

In the management literature, promotional and preventive targeting have been discussed in the context of marketing strategies (Shao et al., 2015), consumer decision-making (Som, Lee, 2012), managerial behaviour (Ahmadi et al., 2017) and investors in the stock market (Cecchini et al., 2021). It is therefore a construct that is a variable shaping specific organisational activities and processes.

However, other factors (besides strategy) are important for achieving goals, for example, teamwork is becoming increasingly important. Organisations are trying to encourage it among their employees in various ways. Some invest in employee knowledge development or coaching. Others motivate employee teams with different challenges (Steinerowska-Streb, 2020). There are also those that try to create psychological safety in the organisation.

Psychological safety is a major factor influencing how employees perceive the consequences of interpersonal risk-taking in the workplace (Edmonson et al., 2012, 2014). The higher the level of psychological safety, the more willing employees are to collaborate, share ideas, take initiatives and boldly challenge existing organisational assumptions. This is a major construct in the context of organisational management and teamwork, as it affects the efficiency and innovation of work and the level of employee engagement (Kark, Carmeli, 2009). It fosters their creativity, arouses their willingness to share information, and encourages them to identify flaws in the organisation, complete projects or develop a product (Bass et al., 2008; Boucher et al., 2018; O'Donovan, McAuliffe, 2020). It is also linked to organisational learning, influencing an organisation's ability to adapt and innovate (Baer, Frese, 2003).

However, despite its importance, there are very few studies on the factors that shape feelings of psychological safety in the workplace. It is therefore worth investigating whether the adopted strategic orientation of an organisation can influence this important aspect of human performance in the context of organisational management and teamwork.

The aim of this article is to identify the relationship between the adopted organisational orientation and the sense of psychological safety among organisational members.

Organisational focus – promotional vs. preventive

The inspiration for this investigation of the preventive and promotional orientation of organisations comes from Higgins' concept of individual self-regulation, who distinguishes between a promotional orientation towards goal achievement - linked to a strategy of striving, growth orientation, profit focus, risk appetite and higher levels of creativity, and a preventive one - linked to a sense of security, realised through a strategy of caution, monitoring for mistakes and avoiding potential losses (Higgins et al., 2001).

Promotion-oriented people approach tasks with enthusiasm and drive, tend to break existing rules and create new ones, and when faced with ambitious goals, feel eagerness, energy and excitement as well as motivation to work harder. They are more likely to find themes in life for which they are willing to exert increased effort, than those with a preventive orientation, and they are more likely to be reckless and impulsive in their actions, perceiving change as a challenge (Bak, 2008).

Those who prefer a preventive approach, on the other hand, focus on avoiding mistakes when implementing their intentions, follow established rules, and show caution and preparation for action. They are more likely to believe that they are incapable of getting what they want and rarely use solutions that are not accepted by others (Bak, 2008).

The organisation also adopts a specific way of achieving its goals. It may focus on continuous process improvement, standardisation of activities, the introduction of procedures to regulate employee behaviour, or it may focus on perceiving new needs of the environment and finding unknown ways to meet them. Therefore, it can be said that organisational culture can also be oriented towards prevention or promotion during strategy implementation.

An extension of the theory of regulatory focus is the concept of *regulatory fit*, which examines the consequences of consistency and inconsistency between a person's attitude and organisational culture, i.e. the conditions - promotional or preventive - created by the organisation for the realisation of goals (Roczniewska, Retowski, 2014).

These conditions may relate to the nature of the task (e.g. a creative task vs. an analytical task), the designated way of completing the task and the consequences of achieving the goal (Roczniewska, Retowski, 2014).

The promotional environment shaped by the organisation will encourage employees to behave innovatively. Organisations adopting this orientation are constantly looking to introduce new products, better suited to the needs of customers.

Within the framework of its mission or communicated values, such an organisational culture will be characterised by the pursuit of profit and a 'be creative and be prepared to take risks' strategy. This culture is challenging for its participants, as it expects continuous innovation, constant questioning of existing solutions and learning through critical analysis of existing rules. It is a culture that requires employees to have the courage to make changes and managers to agree to employees challenging existing procedures and regulations (Rutka, Wróbel, 2012).

Employees who are highly competent and motivated in their work expect to be able to influence their “fate”, to have some autonomy and to be managed in a participatory way.

It seems that the promotional orientation of the organisation will also be reflected in other dimensions. Thus, the organisational structure may be more decentralised, the way power is exercised more relationally, also involving people who are not in the managerial roles in the decision-making process, and the role of the employee imprecisely defined.

When the organisational culture is oriented towards prevention, the fixed procedures and standardisation of activities are crucial, which can foster a strategy of taking care of safety and avoiding mistakes (Roczniewska, Retowski, 2014).

Such an organisation strives to improve its processes through repeatability or replicability and the standardisation of activities. It uses modern technologies that enable it to achieve high efficiency and low costs in the production of services/products. In addition, complex planning and cost control systems are used. This organisational culture promotes a sense of the need to economise and a zero tolerance for waste. A side effect is that the employees become

accustomed to the idea that their main task is to follow procedures rather than to solve problems creatively. When encountering a problem, an employee uses existing solutions developed by the organisation, and is unwilling to question existing rules (Rutka, Wróbel, 2012, pp. 13-15).

Psychological safety in organisations

Teamwork is an aspect of human activity that is *de facto* unavoidable. Regardless of one's professional path or stage of human development, it is a challenge that everyone has faced at some time or another. Its ubiquity therefore implies the need to explore the various problems and difficulties that inhibit its satisfactory progress.

One psychological variable that touches on the issue of team effectiveness is psychological safety. According to Edmonson et al. (2012, 2014), it is a construct that describes the perception of the consequences of interpersonal risk-taking in the workplace. The higher its level, the more willing team members are to share their ideas, take initiative, point out problems that they feel are impeding progress on a collaborative project and have the courage to question the assumptions on which their team functions. Actions associated with interpersonal risk are, for example, revealing one's ignorance, asking someone for help, raising ideas that differ from those of the others. The risks arising from such situations take four possible forms (Edmondson, 2003): being seen as *ignorant*, as someone *incompetent*, as a *negative* or an *intruder*.

Initially, a sense of psychological safety was linked to organisational change. It was argued that psychological safety was necessary for people to feel secure and be able to change their behaviour in response to changing organisational challenges (Schein, 1993). Psychological safety was believed to help people overcome the defensiveness or fear of learning that occurs when presented with data that contradicts their expectations or hopes. With psychological safety, individuals can focus on collective goals and problem prevention rather than self-protection.

We can talk about psychological safety at the individual, organisational and group level. At the individual and group level, psychological safety is associated with an individual's engagement in creative work (Kark & Carmeli 2009), knowledge sharing (Siemsen et al., 2009; Collins, Smith 2006), speaking up and challenging the *status quo* (Siemsen et al., 2009; Liang et al., 2012).

At the organisational level, it is linked to *organisational learning*. It has been noted that positive subjective experiences of relationships at work are central to a sense of psychological safety and thus to organisational learning. Psychological safety also mediated the relationship between failure-based learning and high-quality relationships (Baer, Frese, 2003).

Research has also found that psychological safety positively correlates with firm performance, moderating the relationship between process innovation and firm performance (Baer, Frese, 2003), and influences learning, experimentation and the creation of new practices (Tucker et al., 2007; Bradley et al., 2012). These findings corroborate other research, according to which a psychologically safe environment enables divergent thinking, creativity and risk-taking and motivates engagement in exploratory and exploitative learning (Choo, 2007).

It can be said that research on psychological insecurity carried out at the level of management and quality sciences is mainly conducted in 4 areas. These concern:

1. the essence of psychological safety, e.g. concept, determinants, measurement,
2. areas of psychological safety in organisations, e.g. organisational level, group level, individual level),
3. the impact of psychological safety on the organisation, e.g. productivity, innovation, creativity, team member behaviour, team effectiveness, learning through failure, information sharing, trust,
4. mechanisms underlying psychological safety in organisations, e.g. personality trait activation theory, social information processing theory, social exchange theory, resource behaviour theory, implicit voice theory (Steinerowska-Streb, 2020).

There is little research that seeks to identify the determinants of psychological insecurity. On the national scale (in Poland), the relationship between authentic leadership and subordinates' sense of psychological safety has been investigated. It has been found that psychological safety may be higher if the supervisor behaves according to the characteristics of authentic leadership (Glinska-Neweś et al., 2018). Employees then feel that they can raise difficult issues, ask others for help, and that their individual skills and talents are valued and used.

In such a situation, it seems reasonable to investigate whether there is a relationship between the adopted strategic orientation of the organisation and the sense of psychological safety among the participants in the organisation.

Research method

Taking into account the research findings on the association of psychological safety with process innovation (Baer, Frese, 2003), experimentation and the creation of new practices (Tucker et al., 2007; Bradley et al., 2012) and creativity and risk-taking (Choo, 2007), it was hypothesised that higher psychological safety should positively correlate with an organisational promotional orientation, while lower psychological safety should correlate with an organisational preventive orientation.

To measure the regulatory orientation of an organisation, the questionnaire prepared by M. Roczniewska and S. Retowski questionnaire of the Organisational Regulatory Orientation Scale were used. The accuracy of the scale was confirmed in correlation studies (Roczniewska, Retowski, 2014), which showed a significant relationship between organisational preventiveness and bureaucratisation and organisational promotiveness - with innovation using the scale created by Zeitz (1984). A separate study demonstrated the diagnostic accuracy of this tool (Roczniewska, Retowski, 2014a).

The Organisational Regulatory Orientation Scale contains 2 subscales, each containing 5 statements on organisational promotability (e.g. 'In this organisation, a willingness to take on challenges is promoted') and 5 statements on organisational preventability (e.g. 'In this organisation, compliance with existing procedures and rules is controlled').

To measure the sense of psychological safety in the team, the questionnaire of A.C. Edmondson, validated in Polish conditions by I. Steinerowska-Streb (Steinerowska-Streb, 2022). This tool contains 7 questions, e.g. "If you make a mistake in this team, it is often used against you" or "In this team, members are easily able to discuss difficult issues and problems together".

Responses in relation to the components found in both tools were placed on a five-point Likert scale, where 1 meant strongly disagree and 5 strongly agree.

Spearman rank correlation analysis was used to identify the relationship between organisational orientation and sense of psychological safety.

The study (research sample) involved 205 people, employed in Polish public (61 people) and private organisations (144 people), in various roles: managerial (36 people) and non-managerial (169 people). The survey was developed in paper and electronic versions on the Qualtrics platform. The information about the survey was disseminated via social media and, in the case of the paper version, by direct verbal invitation. The survey was conducted in May 2023. SPSS software was used to calculate the results.

Results

The Shapiro-Wilk test was used to test the normality of the distribution of organisational orientation and sense of psychological safety. The test proved the non-normality of the distribution of the studied variables. The results obtained are shown in Table 1.

Table 1.
Results of normality tests for the distribution of the variables under study

	Shapiro-Wilk		
	statistics	**df**	**Relevance**
Preventive orientation	.953	205	p <.001
Promotional orientation	.967	205	p <.001
Sense of psychological safety	.948	205	p <.001

Source: own elaboration.

Spearman's rank correlation was used to analyse the relationship between organisational orientation and sense of psychological safety. The results obtained from the correlation analysis are presented in Table 2.

Table 2.
Correlations between the promotional and preventive orientation of the organisation and feelings of psychological safety (n = 231)

	Sense of psychological safety	
	Spearman's rho coefficient	**Relevance**
Promotional orientation of the organisation	**0.64**	**p<0.01**
A willingness to take on challenges is promoted in this company (organisation).	0.58	**p<0.01**
In this company (organisation), opportunities for employee development are provided.	0.56	**p<0.01**
This company (organisation) provides opportunities to achieve one's aspirations	0.54	**p<0.01**
Creativity (e.g. new ideas, products, procedures, etc.) is promoted in this company (organisation).	0.51	**p<0.01**
In this company (organisation) there is space for employee initiatives	0.57	**p<0.01**
Preventive orientation of the organisation	**0.36**	**p<0.01**
In this company (organisation) everything is done to avoid job losses	0.19	**p=0.03**
In this company (organisation), it is common to control how employees fulfil their duties	- 0.04	**p=0.48**
In this company (organisation), measures are taken to ensure the occupational safety of employees	0.44	**p<0.01**
In this company (organisation) a lot is done to exclude mistakes in the work	0.37	**p<0.01**
In this company, compliance with existing procedures and rules is controlled.	0.22	**p<0.01**

Source: own elaboration.

Discusion

The analysis shows that there is a strong positive relationship between the adopted promotional orientation of the organisation and members' sense of psychological safety (rho = 0.64). Significance at the p < 0.01 level means that this relationship is statistically significant, suggesting that organisations that promote challenge readiness, employee

development and the creation of space for employee creativity and initiative tend to develop a higher sense of psychological safety among their employees.

It is worth noting that the relationship between prevention-based organisational orientation and sense of psychological safety is moderately positive (rho = 0.36). Significance at the $p < 0.01$ level suggests that loss-focused organisations also have an impact on increasing feelings of psychological safety, albeit with less strength than organisations with a promotional orientation.

The sense of psychological safety is mainly undermined by the tendency of the organisation to minimise losses and the excessive control of employees in following procedures. Although some actions taken as part of a preventive approach may improve psychological safety, for example, attempts to eliminate errors and actions to ensure the professional safety of employees, the relationship is not as strong as that created by actions taken as part of an organisational promotional approach.

According to the concept of psychological safety in an organisation, when an employee feels psychologically safe, his or her confidence increases that the work group or team will not punish him or her for truthfully expressing his or her thoughts. With psychological safety, therefore, the employee's fears of being threatened with embarrassment, ridicule or rejection when they talk about their doubts, questions or mistakes are reduced (Edmondson, 1999). Consequently, the employee is inclined to seek feedback intensively, to share information.

The study described in this article provides evidence of the relationship between organisational orientation and feelings of psychological safety. The results obtained are corroborated by, among others, the research conducted by Baer and Freses (2003). Their study also found a positive effect of organisations that promote innovation and creativity on employees' motivation and sense of security.

Studies carried out by Tucker et al. (2007) and Bradley et al. (2012) also support the results obtained regarding the existing positive correlation between an organisation's promotional orientation and sense of psychological safety, as these authors noted that an environment perceived as psychologically safe can stimulate employees to experiment and create new solutions.

Choo's (2007) research, suggesting that a psychologically safe environment fosters creativity and risk-taking, also highlights the importance of psychological safety in organisations, particularly in the context of creating new solutions and innovations.

Complementing the existing literature research, it shows that organisations with a promotional orientation appear to have a stronger effect on feelings of psychological safety compared to organisations with a preventive orientation.

In the light of these results, it can be said that the creation of favourable conditions, which derive from the organisation's beliefs regarding the achievement of goals, the perception of the employee and their organisational role, and the quality of the supervisor-employee relationship, plays an extremely important role in shaping the sense of psychological safety.

The organisation could therefore enhance psychological wellbeing by promoting an organisational culture that encourages acceptance of diversity, encourages the individual to challenge the established status quo, treats each employee as a full member of the team. The organisation could also create space for the sharing of ideas and individualised development. Last but not least, it is important to provide the right conditions in which employees can perform their duties responsibly and effectively.

Overall, these results suggest that organisations that promote employee development, creativity and initiative tend to create a more conducive working environment, which may be more likely to result in a higher sense of psychological wellbeing in employees. However, a preventive orientation also plays a role, albeit a slightly smaller one. It is important to understand these relationships so that organisations can consciously shape their organisational culture to improve the wellbeing and sense of security of their employees.

Conclusion

The results of the analysis show that there is a clear and statistically significant positive correlation between the adopted promotional orientation of an organisation and the sense of psychological safety of the members of the organisation. This means that in organisations where employees' willingness to take on challenges is promoted, investment is made in developing their skills and space is created for employees' creativity and initiatives, employees feel a higher level of psychological safety.

An organisation's prevention-based orientation shows a moderately weaker positive correlation with feelings of psychological safety, suggesting that there is a relationship between organisations focusing on minimising losses and ensuring the occupational safety of employees and feelings of psychological safety, albeit to a lesser extent than organisations with a promotion-based orientation.

The conclusion is that organisations that promote employee development, creativity and initiative tend to create a more conducive working environment, which can influence a higher sense of psychological safety in employees. However, a preventive orientation also plays a role, albeit to a lesser extent. Understanding these relationships is crucial for organisations to consciously shape their organisational culture and improve the wellbeing and sense of security of their employees.

Organisations should therefore strive to create a sustainable organisational culture that takes into account both promotional aspects and selected preventive measures. Such an approach can contribute to more sustainable management.

Managerial implications

Several suggestions can be made on the basis of the research carried out.

Firstly, it would be useful to promote a promotional orientation that encourages employees to challenge themselves, invest in developing their skills and create space for creativity and initiative. Management could be more focused on developing the potential of employees and supporting their active participation in the life of the organisation.

Secondly, it is crucial for managers to do more to shape an organisational culture that accepts diversity, encourages challenging the established status quo and treats employees as full members of the team.

Thirdly, it is worth balancing a preventive orientation. While some preventive action is also important in fostering a sense of psychological safety, management should not over-focus on minimising losses and over-controlling compliance with existing organisational procedures. Instead, organisations should seek to strike a balance between ensuring occupational safety and encouraging employee development, initiative and creativity.

A final important issue is the monitoring of the sense of psychological safety, which can help organisations identify areas for improvement.

In conclusion, the study can help managers to shape a more effective organisational culture and promote employees' sense of psychological safety. The implications suggest that organisations should invest in employee development, create an environment that fosters initiative and creativity, and ensure a balance between prevention and promotion in risk management and occupational safety.

Future research

Future research may focus on more specific aspects related to the organisational determinants shaping employees' sense of psychological safety and their impact on organisational effectiveness.

Firstly, research can focus on the role of managers' characteristics and behaviours in shaping employees' sense of psychological safety.

It would also be useful to identify and analyse differences between types of organisations (public vs. private) in the level of psychological safety and to identify the reasons for the differences and adapt action strategies.

Another area could be the study of the impact of cultural diversity in international organisations on psychological insecurity. Research in these areas could provide more detailed and contextualised information on the role of psychological insecurity in organisations and how

organisations can shape and support it for the benefit of their employees and the effectiveness of their operations.

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SHARING ECONOMY AS A TOOL OF LOW-CARBON LOGISTICS

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Purpose: It is becoming increasingly difficult for individual companies to achieve a reduction in CO_2 emissions in logistics. One of the tools that can bring measurable results in terms of the effects of low-carbon logistics in the B2B area is the sharing economy. The aim of the article is to identify the relationship between the use of the sharing economy concept and the economic and ecological effects achieved in low-carbon logistics.
Design/methodology/approach: Empirical research was conducted in a group of 250 enterprises in the first quarter of 2023. An electronic questionnaire was used to conduct the research.
Findings: The use of the sharing economy concept for logistics resources allocation is a tool for achieving the goals of low-carbon logistics. The conducted empirical research confirmed the relationship between the use of the sharing economy and selected economic and ecological effects of enterprises in the area of low-carbon logistics.
Research limitations/implications: The period in which the research was conducted was very difficult for the functioning of enterprises due to the post-pandemic times. In the future studies should be repeated for comparative analysis.
Practical implications: The surveyed companies, indicated that logistics is an area which offers significant potential for sharing resources. Achieving the goals of low-carbon logistics is possible without significant capital involvement, a fact that has been indicated so far as a basic barrier to the development of pro-ecological practices in the field of logistics.
Originality/value: The article identifies the relationship between the use of the sharing economy concept and economic and ecological results in low-carbon logistics achieved by enterprises.

Keywords: sharing economy; low-carbon logistics; CO_2 reduction; Carbon emission reduction; crowd logistics.

Category of the paper: Research paper.

1. Introduction

In order to keep up with the requirements of the environment, companies must strive for sustainable development. Government organisations put pressure on businesses by regulating the level of sustainability with laws and directives.

In this context, one of the most important directives is the European Green Deal presented by the European Parliament in December 2019. Legislation was tightened and the CSRD (Corporate Sustainability Reporting Directive) was introduced, requiring entrepreneurs to report ESG relating to environmental, social and corporate governance standards from 2023 (European Commission, 2020).

Modern society increasingly demands that products and services are produced sustainably. In particular, they point to the environmental impact and the inclusiveness of access to products and services. The vogue for buying sustainable products has become so important that the customer is willing to pay more for them.

One of the three elements of sustainable development is the reduction of CO_2 emissions. The main cause of global warming is carbon dioxide (CO_2) emissions. The transport sector accounts for almost 30% of the EU's total CO_2 emissions, 72% of which come from road transport, according to European Parliament data from 2019. According to Doherty and Hoyle (2009), it is estimated that 5 to 15% of the total CO_2 emissions associated with the product lifecycle come from logistics. Modern enterprises consider low CO_2 emissions to be one of the most important features of their business (Ramanathan et al., 2014).

Companies are increasingly demanding sustainable action in terms of supplier selection and development, carrier selection, warehouse location, distribution, freight, as well as routing and vehicle efficiency (Carter, Easton, 2011). On the other hand, customers increasingly expect secure and socially and ecologically responsible supply chains, according to research by Sundarakani et al. (2010). At the same time, the knowledge-based economy with the growing role of innovation and the dynamic development of highly advanced technologies, initiates considerations regarding the preferences of consumers and producers in terms of fundamental economic categories, such as ownership, benefit or profit (Rutkowska, 2018).

However, the challenges of low-carbon logistics that the world faces today are too great for any company to tackle alone. By contrast, combining resources, intelligence, leadership and common sustainability goals with other companies can translate into improved economic, ecological and social results. One of the tools that can demonstrate measurable effects in the field of low-carbon logistics is the sharing economy.

"The sharing economy trend refers to an ecosystem in which users (companies and consumers) temporarily make available, rent or lend assets or services instead of buying and owning them. This system is usually supported by digital platforms that help to combine supply and demand (for example, a platform connects owners of unused assets with people who want

to use them)" (Sharing Economy, n.d.). The sharing economy trend is listed on DHL's global "The Logistics Trend Radar" list, as having a mild impact with implementation within 5-10 years (Sharing Economy, n.d.).

The phenomenon of the sharing economy has already been widely described in the literature over the past decade. The definitions of the sharing economy, as well as similar, broader or narrower concepts (collaborative economy, access economy, peer-to-peer economy, collaborative consumption) are already highly developed. This point is also considered in a specialised form – e.g. crowd logistics. However, many of the questions associated with the sharing economy have not yet been investigated. In particular, the relationships between low-carbon logistic and the sharing economy are under-represented in the literature.

The aim of the article is to identify the relationship between the use of the sharing economy concept and the economic and ecological effects achieved in low-carbon logistics. The article is based on the results of literature analysis and empirical research.

The article begins with an analysis of the literature on low-carbon logistics, its characteristics and effects. Next, the phenomenon of the sharing economy is described, in particular from a B2B logistics point of view, followed by a presentation of its results. Subsequently, the authors compare the effects of low-carbon logistics with the results yielded by the sharing economy. The next part of the article presents the methodology of the undertaken research. The authors then present the findings and related discussion. In the last part of the article, the authors summarise the considerations and indicate further research directions.

2. Literature review and hypothesis development

2.1. The essence and effects of the low-carbon logistics concept

Logistics processes in enterprises can cause significant pollution of the environment. However, due to the important role of logistics in the functioning of today's supply chains, reducing the scale of logistics processes is difficult. Therefore, it is not a question of decreasing the number of logistics processes, but about transforming them in a way that will reduce the negative impact on the environment.

In the literature, the terms "low-carbon logistics" (Böttcher, Müller, 2015) or "low-emission logistics" are used (Osieczko et al., 2021), which define activities aimed at minimising greenhouse gas emissions, mainly CO_2, during logistics processes. Low-carbon logistics are optimisation processes in logistics that apply new technologies and innovative management methods to reduce resource consumption and CO_2 emissions (Li et al., 2020). Low-carbon logistics aims to reduce energy consumption, pollution and emissions through the use of renewable energy and energy efficiency technologies (Xu, 2011). The authors define low-

carbon logistics as a strategy for managing material flows and related information flows, starting from their design, so as to achieve economic as well as environmental goals by reducing greenhouse gas emissions and improving energy efficiency in logistics processes.

Stakeholders are taking action to develop low-carbon logistics in view of expected economic and environmental benefits. For individual companies, the economic benefits associated with low-carbon logistics usually include reduced costs, enhanced competitiveness and positive PR as a company responsible for the environment (Alves et al., 2017; Lai, Wong, 2012; Pazirandeh, Jafari, 2013; Rao, Holt, 2005). In the context of ecological effects, it is important not only to use resources more economically and boost energy efficiency but, above all, to reduce greenhouse gas emissions, especially carbon dioxide (CO_2).

2.2. The essence of the sharing economy concept

In 2011, "Time" magazine ranked the sharing economy as one of the top ten ideas that will change the world. The sharing economy trend includes cultural, social, economic and technological aspects. According to the central tenet of sharing economy, the market exchange process is oriented towards sharing resources. Therefore, we are dealing with a peculiar reorientation and transition from ownership to the availability of goods and services (Rutkowska, 2018). R. Botsman (2011) defines collaborative consumption as a system that activates dormant assets by launching models and markets within them. It provides access to these resources and increases their efficiency. The sharing economy is an economic model in which internet users join forces to share goods and services. The intermediary platform connects the provider (who has an excess of a particular commodity) with the recipient. The sharing economy model is based on the mutual advantage principle, and its attractiveness stems from the idea of consuming without owning property. The sharing economy promotes "positive" materialism, i.e., more conscious consumption based on care for the quality of purchased goods, their origin, manner of use, more efficient use of resources, as well as extending the life cycle of the product (Jaros, 2016). Customers decide to participate in the sharing economy due to its added value, in particular: saving time and money and convenience of use, personalisation and socialisation of experience, as well as the service flexibility and individualism (Cicharska et al., 2019). A key aspect of the sharing economy is improved efficiency, sustainability and social ties. The popularity of this model stems from globalisation and the development of online platforms (Bukietyńska, 2018). The essence of the sharing economy can be considered to lie in a new way of doing business, based on digital techniques that enable the organisation of commercial exchanges (Pietrewicz, Sobiecki, 2016).

The sharing economy includes three groups of participants: providers (who might be private individuals occasionally offering services or professional service providers operating within their professional activities), users and intermediaries, handling transactions and connecting service providers with users through online platforms (Pietrewicz, Sobiecki, 2016). Within the

sharing economy, transactions generally do not result in a change of ownership (European Parliament, 2016).

The sharing economy has a significant impact on both the economic and social spheres, as well as on the environment. In these areas, it leads to arbitration, which reduces income inequalities and increases the availability of certain goods and services. In this way, the more intensive use of already available resources can meet needs at relatively low costs and reduces the necessity for new sources, which reduces pressure on the environment. The sharing economy also leads to decreased emission of pollutants and greenhouse gases, reduced energy consumption and improved living conditions in large cities. In this way, the sharing economy contributes to a better allocation of resources in the economy (Pietrewicz, Sobiecki, 2016).

The sharing economy primarily involves transport, accommodation and space (Airbnb, Landshare, JustPark), skills and time (Skillshare, Skilltrade, Khan Academy) and other material resources, such as tools or equipment (Rutkowska, 2018). In the urban passenger transport segment, the sharing economy model has so far been applied in the form of car-sharing, ride-sharing and bike-sharing (Cicharska et al., 2019).

Often in the same set of terms as sharing economy, you can also find access economy, peer economy, peer-to-peer economy, collaborative economy, collaborative consumption (Sobiecki, 2016). Collaborative consumption refers to systems – based on renting, lending, exchanging, sharing, bartering and giving – that emphasise accessibility rather than possession. Not only does it change what we consume but also how we do it. This trend has three important elements: redistribution markets, a shared-use lifestyle and product handling systems (Botsman, 2011). The behaviours described in the Botsman definition are found in all types of business models: C2C, B2C, C2B and B2B. In the case of the B2B model, companies can share unused resources, whereas in the B2C model, the company organises the access to the resources and the service only facilitates their use. Collaborative economy is based on direct connections between individuals that allow direct exchange and shorten the supply chain. This model replaces the traditional branches of the economy, such as production, consumption and distribution of means of exchange. Examples of this trend include office space sharing, direct electricity purchases from manufacturers and on-demand legal services. Examples of collaborative economy solutions available on the Polish market are presented in Figure 1. Peer-to-peer economy models involve renting, lending, exchanging, sharing, bartering, and giving, and are based on temporary sharing rather than possession. Examples include renting a flat to other people or using other people's flats. In turn, the access economy is based on universal accessibility. Examples of this trend include online access to music, films and books instead of owning them, car-sharing instead of owning one's own vehicle, car-pooling or on-demand rides (Sobiecki, 2016).

The sharing economy has emerged as a new solution, capable of meeting the demand for more innovative and flexible logistics (Carissimi, Creazza, 2022). The sharing economy in logistics is a business model based on digital platforms that allows the exchange of untapped

resources (e.g. material goods, skills, information) between suppliers and customers (Acquier et al., 2017, 2019; Atkins, Gianiodis, 2021; Carbone et al., 2017). Depending on the entities involved (individuals or companies) and the type of logistics resources shared, C2B and B2B solutions can be distinguished. The sharing economy in logistics involves delivery, freight and transportation, storage and fulfilment, and handling services (Atkins, Gianiodis, 2021).

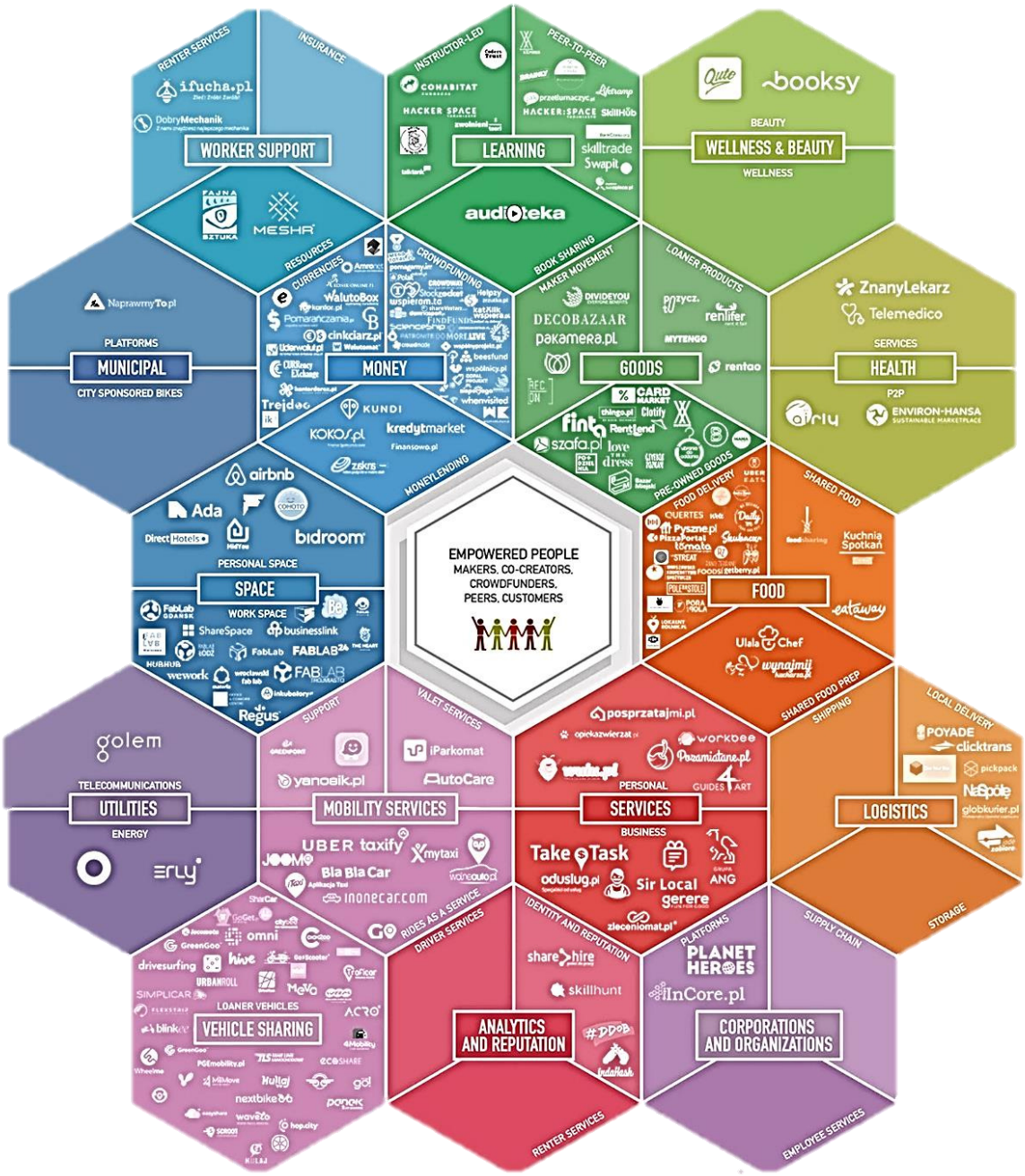

Figure 1. Polish Collaborative Honeycomb.

Source: https://zgiep.com/polish-collaborative-economy-honeycomb-3-0/, 1.04.2023.

Customer-to-Business (C2B) solutions called "crowdlogistics" or "crowdshipping" have often been researched in logistics and they consist in individuals outsourcing logistics activities to companies who own untapped logistics assets, such as vehicles and storage areas (Carbone et al., 2017; Ciobotaru, Chankov, 2021). However, in the case of B2B, sharing economy initiatives involve an exchange of untapped logistics assets between suppliers and customers via a digital platform, which is mostly coordinated by a logistics service provider (LSP) (Carissimi, Creazza, 2022). In contrast to traditional outsourcing services, the sharing economy model enables the utilization of the available logistics assets that are not related to the supplier's core business, which enables the supplier to generate additional income beyond the core business (Tornese et al., 2020).

B2B logistics solutions consist of a full spectrum of logistics services, including storage services (shared warehousing), transportation and freight services (shared transportation), and handling services (shared equipment) (Atkins, Gianiodis, 2021). The operation of B2B sharing logistics initiatives is based on three actors: a service provider who uses available resources, such as storage or transportation sites, to provide the user with a temporary access to those resources; a service receiver who uses the service provider's resources and pays for an access to the service, including a part of the compensation to the service provider and a fee to the entity that enables the service; and a service provider who coordinates the exchange of resources between the other two parties (Carissimi, Creazza, 2022).

The implementation of solutions such as sharing logistics often encounters many obstacles. Therefore, the factors that enable sharing economy logistics solutions are worth mentioning:

- Reliability: the implementation of mechanisms based on quality systems, such as feedback and ratings, or based on pre-selection by requiring the users who enter the platform to upload their certificates during registration.
- Payment security: monetary transactions are made in a pool of anonymous users via a platform.
- Digital platform: thanks to the connection between suppliers and customers, the platform provides efficient offer search and negotiation, enabling them to find the best partner for their goals.
- Critical mass of participants: the presence of a significant number of customers and suppliers joining the platform (Carissimi, Creazza, 2022).

2.3. The effects of the sharing economy concept

The benefits of sharing economy logistics solutions are classified according to the beneficiary: customer, activator, supplier or entire chain. With access to flexible and dynamic services, customers can effectively meet their diverse business needs through the quick availability of additional resources. Users can avoid the usual search and negotiation time required to sign a contract with a new logistics partner, or the time it takes to build their own

solutions. The presence of extremely flexible capacity, which can be activated on demand, enables greater diversification and redundancy of options, which in turn reduces the risk of sudden demand fluctuations. In addition, the full process transparency provided by the platform makes the entire chain more reliable and capable of responding to possible threats (Carbone et al., 2017; Ryu et al., 2019; Mittal et al., 2021; Moncef, Monnet Dupuy, 2021). Sharing economy solutions promote cooperation between both customers and suppliers as they gain access to a new chain that can facilitate the creation of new partnerships or help companies mitigate risk and maintain their market position (Atkins, Gianiodis, 2021; Tornese et al., 2020). Thanks to an access to a wider range of options (choosing the best available rate in the case of shared transportation) or switching from a fixed payment to a payment model according to actual consumption (shared warehousing or equipment), users can obtain economic savings by choosing a service at a lower cost. Suppliers can also benefit economically by generating additional income from untapped assets. Meanwhile, the entities that offer this service may receive monetary compensation for the coordination and management, which boosts their own profits (Tornese et al., 2020; Atkins, Gianiodis, 2021; Ciobotaru, Chankov, 2021; Mittal et al., 2021). Sharing economy solutions may also bring environmental benefits by facilitating an improved utilisation and distribution of resources (i.e. transportation, storage, equipment), and consequently preventing the overproduction of additional resources (Klarin, Suseno, 2021; Ryu et al., 2019), resulting in a reduction in overall waste generation. This may have a direct impact on reducing CO_2 emissions along the chain (Govindan, 2018; Rogerson, Sallnaes, 2017; Asian et al., 2019; Ciobotaru, Chankov, 2021; Piecyk, Mckinnon, 2010). Shared transportation reduces the number of empty or half-empty shipments in the chain, and so it also reduces CO_2 emissions (Moncef, Monnet Dupuy, 2021; Piecyk, Mckinnon, 2010; Rogerson, Sallnaes, 2017). The summary of benefits according to the type of beneficiary is shown in Table 1.

Table 1.
The benefits of the sharing economy concept

BENEFITS	USER	PROVIDER	ENABLER	NETWORK
Access to flexible resources	✓			
Instant availability of resources	✓			
Shorter lead time than traditional service providers	✓			
Access to a new network	✓	✓		
New partners and markets collaboration	✓	✓		
Improvement of relationships	✓	✓		
Improved visibility and reliability	✓			
Responsiveness to changes in demand	✓			
Lower cost of the service	✓			
Pay-as-you-go rather than fixed payment	✓			
Reduction of cost spent on searching for a new supplier	✓			
Additional revenues from underutilized assets		✓		
Efficient search and negotiation		✓		

Cont. table 1.

Transaction fee of the platform			✓	
Reduction of air pollutants by increasing the utilization of vehicles				✓
Use of underutilized assets				✓
Saturation of the warehouse capacity and better assets utilization				✓

Source: The authors' own elaboration based on (Carissimi, Creazza, 2022).

2.4. The common points of sharing economy and low-carbon logistics concepts have in common

The literature review about the impact and effects of the sharing economy on low-carbon logistics indicates a low number of bibliographic items. The authors conducted a survey of literature items in the Scopus database using an advanced search in the form of a query: (TITLE-ABS-KEY (sharing AND economy) OR TITLE-ABS-KEY (access AND economy) OR TITLE-ABS-KEY (collaborative AND economy) OR TITLE-ABS-KEY (collaborative AND consumption)) AND (TITLE-ABS-KEY (low-carbon AND logistics) OR TITLE-ABS-KEY (green AND logistics) OR TITLE-ABS-KEY (zero AND emission AND logistics)). In the title, abstract and keywords section, the query includes the items with phrases such as: sharing economy, access economy or collaborative economy, in comparison with low-carbon logistics, green logistics or zero emission logistics. This search showed 74 literature items as at 31.03.2023.

In the further part of the analysis, the mapping of author's keywords was visualised (Figure 2). A minimum 2 occurrences were selected. Out of 29 keywords, 25 were chosen to form the map below. The most common keywords are: sharing economy, green logistics, sustainability, reverse logistics and circular economy. These keywords are actually associated with both low-carbon logistics and the sharing economy.

An important consequence of the analysis so far is a comparison of the benefits of using the sharing economy and low-carbon logistics (Figure 3). It can be seen that these concepts provide similar benefits in a broad sense. The benefits of both concepts can be presented in several subgroups. The main benefit of both the sharing economy and low-carbon logistics is the reduction of transaction costs. First of all, the above-mentioned concepts increase the use of resources. In other words, untapped or even dormant resources are used, from which enterprises gain additional revenues. This means that low-carbon logistics and sharing economy concepts increase the efficiency of processes. Another benefit is the improvement of energy efficiency, while reducing greenhouse gases and pollution. Activities that positively affect the environmental and social aspect improve relations with the company's environment and competitiveness on the market.

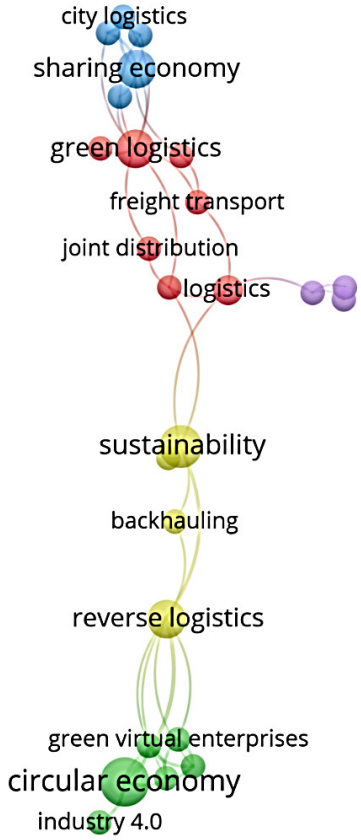

Figure 2. Keywords map based on Scopus search query dated on 31.03.2023.

Source: own work in VOSviewer application.

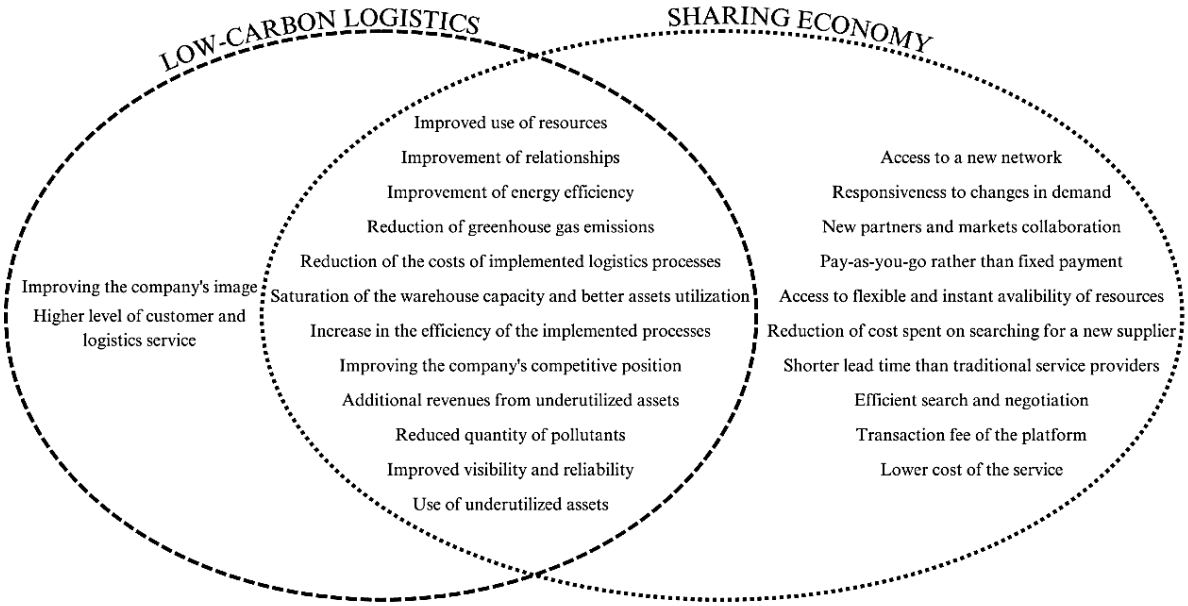

Figure 3. Comparison of the effects of applying low‑carbon logistics vs. participation in sharing economy concept.

Source: The authors' own elaboration.

As a consequence of the analysis, the question arises about the relationship between the use of the sharing economy concept and the achieved economic and environmental effects of enterprises in the area of low-carbon logistics. To answer this question, the authors formulated the following research hypotheses:

H.1: The level of use of the sharing economy is positively related to the ecological performance of low-carbon logistics.

H.2. The level of use of the sharing economy is positively related to the economic performance of low-carbon logistics.

3. Methodology

In order to achieve the assumed research goal in the first quarter of 2023, empirical research was carried out via an electronic questionnaire. The study included a group of 250 entities – 200 small and medium-sized enterprises (subgroup 1) and 50 large enterprises (subgroup 2). Because of financial and organisational reasons within each particular subgroup, the sample selection was quota-based, taking into account the core business type (according to the Polish Central Statistical Office). This means that the surveyed sample (within subgroups 1 and 2) reflects the population structure of small and medium-sized enterprises and large enterprises operating in Poland, taking this feature into account. The structure of the surveyed enterprises is presented in Table 2.

Table 2.
Quantitative structure of the surveyed sample

Business type	**Enterprise type by employment volume**		
	Subgroup 1 = 200 enterprises		**Subgroup 2 = 50 enterprises**
	Small (number of employees <50)	**Medium (number of employees <250)**	**Large (number of employees equalling 250 and more)**
Industry	41	20	25
Construction	21	4	2
Commerce	41	9	7
Services	51	13	16
Total	154	46	50

Source: The authors' own elaboration.

In order to identify the relationship between the use of the sharing economy and the achieved effects (economic and ecological) of the studied enterprises in the area of low-carbon logistics, a comparative analysis was carried out using descriptive statistics methods (including

measures of the structure of collectivity and interdependence of phenomena) and statistical inference. In order to ensure the cognitive value of the obtained results, a reliability analysis was conducted using Cronbach's alpha coefficient (0.863). It showed good consistency between the respondents' responses regarding the results of using the sharing economy.

It is also worth emphasising that the period when the research was carried out was very difficult for businesses, which may constitute a kind of research limitation. On the one hand, the energy crisis has hit, which is a consequence of the war in Ukraine and the European Union's over-dependence on the supply of Russian energy resources. On the other hand, the so-called European Green Deal is being implemented, which aims to reduce greenhouse gas emissions to 55% below the 1990 level by 2030, and ultimately strives to achieve climate neutrality in Europe by 2050 (European Commission, 2020).

4. Results and discussion

The starting point for achieving the assumed research goal was the division of the surveyed enterprises into two groups. The first group, marked with the *SE* symbol, contains enterprises that have made their unused resources available and/or used the resources of other enterprises. In some cases, these enterprises also act as intermediaries between suppliers and recipients of resources. In total, this group includes 70 enterprises, which represents 28% of all surveyed enterprises. The second group (marked with the symbol *nSE*) consists of 180 enterprises that either act only as an intermediary between the supplier and the recipient of resources, or declare that they have not taken advantage of the opportunities offered by the sharing economy (Table 3).

Table 3.
Division of the surveyed enterprises into two groups SE and nSE

Subgroups studied	**Makes its unused resources available**	**Uses the resources of other companies/ consumers**	**Is an intermediary between the supplier and the recipient of resources**	**Does not take advantage of the sharing economy**	**N = 250**
SE (N = 70)	X				20
	X	X			6
	X	X	X		2
		X			38
		X	X		4
nSE (N = 180)			X		30
				X	150

Source: The authors' own elaboration.

The analysis of the obtained results begins with a comparison of the respondents' responses regarding their level of involvement (using a 7-point Likert scale) in the implementation of low-carbon logistics. In other words, the surveyed enterprises declared whether, in addition to submitting to legal regulations and implementing emerging technologies enabling the reduction of emissions of harmful substances into the atmosphere (modern IT systems, modern communication and propulsion technologies, modern energy-efficient technologies, etc.), they cooperate with other entities in order to achieve the assumed effects of low-carbon logistics and conduct an effective policy based on the principles of the low-carbon logistics concept (Figure 4).

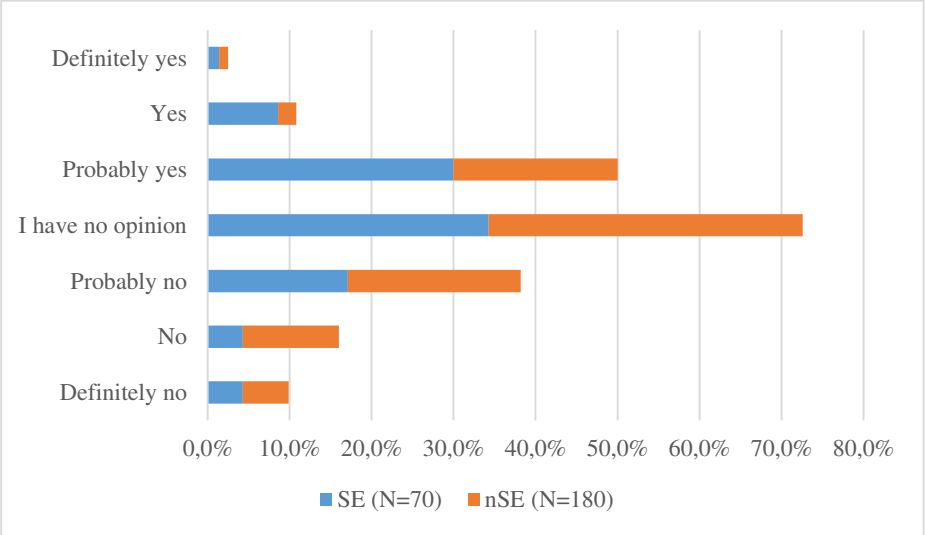

Figure 4. Acting as a leader in the implementation of low-carbon logistics in the surveyed enterprises**.**
Source: The authors' own elaboration.

According to the results of the research, most of the surveyed enterprises limit their implementation of low-carbon logistics to the bare minimum. The most common manifestation of such action is compliance with applicable legal regulations. Examples of applicable legal acts include the directives on permissible emission limits successively implemented by the European Union, which aim to eliminate vehicles emitting excessive amounts of harmful substances into the atmosphere. The latest announcements of the European Commission concern the introduction of a total ban on the sale of combustion vehicles by 2035 (European Commission, 2023).

Analysis of the structure of responses given regarding use of the sharing economy indicates that enterprises declaring that they share resources also tend to claim a higher level of involvement in the implementation of low-carbon logistics than enterprises that do not take advantage of the sharing economy. With reference to the research hypotheses, this may mean that resource sharing has a positive relationship with the economic/ecological results achieved by the surveyed enterprises in the scope of action taken towards low-carbon logistics. As a result, a comparative analysis of the economic and environmental results achieved by the surveyed companies (*SE* and *nSE* groups) was carried out for low-carbon solutions

implemented in logistics processes – Figure 5 (average values). The respondents assessed the scope of achieved goals on a scale from 1 to 7, where: 1 – a given result was definitely not achieved, 7 – a given result was definitely achieved.

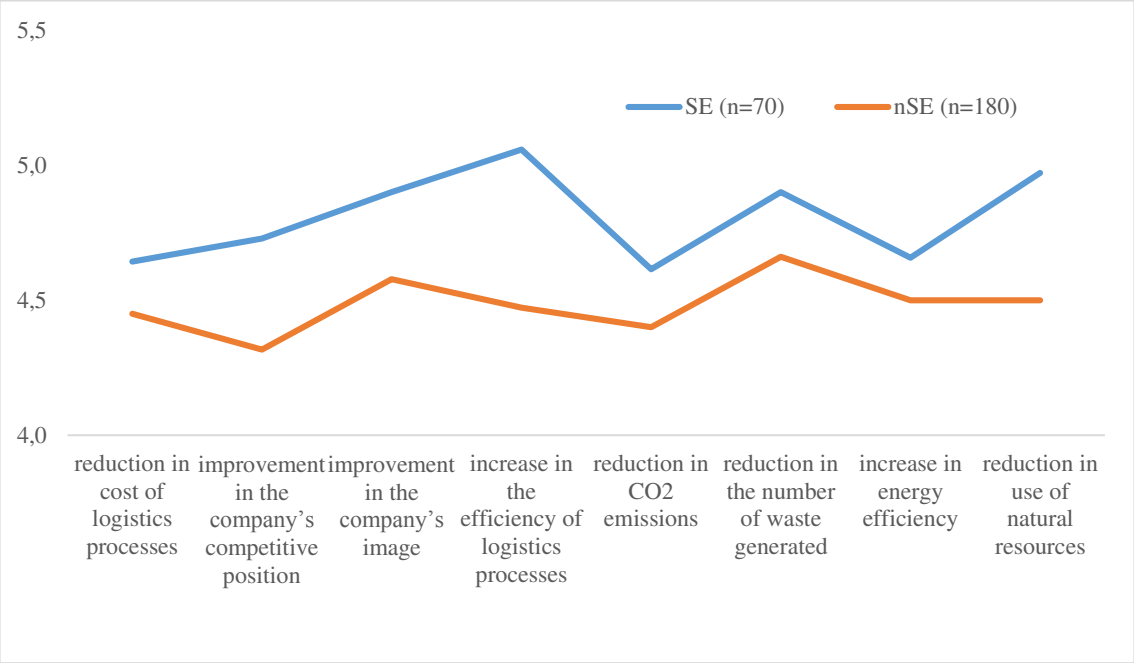

Figure 5. Effects of low-carbon logistics in the surveyed enterprises.

Source: The authors' own elaboration.

An analysis of the data presented in Figure 5 proved that in the area of low-carbon logistics, the economic and ecological results achieved by the surveyed enterprises that use resource sharing are higher in all cases than those achieved by companies not involved in the sharing economy. The greatest differences are visible in terms of increasing the efficiency of logistics processes and reducing the use of natural resources. Statistically significant differences between the two separate groups (SE and nSE) were also demonstrated using the Mann–Whitney U test (Table 4).

Table 4.
The results of the Mann–Whitney U test

Distribution of the achieved effects regarding:	Statistical significance	Decision
reducing the costs of logistics processes is the same for enterprises using and those not using the Sharing Economy	0.180	Yes
improving the competitive position of the company is the same for enterprises using and those not using the Sharing Economy	0.013	No
improving the image of the company is the same for enterprises using and those not using the Sharing Economy	0.022	No
increase in the efficiency of logistics processes is the same for enterprises using and those not using the Sharing Economy	0.000	No
reduction in CO_2 emission is the same for enterprises using and those not using the Sharing Economy	0.154	Yes

Cont. table 4.

reduction in the amount of waste generation is the same for enterprises using and those not using the Sharing Economy	0.069	Yes
increase in energy efficiency is the same for enterprises using and those not using the Sharing Economy	0.376	Yes
reduction of the natural resources consumption rate is the same for enterprises using and those not using the Sharing Economy	0.005	No

Note. ($p < 0.01$).

Source: The authors' own elaboration.

The results of the test confirmed statistically significant differences in the distribution of economic results achieved by the *SE* and *nSE* enterprises in terms of: *improving the competitive advantage and company image and increasing the efficiency of logistics processes*. As far as ecological effects are concerned, statistically significant differences were demonstrated in the scope of *reducing natural resource exploitation*. As for other effects, no statistically significant differences were observed. Therefore, there are no grounds for rejecting hypothesis H1 in terms of the three economic objectives mentioned above and there are no grounds for rejecting hypothesis H2 in terms of *reducing the use of natural resources. Increasing the efficiency of logistics processes* and *reducing the consumption of natural resources* are typical results achieved by the enterprises engaged in resource sharing. It can therefore be concluded that the sharing economy can also be an important tool for achieving selected economic and ecological goals of low-carbon logistics. Moreover, it is worth noting that the level of commitment to the implementation of low-carbon logistics declared by the *SE* group companies translates to a greater extent (as compared to the nSE group) into the actual results achieved by these companies – Table 5.

Table 5.
The level of commitment in the process of implementing low-carbon logistics vs the achieved effects of the surveyed enterprises in the area of low-carbon logistics – Spearman's rank correlation table

Assessment of the level of commitment in the process of implementing low-carbon logistics in individual groups of the surveyed enterprises	**Achieved results**							
	reduction of the costs of mplemented logistics processes	improving the company's competitive position	improving the company's image	increase in the efficiency of logistics processes	reducing CO_2 emissions	reducing the amount of waste generated	increase in energy efficiency	reducing the use of natural resources
SE (n=70)	.398**	.389**	.348**	.268*	.402**	.312**	.317**	.241*
nSE (n=180)	.236**	.250**	.196**	.177*	.322**	.170*	.152*	.286**

** - significant correlation at the level of 0.01 (two-tailed), * - significant correlation at the level of 0.05 (two-tailed).

Source: The authors' own elaboration.

In the group of the companies sharing resources (SE) the strongest positive correlation between the level of involvement in the process of implementing low-carbon logistics was observed in the case of CO_2 emission reductions (0.402). This result is crucial, considering the assumed goals of low-carbon logistics.

5. Conclusion

The use of the sharing economy concept for logistics resources allocation is undoubtedly a tool for achieving the goals of low-carbon logistics. The conducted empirical research confirmed the relationship between the use of the sharing economy and selected economic and ecological effects of enterprises in the area of low-carbon logistics. In Polish circumstances, the use of the sharing economy concept and low-carbon solutions in the field of logistics are not yet a common practice. The authors' research conducted in 2021 (Kamińska, Zowada, 2022) demonstrated that in terms of emissions of harmful substances into the atmosphere, the vast majority of enterprises in Poland merely comply with legal regulations regarding natural environment protection. Secondly, ecological results are more difficult to identify and have a less measurable character, which may be related to the different methodology of calculating the so-called carbon footprint. Furthermore, from the perspective of the enterprises (the micro perspective) the results in the area of low-carbon logistics are not directly noticeable by their managers and owners but are visible from the perspective of the entire economy (the macro scale). Consequently, the lack of visible effects at the micro level does not motivate the owners or managers to take further steps towards developing their business in a low-carbon logistics direction.

The surveyed companies, however, indicated that logistics is an area which offers significant potential for sharing resources. Among the declared practices of the sharing economy, transport and storage was most often mentioned. For example, sharing resources in transport makes it possible to obtain a lower unit cost of delivery as well as to reduce the distances travelled separately and, as a consequence, to achieve goals in terms of low-carbon logistics. This means that achieving the goals of low-carbon logistics is possible without significant capital involvement, a fact that has been indicated so far as a basic barrier to the development of pro-ecological practices in the field of logistics (Murphy, Poist, Braunschweig, 1995; Seuring, Müller, 2008; Tacken, 2014; Govindan, Kaliyan, Kannan, Haq, 2014; Mala, Musova, 2015).

According to the authors, research on the possibility of sharing resources in order to achieve the goals of low-carbon logistics should be continued, as a complement to the advanced and relatively expensive low- and zero-emission technologies. These studies, however, must no longer be carried out on the scale of individual companies, but on the scale of the entire

supply chains from various industries. The research results can also be related to the results of ESG reporting.

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HR STRATEGY FLEXIBILITY AS A BASIS FOR BUILDING ORGANISATIONAL RESILIENCE

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Purpose: To point out the necessity of flexibility of personnel strategy in building organizational resilience under the conditions of changes made in the overall strategy of the enterprise in the dimensions of progress and regression.
Design/methodology/approach: The study is based on a critical analysis of the literature on the subject and, due to the topicality of the subject matter, is a continuation of the research conducted by the author in the area of organisational functioning under conditions of change, including ways of coping with difficult situations, situations of uncertainty or, finally, changes in the context of building organisational resilience. A selection of articles from the Google Scholar database was chosen to establish the definitions of organisational resilience and flexibility within HR strategies. Additionally, the Scopus and WoS databases, previously used in the author's research, were consulted.
Findings: The considerations presented in this paper have shown, under the conditions of changes made to the company's capabilities in terms of progress/regression, resulting, among other things, from an unstable, uncertain environment, the application of an appropriate HR strategy will allow the organisation and employees to find their feet more quickly in the new situation.
Practical implications i Social implications: An effective mean of linking the functioning of the whole organisation and giving employees a sense of stability while facilitating the organisation's functioning under conditions of volatility is the use of appropriate functional strategies that are consistent with the change of progress or regression, including the HR strategy and its elements such as employment, working time, qualifications, training and the incentive system.
Originality/value: The study highlights the importance of flexibility of selected elements of HR strategy in building organisational resilience. Any change regarding the overall strategy in the dimension of progress or regression will require appropriate action at the level of human potential, i.e. an adequate HR strategy and consistent action in its individual elements such as employment, working time, training, qualifications or the incentive system.
Translated with www.DeepL.com/Translator (free version).

Keywords: organisational resilience, variability, functional flexibility, HR strategy.

Category of the paper: Viewpoint, General review.

1. Introduction

The literature draws attention to two ways of understanding resilience - firstly as a quick, flexible finding of oneself in crisis (often surprising, unexpected) circumstances, adapting actions to current needs and possibilities, and secondly as the ability to take action and gradually return to normal functioning after such a situation has ended (Kisilowska-Szurmińska, 2022, p. 360). Resilience is therefore understood as an aggregated competence that is helpful in managing a crisis bringing together skills and qualities such as knowledge acquisition; attentiveness; strength of character; motivation and self-confidence; calmness; control of stress and emotions as well as courage and aspiration; inner strength to fight against adversity; ability to recover lost or weakened strengths, and resilience to harmful factors (Bugaj, Witek, 2022, p. 16). Resilience generally refers to the maintenance of positive adaptation during severe adversity (Sutcliffe and Vogus after: Siltaloppi, Laurila, Artto, 2022, p. 715), to an organisation's ability to cope with adversity (Ingram, 2023, p. 7) as the ability of the company to return to the state prior to occurrence of the stress factor (Majchrzak, 2020, p. 35) and to the ability and innate motivation of human beings to resist, circumvent and transform unexpected events and adversarial situations that threaten their self-realisation (Richardson, after: Siltaloppi, Laurila, Artto, 2022, p. 715). Organisational resilience is potentially useful for illuminating the ability of human beings to sustain their agendas under several successive measures of organisational control. At the organisational level, the concept of resilience has been used to describe an organisation's ability to absorb stresses and maintain or improve performance in the face of adversity (Kahn et al. after: Siltaloppi, Laurila, Artto, 2022, p. 718), or finally as a positive adaptation to an unexpected adverse situation (Ingram, Bratnicka-Mysliwiec, 2019, p. 186). The literature on the subject has proposed a holistic framework to assess resilience management practices and grouped them into the following eleven categories (Zapłata, Wisniewski, 2022, p. 417):

- cooperation,
- planning,
- procedures,
- training,
- infrastructure,
- communication,
- corporate governance,
- learning,
- understanding the situation (awareness),
- resources,
- assessment.

Resilience, defined as the ability to rapidly and effectively adapt to crisis situations, necessitates modifications to the overall strategy (in all dimensions mentioned in subsection 5). Such changes require targeted efforts for human resources management, including a well-rounded personnel strategy and uniform actions across all components. If the company's overarching strategy is adjusted to the changes in the environment, then there ought to be a swift response in the personnel policy. This involves employment, working time, qualifications, training and the incentive system.

The purpose of this article is to point out the specific role of HR strategy flexibility and its elements in building organisational resilience,, as 'an organisation's capacity for resilience can be developed through a human capital management strategy (Douglas, 2021, p. 2).

2. Functional flexibility of the organisation

Theory and practice point to the characteristics of companies that are successful in the market. Among the characteristics of companies that stand out are their innovation, customer orientation, creation of new markets and flexibility (Majchrzak, 2020, p. 33). 'Viewing an organisation in terms of the functions it performs, it can be assumed that partial flexibilities will have the dimension of individual functions, e.g. procurement, production/provision of services, distribution, or management functions, e.g. flexibility of planning, organising, control. With this arrangement, flexibility can refer to individual functional areas of companies, including production flexibility, financial flexibility, personnel flexibility' (Januszkiewicz, 2018, p. 41). Functional flexibility therefore represents the ability to make multidimensional changes (i.e. the progress/regression dimension, the defensive/offensive dimension, the strategic/operational dimension) in market and marketing, technical and production, human, organisational, economic and financial potential as a result of changes that have occurred, are occurring or are about to occur both in the organisation's environment and in the organisation itself (Bujak, Puszko-Machowczyk, 2011, p. 146). The article focuses on changes in the human potential plane, and in particular on selected elements of HR strategy such as: employment, working time, training, incentive system. As far as qualifications are concerned, this article does not take them into account. This is because they constitute a set of learning outcomes, compliant with established standards, the achievement of which has been formally confirmed by an authorised institution (Juchnowicz, 2014, p. 15)[1].

[1] Qualifications are closely linked to an occupation; one often speaks of professional qualifications. Thus, an occupation is 'a set of tasks (a set of activities) distinguished as a result of the social division of labour, performed permanently or with minor changes, requiring relevant qualifications, acquired as a result of training or practice'. The public register that collects information about all qualifications included in the Integrated System of Qualifications (ISQ), independently of other existing registers and inventories in Poland created for the needs of individual ministries, industries, environments and institutions, is the Integrated Register of Qualifications (IRQ). This register was established in 2016 under the Act of 22 December 2015 on the Integrated System of Qualifications.

3. Personnel strategy versus overall strategy

In the literature, authors define the concept of a company's HR strategy in different ways. Often synonyms are used, such as: HR strategy, HR management strategy, personnel strategy, human capital management strategy or social potential development strategy. HR strategy belongs alongside with e.g. marketing, financial, production, investment and research and development strategies to one of the functional strategies. Functional strategies are closely linked to the overall strategy. Hence, the formulation of each functional strategy should be in line with the overall strategy (also known as the general or global strategy) of the company. Thus, e.g. in formulating the company's objectives and the means of achieving them, the general objectives are a guideline for defining the objectives of the company's financial or investment activities. In the literature on the subject you can also find a statement that 'the different types of strategy (including general strategy and functional strategy) overlap or complement each other' (Rostowski, 2003, p. 9). Researchers tend to recognise that there is a relationship between these strategies and 'the relationship between HR strategy and organisational strategy is of a feedback nature" (Stalewski, & Chlebicka,1997, p. 31). In the literature on the subject you can find relationships between overall strategy and HR strategy. The possible relationships between overall strategy and HR strategy are presented in a simplified way in figure 1.

Thus, in the first case, there is no link between these strategies. The second approach shows the greater importance of human resources in the organisation, but the HR strategy is subordinated to the overall strategy of the company (reactive approach). The third relationship consists in 'two-way communication and some agreement' between the strategies (Ludwiczynski, Stobinska, 2001, pp. 73-74). The next relationship presented shows a strong link between strategies. The human potential of the organisation is recognised in this case. Overall strategy and HR strategy develop together (interactive approach); people are recognised as a key element in building competitive advantage rather than as a 'tool' for implementing the organisation's strategy. In the latter case, HR strategy occurs at the forefront of the organisation. Here, people are a factor in gaining competitive advantage, setting the directions for the resolution of overall strategic objectives (active approach).

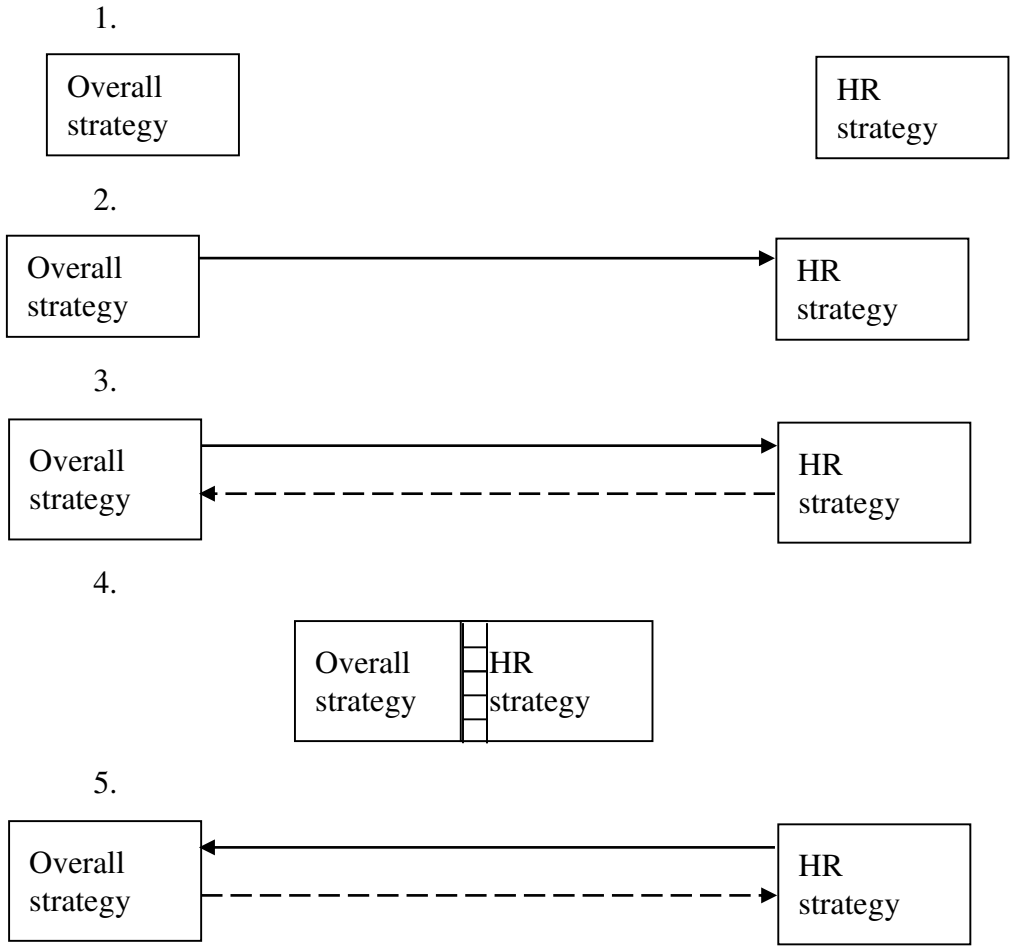

Figure 1. Relationships between overall strategy and HR strategy.

Source: compiled based on: Ludwiczyński, 2001, p. 73; Kołodziej, 2019, p. 29.

4. Types of HR strategy

There are many types of HR strategy in the literature on the subject. Thus, e.g. due to the relationship to the market, a following distinction has been made:

1. offensive strategies, drawing on the external labour market,
2. defensive, focusing on the in-house market (Lipka, 2007, p. 21).

The offensive strategy applies to companies that are characterised by high growth rates, require their employees to be creative, innovative and accept risk. Employees are evaluated for the results they achieve; an emphasis on long-term development is also characteristic (Juchnowicz, 2014, pp. 13-14). On the other hand, a defensive strategy is found in companies that focus on quantifiable, quantitative results, which are the basis for employee evaluation (Juchnowicz, 2014, pp. 13-14).

In the concepts of research on HR strategies, there are also bipartite (two-dimensional) types of HR strategies, consisting in the use of a set of pairs of different strategies to characterise the

actions taken towards employees. Thus, a following distinction has been made (Dabrowicz, 2010, p. 128; Tyranska, 2009, p. 357):

1. self-selection (rotation) - the aim is to maximise the use of human resources with minimal involvement of the employer in the personnel management process,
2. autonomisation - implies the optimal use of human resources by creating conditions for the freedom of action and self-development of personnel,
3. transaction - the aim is to maximise the use of human resources with strong involvement of the employer in the personnel management process,
4. transformation - the optimal use of human resources is based on the development of employee potential, but expectations of attitudes of loyalty and strict adherence to imposed and sharply enforced rules of the organisational game prevail.

As far as HR strategies are concerned, out of the rich typology found in the literature on the subject, the following have been taken into account in this discussion (Krupski, 2003, p. 274):

1. quantitative strategy **-** looking at human resources mainly from a cost perspective,
2. qualitative strategy **-** aiming to achieve an optimal result by motivating employees appropriately.

On the other hand, applying the criterion of the utilisation degree of the diversity of human resources makes it possible to distinguish:

1. a strategy geared to reducing the degree of diversity in order to avoid increased expenditure on staff management,
2. a strategy to match the degree of diversity of the workforce with the structure of the customers, in line with the demand that the interior of the organisation should reflect the type and complexity of the environment,
3. a strategy geared to increasing the degree of diversity, with the aim of broadening the network of contacts contributed by each employee (Lipka, 2007, p. 21).

A division of HR strategies by the criterion of the approach to employee retention often appears in the literature on the subject. This criterion makes it possible to distinguish between an 'entry' oriented strategy, a development and activation strategy and an 'exit' oriented strategy (Krupski, 2003, p. 310).

In addition, the following forms of exit oriented strategies are distinguished:

1. *outplacement* - refers to redundancies (departures) of employees accompanied by measures taken by the organisation to assist the departing employees (counselling, retraining, looking for a new job, etc.),
2. *downsizing* - refers to the downsizing of a company and the reduction of its workforce, accompanied by a set of activities aimed at improving the functioning of the company, e.g. by changing working methods, organisational structure, the way it communicates, etc,

3. *employee leasing* - consists in temporarily - usually up to 6 months - lending (making available) a company's employees to another organisation, while maintaining the employment relationship with the existing employer,
4. *lay off workers* - means temporarily laying off workers, i.e. until the possibility of re-employment arises (Krupski, 2003, p. 310; Lipka, 2007, p. 21).

5. Flexibility of human potential factors in building organisational resilience

Distinctive features of flexibility can include changes made to the company's potential in the following dimensions:

1. progress/regression,
2. offensive/defensive,
3. strategy/operation (Bujak, Puszko-Machowczyk, 2011, pp. 346-347).

The first category of business potential, i.e. the progress/regress dimension, relates to the issue of organisational development. It includes quantitative and qualitative changes of a progressive and regressive nature. Quantitative changes are related to differences in the magnitude of one or more parameters. Qualitative changes, on the other hand, indicate new properties, reactions or behaviours of a distinguished system. A progressive change is a change resulting in an increase in the quantitative and qualitative potential of an organisation regarding an existing or a new concept of business operation at a given time. A regressive change is a change that causes a decrease (reduction) in the quantitative-qualitative potential of a company's previous concept of business operation at a given time. It leads to the depletion or even disappearance of some of its elements. The article considers the changes occurring in the progress and regress dimensions. The second dimension called the offensive/defensive dimension is related to the organisation's ability to control, and includes defensive and offensive changes. The strategic/operational dimension, on the other hand, is related to the depth and stability of the changes made. It includes strategic changes and operational changes.

Table 1 attempts to juxtapose changes in the progress or regression dimension with the corresponding HR strategies.

Table 1.
Changes in the dimension of progress or regression and the corresponding HR strategies

DIMENSION OF CHANGE/GENERAL STRATEGY	CHANGES IN THE DIMENSION OF PROGRESS (E.G. DEVELOPMENT STRATEGY)	CHANGES IN THE REGRESSIVE DIMENSION (E.G. COST REDUCTION STRATEGY)
EXEMPLARY HR STRATEGIES	OFFENSIVE STRATEGY QUANTITATIVE AND QUALITATIVE STRATEGY ENTRY ORIENTED STRATEGY	DEFENSIVE STRATEGY QUANTITATIVE AND QUALITATIVE STRATEGY EXIT ORIENTED STRATEGY
Employment	increase in level of employment through recruitment	reduction in level of employment through derecruitment, outplacement, downsizing
Working time	increasing working time through the design of working time systems	narrowing working time by development of working time systems
Training:	an increase in funding so-called "hard" training, an increase in the number of training courses for employees	a decrease in the increase in financial expenditure on so-called "hard" training, a reduction in the number of such training courses, the dominance of so-called "soft" training courses
Incentive system	increased motivation through increased investment in motivation, increasing the number and types of motivators, - aggressive incentive system	maintenance or small decrease in motivation by reducing investment in motivation, reducing the number and types of motivators - equivalent incentive system

Source: own elaboration.

Thus, in the case of change in the dimension of progress, an example of an overall strategy that can be implemented in a company might be a growth strategy. Change in this case will be about increasing the quantitative and qualitative potential of the organisation. Hence, the most suitable HR strategies here will be, for example, an offensive strategy geared towards continuous growth or a mixed quantitative-qualitative strategy aiming at increasing the quality of employee competence. The application of an entry oriented strategy in the case of the progress dimension seems to be appropriate, since competitive advantage is gained by increasing the number of employees (Krupski,. 2003, p. 310; Lipka, 2007, p. 21).

In the plane of HR management, employment, working time, training and the incentive system, among others, can be shaped. Depending on the HR strategy pursued, these elements will also require consistent actions.

The progress dimension will be related to the need to increase the level of employment, through external recruitment, i.e. drawing on the external labour market. In a dynamically developing organisation, there will be an increase in employment and a demand for employees with highly qualitative competences. Therefore, there will be an increase in substantive training for employees (so-called 'hard' training). Working hours will be extended by appropriately shaping working time systems and employee leave management (e.g. by postponing holidays). The most appropriate incentive system may turn out to be an aggressive remuneration system, characterised by a high share of movable remuneration and a large pay differential (Borkowska, 2021, pp. 51-53).

On the other hand, under the conditions of changes made to the company's potential in the dimensions of regression, an example of a general strategy that can be implemented in a company will be, for example, a cost reduction strategy. Change in this case will be about increasing the quantitative and qualitative potential of the organisation. Hence, the most suitable HR strategies to be implemented here will be e.g. a defensive strategy, aiming to minimise the scope of influence of the environment in order to maintain relative stability (Karaszewska, 2010, p. 129), or a mixed quantitative-qualitative strategy oriented mainly towards staffing. An exit oriented strategy will be related to not keeping employees in the organisation (Krupski, 2003, p. 310; Lipka, 2007, p. 21).

The regression dimension will be related to the need to reduce the level of employment, through forms of exit oriented strategy such as derecruitment, outplacement or downsizing. There will be a narrowing of working hours in a cost-reducing organisation. The number of substantive training courses for employees will tend to decrease. However, there may be an increase in financial expenditure on so-called 'soft' training (associated with, e.g. coping with situation of derecruitment). Working time will be reduced through appropriate shaping of the working time system. The most appropriate incentive system may turn out to be an equivalent remuneration system in which a fixed salary predominates.

6. Summary

It follows from the above considerations that an important factor in building organisational resilience is an HR strategy that is appropriately aligned with changes in the company's potential in the progress/regression dimensions. This relationship is also driven by the need for coherence between overall strategy and HR strategy. A flexible HR strategy will be a factor supporting the proper building of organisational resilience.

Moreover, it also seems important to pay attention to the flexibility of selected elements of HR strategy in building organisational resilience. Any change in the dimension of progress or regression (but also of the other dimensions) will require appropriate action at the level of human potential, i.e. an adequate HR strategy and consistent action in its individual elements such as employment, working time, training, qualifications or the incentive system.

The analysis indicates that:

- the dimensions of progress and regression necessitate the implementation of suitable personnel strategies and actions across various elements such as employment, working hours, training, qualifications, and incentives,
- the dimension of progress is associated with the need to elevate employment levels through external recruitment, particularly within a dynamically evolving organisation,
- therefore, employees will receive more substantive training,

- working hours will also increase,
- an aggressive remuneration system will be implemented, featuring a large portion of variable pay and a substantial wage gap,
- the regression dimension necessitates a reduction in staff numbers,
- within a cost-cutting organisation, there will be a decrease in working hours, and the number of substantive training courses for employees will exhibit a downward trend,
- conversely, soft skills training will increase,
- while staff working hours will be decreased, an equitable compensation system will be implemented, in which fixed salaries will be primarily utilised.

Further research on using flexible personnel strategies to enhance organizational resilience should concentrate on changes made in defensive/offensive and strategic/operational dimensions within market/marketing, technical/production, human, organizational, and economic/financial domains.

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RESOURCES AND COMPETENCIES IN THE AREA OF EMPLOYMENT – A COMPARISON OF DAIRY COOPERATIVES FROM ŚWIĘTOKRZYSKIE AND MAŁOPOLSKIE VOIVODESHIPS

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Purpose: The purpose of this article is to identify and compare the importance and state of resources and competencies in the area of employment from the point of view of dairy cooperatives from Poland from the Świętokrzyskie and Małopolskie Voivodeships, which are adjacent to each other.
Design/methodology/approach: Direct interviews using a questionnaire survey were conducted among representatives of cooperatives representing 41% of the population, which resulted from the willingness to participate in the survey.
Findings: Cooperatives' representatives are aware of the importance and state of resources and competencies in the area of employment. There is a difference in the opinion of cooperatives' representatives from both voivodships about the importance and state of resources and competencies in this area. Cooperatives from Małopolskie Voivodeship higher assessed the importance of this kind of resources/competencies (the average rating is 4.22), while in case of cooperatives from Świętokrzyskie Voivodeship the average rating is 4.0. Moreover, cooperatives from Małopolskie Voivodeship stated that the state of their resources/ competencies is the same as the competitors. A different situation is in case of cooperatives from Świętokrzyskie Voivodeship as three of resources/competencies are assessed to have higher competitive potential than competitors and four to have lower competitive potential than competitors.
Originality/value: The comparison of the importance and state of resources and competencies in the area of employment of selected cooperatives from two different voivodships.

Keywords: resources, competencies, employment, cooperatives.

Category of the paper: Research paper.

1. Introduction

In the market economy it is crucial to know the importance and state of resources and competences especially in the case of employment, as human resources are the most important resource in the company, and their discontent can destroy the company because an organization's success is determined by decisions employees make and behaviors in which they engage (Omprasad Reddy, 2021, p. 36). Human resources represent the employees under direct control of the company; their management is the process or processes focused on maximizing employee performance to achieve the employer's strategic objectives (Garengo, Sardi, Nudurupati, 2022, p. 3057). Hence companies constantly face challenges in efforts to increase the knowledge, understanding, skills, and abilities of its employees so that they can provide the expected results (Mogea, 2023, p. 59). It comes from the fact that companies come across too many challenges or uncertainties including globalization, more innovations, advent of the latest technology use, economic and political instability and ethical and ecological challenges (Aslam, Aslam, Ali, Habib, 2013, p. 89). Therefore, boosting competitiveness, increasing flexibility, and raising the effectiveness are going to be out of reach if employees are not involved and fully devoted to their company's goals and do not take active part in all company activities concerning them (Veleva, Antonova, 2017, p. 140). Hence, companies should have under control this kind of resources and constantly receive information about to react on time. Only having continuous feedback on the state of resources/competences allows the company to react on time in case of any irregularities. Such knowledge also allows the company to react appropriately in the event of any problems with employees and allows it to retain the best employees, whose intellectual capital is invaluable. Additionally, knowledge about the state of resources/competences compared to the competition allows for appropriate actions on time to be better than the competition. Only such a way of proceeding can lead to success on the market and competitive advantage, and then to its maintenance. Hence, the aim of the article is to identify and compare the importance and state of resources and competencies in the area of employment from the point of view of dairy cooperatives from Poland from the Świętokrzyskie and Małopolskie Voivodships, which are adjacent to each other. To achieve the goal there were taken into account the following resources/competences established by Stankiewicz (2002): the level of education of employees, applied employee motivation systems, used employee recruitment and selection systems, applied training systems, work productivity, innovation and creativity of employees, openness of employees to changes, the willingness of employees to improve their qualifications, employee loyalty to the company, employees' trust in the company's management, knowledge of the company's strategy by employees, results orientation, willingness to compete, the existence of a spirit of cooperation, respect for the client and his needs, faith in success, knowledge of foreign languages by employees.

2. Human resources and competencies

Human resources in a company are a collective of employees. They are an organized workforce, creating a system that is defined in the following aspects: organizational, ergonomic, psychological, socio-economic, legal (Stabryła, 1995, p. 109). Human resources are the leading resource of any organization (Masłyk-Musiał, Rakowska, Krajewska-Bińczyk, 2012, p. 213). Human resources are renewable resources, unlike most natural and tangible resources. People have the ability to learn and constantly improve, while the feature of other resources is their gradual depreciation and consumption (Michalak, 2007, p. 58). The concept of human resources includes employees employed in the enterprise along with their education, experience, professional qualifications, performed work, interpersonal relations and communication skills (Strużycki, 2004, p. 144). Human resources include activity, skills and knowledge of employed people (Michalak, 2007, p. 58). Their potential can be assessed on the basis of education, experience, professional achievements and talents. Human resources in an organization are a source of organizational knowledge (Masłyk-Musiał, Rakowska, Krajewska-Bińczyk, 2012, p. 213). They are defined as labor resources or manpower (Michalak, 2007, p. 58), which is the social reserve of the organization, a reserve of human energy and knowledge, skills and habits that can be directed towards the implementation of the organization's mission and goals, but which can also independently influence in various, often uncontrolled ways, on the organization and its environment (Koźmiński, Jemielniak, 2008, p. 177).

Human capital can be a company's greatest asset; it can make or break the business strategy and is a key differentiator (World Economic Forum & Watson, 2020, p. 7). Firms can create a competitive advantage from human resources and their management practices when employees create organizational value (Pablos, Lytras, 2008, p. 49). Human resources create value by increasing the performance and agility of the talent (human capital) and culture (organization capability) of the organization (Ulrich, Younger, Brockbank, Ulrich 2012, p. 217). Therefore, it is extremely important to skillfully manage human resources.

Human resource management, the management of work and people towards desired ends, is a fundamental activity in any organization in which human beings are employed (Boxall, Purcell, Wright, 2007, p. 1). The purpose of human resources management is to adjust the available human resources to the mission and goals of the company. Employees are treated here as an important strategic factor in the development of the form and a resource in whose development one should invest (Unold, 2009, p. 375). Human resource management is the process of employing people, training them, compensating them, developing policies relating to them, and developing strategies to retain them (The Open University of Hong Kong, p. 2). Hence, strategic and operational human resource management is distinguished. Strategic human resources management includes long-term decisions (actions) in the personnel sphere,

of fundamental importance for the survival and development of the organization. On the other hand, resource management at the operational level comes down to current decisions (actions) in relation to the employees of the (Unold, 2009, p. 372). Effective human resource management generates a higher capacity to attract and hold employees who are qualified and motivated for good performance (Pablos, Lytras, 2008, p. 49).

The four key dimensions to human resource management include:

- Organizational integration: it involves the matching of human resources strategies to the needs of the business strategy.
- Employee commitment: it is expected of employees to identify the interests and goals of the organizations, and be aligned and committed in achieving these goals.
- Flexibility: employees are expected to adapt willingly to change within the organizational structure, without any strife or prejudice.
- Quality of work: high levels performance attainment of organization depend on the quality of members of staff and management of such organization (Guest, 1987).

The entirety of people's competencies and opportunities existing in the organization are also often referred to as human resources, which should be consciously planned, developed and nurtured, thereby shaping effective behavior in the organization (Kożusznik, 2002, p. 19). The term competence refers to the unique combination of business specializations and people's abilities that give an organization its specific character. In addition, it identifies the sources of motivation, effort, professional specialization and cooperation in the organization (Kossowska, Sołtysińska, 2002, p. 12). In the case of employees, a competency is an acquired ability, which is described by a certain set of tasks that can be performed if one has the appropriate knowledge (Seel, 2012, p. 668). The performance of human resource depends on competencies that have many aspects, including knowledge, experience, technical and soft skills, motives, emotions, and behaviors (Ali, Qureshi, Memon, Mari, Ramzan, 2021, p. 1). The basic competencies of employees of modern organizations include: the ability to search for and process information; ability to work in a team and interact with people; ability to function in increasingly complex organizations; the ability to formulate a problem and look for solutions, classify problems according to their importance, respond to unforeseen situations; the ability to organize one's work, the ability to act on one's own, to set goals and priorities, to create an action plan; the ability to organize the work of others, manage resources, set directions, negotiate goals, decide and seek compromise solutions, analyze and control the results obtained (Mikuła, 2006, p. 210).

3. Materials and methods

The research was conducted among dairy cooperatives' executives who were asked to assess the importance and state of resources and competencies in the area of employment. All dairy cooperatives from the Świętokrzyskie and Małopolskie voivodeships were asked to take part in the research, however, because of the tendency of the representatives of cooperatives to participate in the research, the research had been conducted on a sample of 7 out of 17 dairy cooperatives from Świętokrzyskie and Małopolskie voivodeships, i.e. 41% of cooperatives running the business in the year of conducting the research. There was used an interview questionnaire, which was structured and contained carefully selected questions in terms of number, content, form and order.

4. The importance and state of resources and competencies in the area of employment – a research results

On the basis on the interview results, a table 1 was prepared.

Table 1.
The importance from the point of view of competitiveness and state in comparison to competitors of resources and competencies in the area of employment

Resources/competencies	The importance		The state	
	Świętokrzyskie Voivodeship	Małopolskie Voivodeship	Świętokrzyskie Voivodeship	Małopolskie Voivodeship
The level of education of employees	4.00	4.75	2.00	2.00
Applied employee motivation systems	4.33	4.75	2.00	2.00
Used employee recruitment and selection systems	4.33	4.25	2.00	2.00
Applied training systems	4.00	4.00	2.00	2.00
Work productivity	4.00	3.75	2.00	2.00
Innovation and creativity of employees	3.67	4.50	2.33	2.00
Openness of employees to changes	4.00	3.75	1.67	2.00
The willingness of employees to improve their qualifications	4.00	4.50	2.33	2.00
Employee loyalty to the company	4.00	4.50	2.33	2.00
Employees' trust in the company's management	3.33	4.00	2.00	2.00
Knowledge of the company's strategy by employees	4.00	4.25	2.00	2.00
Results orientation	4.00	4.00	1.67	2.00
Willingness to compete	4.33	4.50	2.00	2.00
The existence of a spirit of cooperation	4.33	4.25	2.00	2.00
Respect for the client and his needs	4.67	4.25	2.00	2.00
Faith in success	3.33	4.25	1.67	2.00
Knowledge of foreign languages by employees	3.67	3.50	1.67	2.00

Where:

- in case of the importance from the point of view of competitiveness: 5 - extremely important from the point of view of competitiveness, 4 - very important, 3 - quite important, 2 - not very important, and 1 - completely unimportant,
- in case of the state of resources/competences in comparison to competitors: 1 – worse, 2 - similar, 3 - better.

Source: own work.

Taking into account the research results showed in Table 1 it can be seen that:

- extremely important resources/competencies in the area of employment from the point of view of competitiveness in case of cooperatives from Małopolskie Voivodeship, are: the level of education of employees, applied employee motivation systems, innovation and creativity of employees, the willingness of employees to improve their qualifications, employee loyalty to the company and willingness to compete, while for cooperatives from Świętokrzyskie Voivodeship extremely important is only the respect for the client and his needs;
- most of resources/competencies in the area of employment from the point of view of competitiveness are very important in both voivodeships, however they vary taking into account the average rating. The highest are rated the applied employee motivation systems, used employee recruitment and selection systems, willingness to compete, and the existence of a spirit of cooperation in case of cooperatives from Świętokrzyskie Voivodship (average rating – 4.33), and used employee recruitment and selection systems, knowledge of the company's strategy by employees, the existence of a spirit of cooperation, respect for the client and his needs, and faith in success in case of cooperatives form Małopolskie Voivodeship (average rating – 4.25). Little bit lower (average rating – 4.0) are rated the following resources/competencies: the level of education of employees, applied training systems, work productivity, openness of employees to changes, the willingness of employees to improve their qualifications, employee loyalty to the company, knowledge of the company's strategy by employees, and results orientation in case of cooperatives from Świętokrzyskie Voivodeship, and applied training systems, employees' trust in the company's management, and results orientation in case of cooperatives from Małopolskie Voivodeship. Lower than this are rated: the innovation and creativity of employees, and knowledge of foreign languages by employees (average rating – 3.67) when we are looking at the research results of cooperatives from Świętokrzyskie Voivodeship, and work productivity, openness of employees to changes (average rating – 3.75), and knowledge of foreign languages by employees (average rating – 3.5) in case of cooperatives from Małopolskie Vovodeship.
- only cooperatives from Świętokrzyskie Voivodeship stated that quite important are for them: employees' trust in the company's management and faith in success. For cooperatives from Małopolskie Voivodeship non resources/competencies in the area of employment from the point of view of competitiveness are quite important.

When analyzing the state of resources/competences in the area of employment in comparison to competitors it can be seen that all of them are considered to be similar to competitors in case of cooperatives from Małopolskie Voivodeship. On the other hand, cooperatives form Świętokrzyskie Voivodeship stated that some resources/competences are better than competitors. These are: innovation and creativity of employees, the willingness of employees to improve their qualifications, and employee loyalty to the company. In the same time they stated that a little bit worse than in competitors are the following resources/competences: openness of employees to changes, results orientation, faith in success, and knowledge of foreign languages by employees.

5. Conclusion

A dynamically developing world means that it is necessary to constantly be up to date with all issues related to the operation of an enterprise in the economy, and this requires both employers and employees to constantly adapt to changing conditions and update their knowledge. Hence, it is extremely important for top management to constantly monitor the company's resources/competencies, including their condition in comparison to the competition, which is a manifestation of its intelligence. An intelligent company uses its resources and competences to build its competitive advantage. This is done through continuous learning, nurturing and expanding resources and competencies. Awareness of the importance and status of resources and competencies is a manifestation of the enterprise's intelligence (Konieczna, 2016, p. 272), especially when we take into account the sphere of employment, because having and improving employee competences influences business development. If employees have the opportunity to improve their competences, they gain the opportunity to acquire new knowledge and improve their skills, which affects their effective performance of tasks, increases motivation and avoids burnout. Such action is a competency-based human resources management process, the main goal of which is to guarantee the organization appropriate competency resources necessary to achieve its strategic goals.

As showed the research results cooperatives know the importance and state of resources and competences in the sphere of employment. As they stated the most important in this sphere are applied employee motivation systems (average rating of all respond is 4.54), then respect for the client and his needs (4.46), and willingness to compete (4.42). At the end of the ranking are: faith in success (3.79), employees' trust in the company's management (3.67), and knowledge of foreign languages by employees (3.59). However, they are stated as quite important.

Recommendations for future research can be made to address the area limitations of this research, namely to carry out a study among cooperatives from other voivodships, to find out if they are aware of the importance and state of resources and competencies in the area of employment.

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MANAGING THE AIRPORT-PROXIMATE AREAS

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Purpose: Identifying the main gaps in local planning in the context of sustainable development and addressing spatial conflicts in airport-proximate areas, using the examples of areas surrounding airports in Gdańsk and Kraków are objectives of the research.
Design/methodology/approach: The research is based on analyzing Polish and foreign literature, documents, reports, and other information and data obtained directly during the research process. A quantitative-qualitative analysis was conducted based on Local Development Plans (LDPs) adopted between 1995 and 2022 in the airport-proximate areas covered by the resolution establishing restricted use areas (RUAs) around Lech Wałęsa Airport in Gdańsk and Kraków-Balice Airport. The quantitative analysis included the number of plans and functions for these areas, while the qualitative analysis focused on potential conflicts between land functions and airport activities.
Findings: The complexity of planning policy and its legal and institutional environment, dependence on conditions of various nature (e.g., historical, political, economic, and social), and the interdependence of interests among different entities create decision-making conditions that ultimately hinder the implementation of the primary spatial development goals associated with ensuring sustainable development. The gaps in local planning concern the generation of spatial conflicts, especially between aviation-related functions and residential functions.
Research limitations: The analysis did not include the size of the areas covered by LDPs. The analysis was conducted based on the number of LDPs and their functions; the original versions of plans were examined.
Practical/social implications: Research implications include among others determining the potential for spatial conflicts in airport-proximate areas due to regulations adopted in local plans; identifying possible solutions to improve the effectiveness (in line with sustainable development principles and spatial conflict prevention) of interventions by local authorities using LDPs.
Originality/value: This study is directed towards stakeholders in local development. The issue of assessing the effectiveness of planning interventions in areas around airports in this scope has so far not been analyzed using a quantitative-qualitative analysis of LDPs.

Keywords: local development, spatial management, land-use planning, airports.

Category of the paper: research paper.

1. Introduction

In the era of globalization, the significance of aviation transport is paramount. Besides their obvious transportation function, airports also have a substantial impact on the quality of life in cities, the urban tissue, and local (spatial) planning implications (Freestone, Baker, 2011).

With the increased number of passengers served and cargo transported, passenger terminals are enriched with various services for travelers and additional commercial activities. Additional functions are also developed around airports (Freestone, 2009), such as business centers, commercial and service facilities, bus stops, railway stations, car rental services, industrial parks, and logistics and freight-related buildings (Stangel, 2013). Therefore, it can be concluded that the location and development of airports significantly influence the surrounding areas (Gierczak-Korzeniowska, 2016).

The literature describes various development models of areas in the proximity of airports-based on the shape and direction of developments in the airport-proximate zones. These models include Airport City, Aeropolis, Airport Corridor, Airport Regio, and Aeria, among others (see Roeseler, 1971; Conway, 1980; Schaafsma, 2010; Kasarda, 2001; Schlaack, 2010). Furthermore, it is noted that the distinction between the airport and its surrounding territory is blurred and becomes a unified urban landscape (Figure 1).

Graphic Example	Concepts' Features	Planning and Developing
Airport Region (70s)		
	* An embryonic Aerotropolis from the 70's * A public planners view * Development of residential and industrial areas around the airport * Connected to host city and to main industrial and logistical sites by roads (highways and conventional roads) and conventional rail	* Top-down planning * Public authorities view * Public developers
Airport City		
	* Limited to the airport perimeter * Large supply of various services: commerce; public services; leisure and business spaces	* Privately and public developed and managed by airport authorities
Airport Corridor		
	* Developed on a corridor between the airport and the host city * Greater and more varied involvement of public on the infrastructure planning * Connected to host city and region by highways (express or not) and railway (express/high speed or not)	* Public-privately planned * Intervention of various stakeholders in cooperation: airport authorities; private developers; local and regional public institutions;
Aerotropolis		
	* Extrapolation of the Airport City to the surroundings of its perimeters * Replication of Airport City services, industrial, residential, thematic and logistical spaces * Features similar to Airport Corridor	* Unplanned to national and regional planed * Mix of developers: private; public; private and public
Airea		
	* A fragmented and dispersed developed area around the airport in a polycentric and metropolitan way * Features similar to Airport Corridor and Aerotropolis	* Regional and local planning * Private and public developers * Mix between private/public and small/large components

Airport; **A** - Airport City; Concept's area; Host city

Figure 1. Development models of airport-proximate areas –- concepts, features, and characteristics. Source: (Correia, de Abreu e Silva, 2015).

The factors these models have in common are the airport location as a central element of intercity transport, the support of mixed and non-aviation development, and the importance of planning in ensuring the effective allocation of regional resources and infrastructure development (Freestone, Baker, 2011). Therefore, airport development planning must be combined with a more comprehensive process of local planning of airport-proximate areas and to create a vision of their development as a whole and in line with sustainable development.

2. Local planning around airports in conditions of sustainable development

The space around the airport requires special attention, not only because it combines numerous functions that may generate conflicts in space but also because the development of these areas must be planned many years in advance. However, it is indicated that at their creation stage, airports were planned as self-existing institutions without a functional background, therefore the need to "reserve" land for the future development of airport-related services was often not addressed. Nowadays, airports are not just places from which people can embark on a trip; they have become business centers with a rich offer of accompanying services (Puzdrakiewicz, Pokora, 2019). The importance of these areas increases as transport links are expanding. Due to the above, the airport-proximate areas enjoy a growing interest from local authorities and investors (Puzdrakiewicz, Pokora, 2019; Gierczak-Korzeniowska, 2016). This results in a dynamic urbanization process in the areas of civil airports (Kunicka-Kowalska, Kowalski, 2014).

It should be emphasized that the airport's operation affects the environment, causing numerous external effects, both positive – such as job creation (Brueckner, 2003), development of infrastructure and construction – and negative, e.g., noise and pollution emissions. Therefore, it can be assumed that the airport's existence should in some way limit the permitted functions of the airport-proximate areas, e.g., the residential function related to the increase in the number of inhabitants of the airport-proximate areas, or influence the location of health care services. The progress of urbanization should thus be controlled through effective space management, considering the specificity of urban, suburban, and rural areas (Chi, 2012).

The purpose-bound interpretation of effectiveness relates to assessing the effects of action in relation to the adopted effects (Zieleniewski, 1969). Local planning is defined as systematic activities aimed at the effective use of space, reconciling the interests of its various users, and achieving social and economic goals. An important aspect of local planning is the use and protection of the natural and built environment so that it is possible to meet the needs of current and future generations (Ministry of Development and Technology, 2023). Therefore, local planning is effective and efficient if it complies with the principles of sustainable development and prevents spatial conflicts. In other words, local planning involves actions that meet the

community's economic, social, and ecological needs. Sustainable development is the factor that can both stimulate and distimulate the investment process. Public authorities, especially in large cities, are responsible for this challenging task, one of the main problems of which is changing the function of a given area and addressing the needs of various stakeholders (Hołuj, 2018) while maintaining the above-mentioned principles of sustainable development and stimulating local economic development. Local development plans (LDPs) are the tools used for this purpose. In the context of airport-proximate areas, they aim to organize space so that, on the one hand, the future infrastructure and development do not interfere with the nature of air operations (Kunicka-Kowalska, Kowalski, 2014). On the other hand, the airport's operation should have the least possible impact on residents' comfort and quality of life. In this context, there is a constant contradiction between expectations of greater mobility and decreasing tolerance for the negative effects of transport and its related consequences (Pawłowska, 2015).

Tools for reducing aircraft noise are not only local plans understood as the final document constituting local law, but also the entire process of adopting local plans, which enables co-deciding on how the space is developed, is also important, as effective management depends on cooperation between the market, public authorities, and social organizations (Frąckiewicz-Wronka, 2023). Moreover, an action is considered effective if it brings results that are not only effective ("doing the right things") but are efficient as well ("doing the things right") (Buklaha, 2012).

Other tools for reducing aircraft noise include acoustic modernization, restrictions and prohibitions, and restricted use areas (RUAs). The RUA is one of the methods of reducing aircraft noise, as indicated by the International Civil Aviation Association (ICAO, 2008). This is a geographically separated protection zone for areas exposed to excessive noise occurring many kilometers from the border of the entity responsible for the emission. In the RUA area, maintaining permissible environmental noise levels within the area to which the airport management company has legal title is impossible despite using available technical, technological, and organizational solutions.

The implementation of planning procedures, the integration of various levels of development policy and the tools it uses with separate policies, including environmental policy, enable the identification of gaps and problems in this process. The complexity of planning policy and its legal and institutional environment, dependence on different conditions (e.g., historical, political, economic, social), and the interdependence of the interests of various entities create prerequisites for making decisions that may ultimately hinder achieving original local development goals related to ensuring sustainable development and minimizing the risk of conflicts in space.

The literature on the subject identifies many problems that appear in planning processes conducted by Polish municipalities. One of them is the low integration of various aspects of development planning, particularly socio-economic planning, local planning and planning for nature and landscape protection (Drzazga, 2015). Other important issues include the lack of local plans in urbanized and urbanizing areas, failure to ensure proper development and infrastructure of buildings, drastically overestimated size of areas in LDPs intended for housing development and a high number of administrative decisions allowing construction without local plans (Kowalewski et al., 2020). These problems can also be observed in planning of airport-proximate area (Wojewnik-Filipkowska, Koszarek-Cyra, 2022).

One of the challenges in managing the airport-proximate areas is the multi-scalar nature of airport-related problems. Three vectors of problems can be identified: vertical (different levels, often from national to local), horizontal (different interests in the same sphere) and sectoral (public and private stakes) (Cidell, 2004; Galvin, 2010). Additionally, the negative effects of local planning are most often observed when a change occurs in an area owned by many users (Hołuj, 2018). This article focuses on selected problems (gaps) in local planning related in particular to the above-mentioned horizontal and sectoral layout. This study is part of the research trend on assessing the effectiveness of planning interventions in the housing market (see Habdas, Konowalczuk, 2018). It also continues and expands on earlier authors' research and is part of the research project "SOWA 2023"[1].

The study analyzed LDPs in terms of their validity, the frequency of the occurrence of the residential function – one that conflicts with the intensification of air traffic – the source of nuisance and the reasons for the reduction of the quality of life of residents living in areas adjacent to the airport. In this way, the possibility of spatial conflicts in the airport-proximate areas was examined and possible solutions were indicated to improve the effectiveness of interventions of local authorities using local development plans. Comparative research was carried out for the airport-proximate areas of the Kraków-Balice airport and Lech Wałęsa airport in Gdańsk.

3. Methods

A quantitative-qualitative analysis was conducted based on LDPs adopted between 1995 and 2022 in the airport-proximate areas covered by the resolution establishing RUA around Lech Wałęsa Airport in Gdańsk (Uchwała Nr 203/XVIII/16 Sejmiku Województwa Pomorskiego, 2016) and Kraków-Balice Airport (Uchwała NR XVIII/247/20 Sejmiku Województwa Małopolskiego, 2020). The quantitative analysis included the number of plans

[1] https://ie.uek.krakow.pl/kenipi/2023/03/08/projekt-sowa-2023/.

and functions for these areas, while the qualitative analysis focused on potential conflicts between land functions and airport activities.

Spatial conflict is a complex conflict encompassing both spatial aspects and natural, economic, cultural, social, psychological, legal, organizational, and technical dimensions. In the context of the current research, conflict refers to the inconsistency in the intended use of adjacent areas, which is associated with negative external effects in the form of noise and odor emissions (Ułańska, 2012). This conflict relates to transport and technical infrastructure, investment pressure, and adverse effects on the natural environment (Puk, 2011). The compatibility or incompatibility of the intended land use and the possibility of conflicts associated with it was determined based on the analysis and synthesis of the literature, according to which conflicts most commonly occur between industry and residential, recreational, agricultural, and forestry functions, as well as between transport and residential and recreational functions (Grochowska, 2017; Dmochowska-Dudek, 2011). An analysis of the frequency of a particular land function in the examined LDPs was conducted to identify potential conflicts. Since different plans may use varying terminology for specific functions, the presentation of results was simplified, and the following symbols were applied:

- MN: residential areas.
- MNU: residential and service building areas.
- U: service areas.
- UP: production and service areas.
- R: agricultural areas.
- P: industry areas.
- Z: green areas.
- WS: inland waters.
- KD: road areas.
- KK: railway areas.
- KL: airport areas.
- T: technical infrastructure areas.
- I: other areas.

The research for the airport-proximity area in Gdańsk was conducted in 2020 and for the Kraków-Balice area in 2022. In both cases, the analysis included all the valid plans for the selected areas during the research. The plans for airport-proximity areas in Gdańsk were developed from 1995 to 2020, whereas for Kraków the documentation concerned the years from 2004 to 2022. To facilitate comparison, data for the years related to both areas were compared which include LDPs from 2004 to 2020.

The spatial scope of the analysis was determined based on the RUA. In the case of Gdańsk, the analysis covered the LDPs for the following districts and areas within Gdańsk: Matarnia, Kokoszki (including districts of Housing Kokoszki and Industrial Kokoszki), Brętowo, Jasień, Piecki Migowo, Zabornia (a part of Ujeścisko-Łostowice), as well as villages in the municipality of Żukowo: Miszewko, Rębiechowo, Banino, and Czaple, and the village of Tokary in the municipality of Przodkowo. In the case of Kraków, the spatial scope of the analysis included the following districts and areas: District IV Prądnik Biały, District VI Bronowice, District VII Zwierzyniec, as well as villages in the municipality of Zbierzów: Aleksandrowice and Balice, and villages in the municipality of Liszki: Mników and Morawica.

4. Development of the Gdańsk and Kraków Airport – Case Studies (Materials)

Gdańsk Airport was opened in 1974 on a 240-hectare site. Since 1993, the airport has operated as a commercial company owned by the following entities: the City of Gdańsk (33.63% share), the Pomeranian Voivodeship (32.85% share), Polish Airports State Enterprise (Polskie Porty Lotnicze S.A.) (29.09%), the City of Gdynia (2.23%), and the City of Sopot (2.19%). The airport is located approximately 10 km from the city centers of Gdańsk and Sopot and about 23 km from the center of Gdynia in a straight line. The Tri-City bypass road and national highways intersect in the vicinity of the airport. The Pomeranian Metropolitan Railway was built in 2015. It is directly connected to Terminal T2. The airport is well-connected through bus lines to the surrounding towns and villages. The airport's catchment area includes northern Poland, with approximately 2.5 million people living within a 100 km radius of the airport. The airport's infrastructure allows 41-44 takeoff and landing operations per hour. The runway has 7 taxiways and the apron on the departure side can accommodate approximately 38 Code C aircraft. The airport has two passenger terminals. Terminal T1 (almost 10,000 square meters of usable space) was put into operation in 1997. The construction of Terminal 2 (currently 54,000 square meters of usable space) began in 2010, and it was expanded in 2014-2015. From 2019 to 2022, a new Western pier was added to the Terminal 2. Gdańsk Airport is the only one in Poland with passenger bridges suitable for turboprop aircraft such as Bombardier Q400. Currently, it offers approximately 70 regular connections to destinations in Poland and Europe (Gdańsk Lech Walesa Airport, 2023).

Kraków-Balice Civil Airport was established on the grounds of a military airport in 1964, covering an area of 10 hectares. The total area of the airport includes 310 hectares, with 27.5 hectares under the management of the company "Międzynarodowy Port Lotniczy im. Jana Pawła II Kraków-Balice sp. z o.o." The overall area does not include the military area. The shareholders of the company are as follows: Polish Airports State Enterprise (Polskie Porty Lotnicze S.A.) (76.19%), the Małopolskie Voivodeship (22.73%), the City of Kraków (1.04%), and the Municipality of Zabierzów (0.04%). The airport is 11 km west of Kraków and is directly adjacent to the A4 motorway and the S7 expressway. The airport is well-connected by means of rail and bus lines to Kraków and surrounding areas. The service area of Kraków-Balice Airport covers southeastern Poland. Approximately 7.9 million people reside within 100 km from the airport, including the vicinity of Katowice Airport (68 km away). The airport is equipped with two terminals. The current apron at Kraków-Balice Airport can accommodate 23 Code C aircraft. New investments include the expansion of the aircraft parking apron on the Western part of the airport, creating an additional 15 Code C parking spaces (the investment progress as of December 31, 2022, is 70%). Moreover, a new cargo terminal is planned, including office and warehouse space with a total usable area of 5.6 thousand square meters. It is expected to be completed in the fourth quarter of 2024 (Kraków Airport im. Jana Pawła II, 2023).

Based on the contour lines of noise emissions for both the airport-proximity areas in Kraków and in Gdańsk, the RUA was defined and divided into zones A, B, and C (Kraków) as well as zones A and B (Gdańsk) (Table 1, Figure 2, Figure 3). Specific usage restrictions and development constraints were assigned to each zone, depending on the noise intensity resulting from aviation operations, flight approach and departure routes during the day and at night, and air traffic forecasts (Table 1, Figure 1, Figure 2).

Table 1.
RUAs in the vicinity of Lech Wałęsa Airport near Gdańsk and Balice Airport near Kraków

Zone	Kraków-Balice Airport	Gdańsk Airport
A	the boundary is determined from the outside by the maximum range of the night noise isoline: 50 dB or the day-evening-night noise isoline: 60 dB, from the inside by the airport boundary	limited from the outside by the envelope of the isoline of 50 dB at night and 60 dB during the day and from the inside – the boundary of the airport area
B	the boundary is determined from the outside by the day-evening-night noise isoline: 55 dB, from the inside by the maximum range of the night-evening-night noise isoline: 50 dB, from the inside the maximum range of the night-evening-night noise isoline: 60 dB or the airport boundary	limited from the outside by the boundary of the limited use area (45 dB isoline envelope at night, required for areas with higher standards acoustic) and from the inside – the envelope of the isoline of 50 dB at night (required for residential areas)
C	the boundary is marked by night noise isolines of 45 dB, from the inside the maximum range of day-evening-night noise isolines: 55 dB	no zone C

Source: Uchwała Nr 203/XVIII/16 Sejmiku Województwa Pomorskiego, 2016; Uchwała NR XVIII/247/20 Sejmiku Województwa Małopolskiego, 2020.

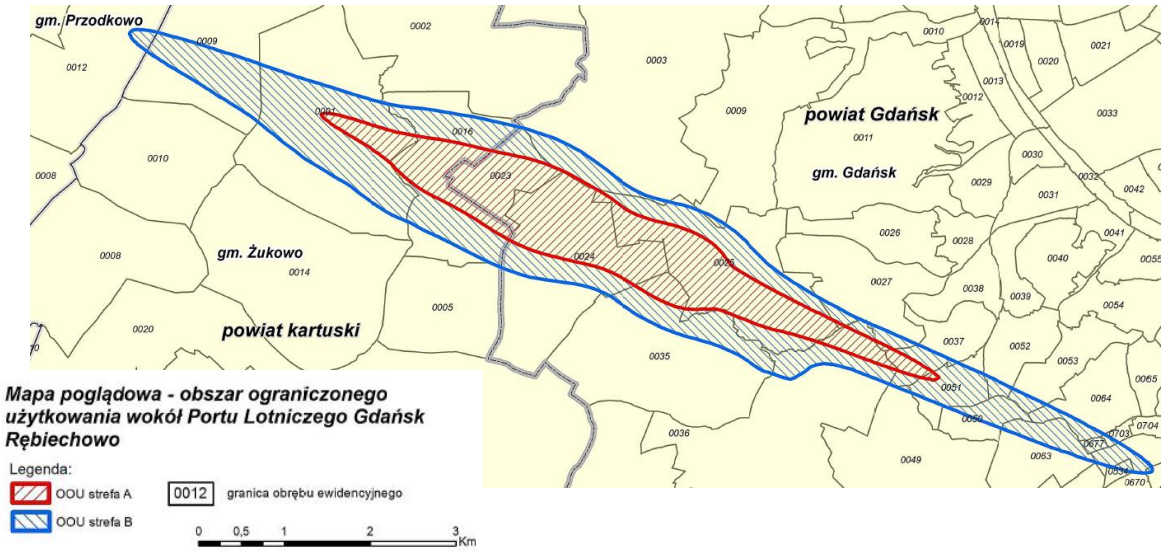


Figure 1. Restricted Use Area (RUA) around Lech Wałęsa Airport serving Gdańsk.
Source: Appendix No. 4 (Uchwała Nr 203/XVIII/16 Sejmiku Województwa Pomorskiego, 2016).

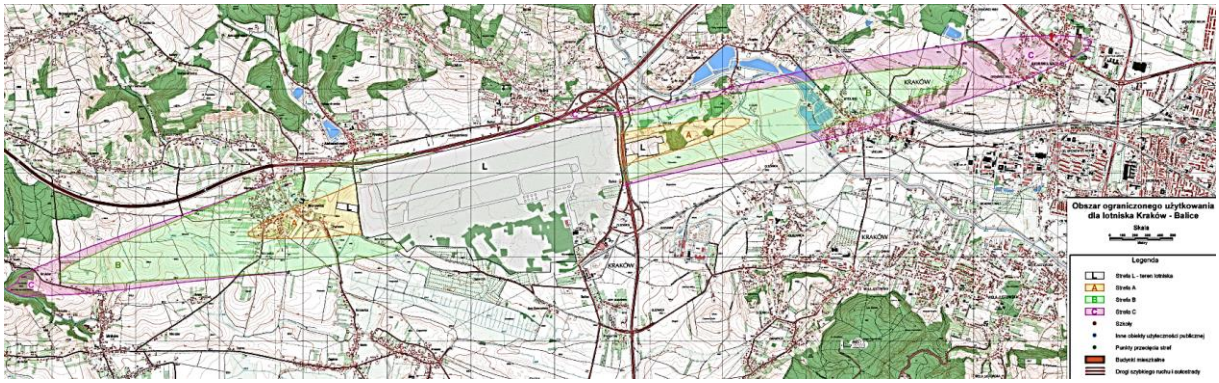


Figure 2. Restricted Use Area (RUA) for Kraków-Balice Airport.
Source: Appendix No. 1 (Uchwała Nr XXXII/470/09 Sejmiku Województwa Małopolskiego, 2009).

The restrictions and development rules for these zones involve prohibition or limitation on residential functions, the location of recreational areas, and the construction of buildings with permanent, extended, or round-the-clock occupancy (especially hospitals, nursing homes, schools, dormitories). The resolution also specifies technical requirements for buildings located within the RUA.

5. Results and discussion

At both of the analyzed airports, air transport for recreational travel, business travel, and cargo shipments grew dynamically during the analyzed period. The year 2020 was exceptional due to the COVID-19 pandemic. Neither of the analyzed airports reached pre-pandemic levels in 2022 (Figure 3).

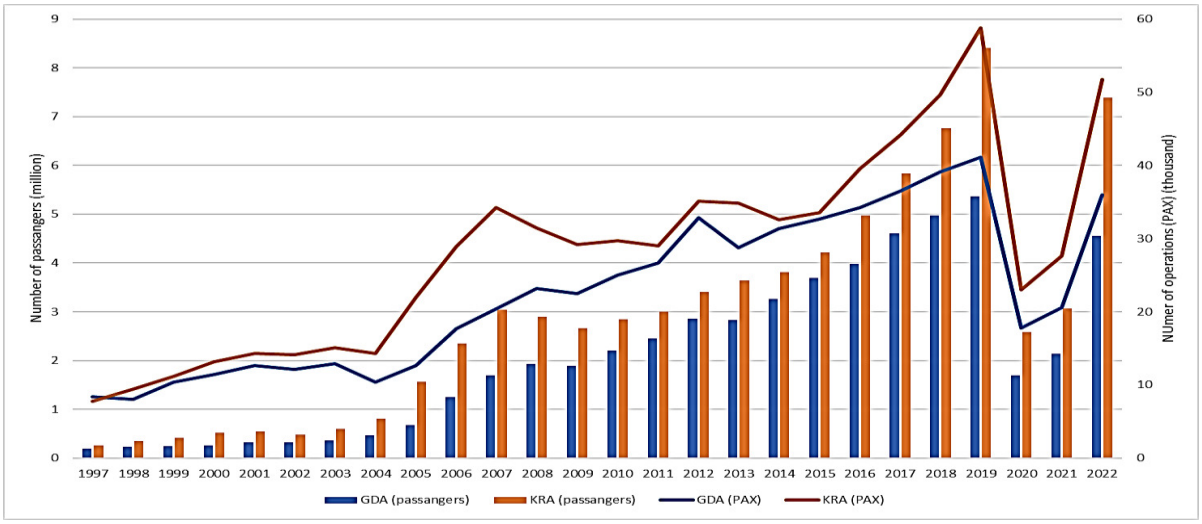
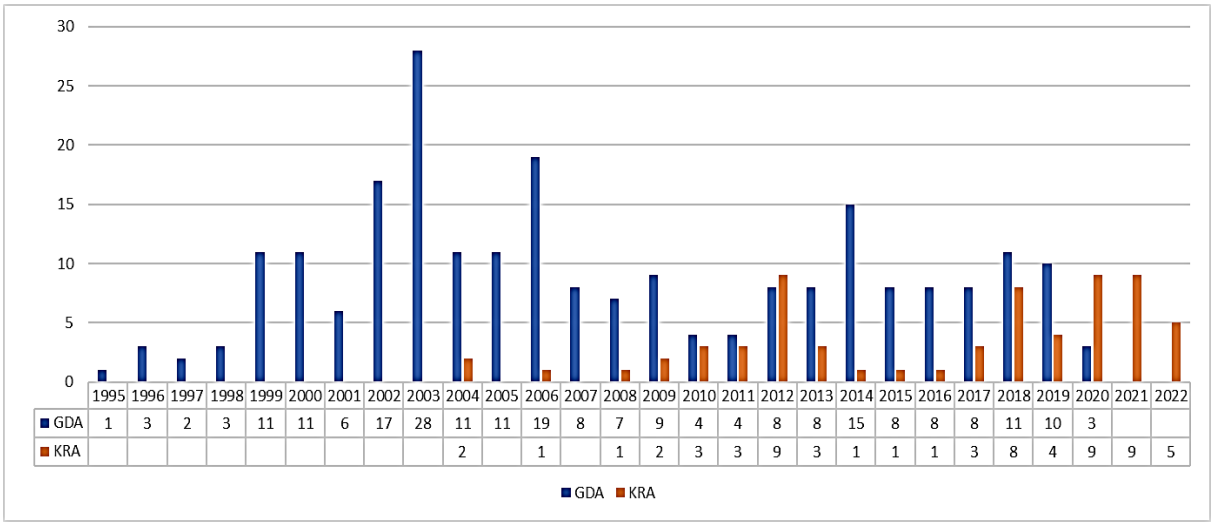


Figure 3. The number of passengers served, operations conducted in domestic and international traffic (regular and charter), and the number of PAX operations in the years 1999-2022 at Gdańsk Airport (GDA) and Kraków Airport (KRA).

Source: Own analysis based on (Civil Aviation Authority, 2023).

Since 2010, Gdańsk Airport has been serving over 2 million passengers annually, while Kraków Airport has been doing so since 2006. From 1997 to 2022, the number of passengers at Gdańsk Airport increased by over 23 times, while at Kraków Airport, 28 times. During the same period, operations increased by factors of 4 and 6, respectively.

The development of airports has stimulated the development of airport proximity areas, which relates to local development policy. In the airport vicinity in Gdańsk, 234 LDPs were adopted from 1996 to 2022, while in Kraków, 65 LDPs were adopted from 2004 to 2022 (Figure 4).



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
GDA	1	3	2	3	11	11	6	17	28	11	11	19	8	7	9	4	4	8	8	15	8	8	8	11	10	3		
KRA										2		1		1	2	3	3	9	3	1	1	1	3	8	4	9	9	5

Figure 4. The number of local plans established in the airport-proximate areas near Gdańsk (GDA) (1995–2020) and Kraków (KRA) (2004-2022).

Source: own study based on planning documents of the surveyed communes (as of January 1, 2012 – Gdańsk; January 1, 2023 – Kraków).

In Gdańsk, of the whole of the surveyed area during the mentioned period (1995-2020), the highest number of LDPs was adopted in 2003. This can be associated with the implementation of a new law on local development planning. Article 87.1 of this law stipulated that LDPs adopted before January 1, 1995, would lose their validity. Creating a spatial vision, closely linked to the relatively regular adoption of LDPs for Gdańsk's districts, can be considered an ongoing and consistently executed process since 2002 (except for 2011), as new plans were adopted every year. In contrast, in the Żukowo municipality, such plans were only developed for the village of Banino in recent years. New LDPs for the villages of Czaple and Rębiechowo have not been created since 2007 (Czaple) and 2010 (Rębiechowo). It can be inferred that this is an action aimed at avoiding conflicts, at least in the short term.

During the consistent analysis period from 2004 to 2020, an average of nearly 9 LDPs were adopted annually for the surveyed area in Gdańsk, while in Kraków it was slightly over 3 plans per year. In Gdańsk (for urban areas), a total of 139 plans were published, while in rural areas, there were 13 plans. The highest number of plans was published in Gdańsk in 2006 (19 plans) and 2014 (15 plans). Kokoszki district had the highest number of plans (41), followed by Jasień (32) and Brętowo (28). Kokoszki is the westernmost district of Gdańsk with a mixed residential and industrial character, bordering Jasień to the east. Jasień is one of the best-situated districts in Gdańsk, characterized by multi-family housing with large-scale retail facilities in its Western part. It also borders agricultural fields, allotment gardens, and recreational areas. Brętowo, also located in the Western part of the city, near the Oliwa Forests and Strzyża Creek, consists mainly of residential areas with heterogeneous architecture, including both prefabricated apartment buildings and single-family houses.

Regarding the airport-proximity areas in Kraków during the study period, 65 LDPs were in force. They were adopted for the analyzed area between 2004 and 2022. A noticeable difference was observed in the number of plans adopted for urban areas (58) compared to rural areas (7). Similar to the case of Gdańsk, this suggests that the city's involvement in the planning process is greater than that of the surrounding municipalities. The highest number of LDPs was adopted for District IV of Kraków – Prądnik Biały (the most populous district in Kraków; 25 plans) and District VII Zwierzyniec (20). The lowest number of plans were adopted for the villages of Aleksandrowice (1) and Balice (1). Due to their natural attractiveness, both villages are part of the Tenczyński Landscape Park. In the 1970s, a small residential estate was built on the eastern outskirts of Aleksandrowice. A4 motorway runs south of the village, and beyond it lies the airport, located within the village of Balice.

While analyzing the documents, it was also observed that LDPs prepared for the Kraków airport proximate zones cover large land areas. In contrast, Gdańsk often involves small areas, in extreme cases a few plots or a single street. This may indicate that planning in Kraków and surrounding municipalities is based on a broader land development vision and is carried out more thoughtfully than in Gdańsk. In Gdańsk, changes or the adoption of new plans seemed more ad hoc and appeared to be a way to address current issues rather than being part of

comprehensive spatial management. When analyzing the timing of plan adoption in Kraków, most documents were created in 2012, 2020, and 2021. The last two years, characterized by high activity, indicate that planning processes around the Kraków airport are carried out very actively, and the plans are regularly updated. This also confirms that, unlike Gdańsk, where plans from the 1990s were still in effect at the time of the study, the oldest plans around Balice Airport date back to 2004, with the vast majority being adopted after 2010. Due to the fact that local planning can lead to spatial conflicts, the frequency of land functions specified in the LDPs applicable for the respective areas was analyzed (Tables 5 and 6).

Table 5.
Number of plans in which a specific function occurred – Gdańsk (plans from 1996-2020)

Area	MN	MNU	U	UP	R	P	Z	WS	KD	KK	KL	T	I
Banino	8	6	3	0	2	1	5	3	7	0	0	1	0
Brętowo	21	14	20	4	1	0	24	1	23	4	0	4	3
Czaple	0	1	0	2	1	0	0	0	2	0	0	1	0
Jasień Szadółki	30	27	35	15	0	1	28	0	32	5	0	14	1
Klukowo Rębiechowo	11	9	16	9	0	1	11	1	17	4	0	9	0
Kokoszki Mieszkaniowe	28	31	33	18	0	0	18	0	34	1	0	12	2
Kokoszki Przemysłowe	2	2	5	12	1	0	10	0	12	0	3	5	0
Matarnia-Złota Karczma	5	4	8	7	0	0	7	0	7	1	3	2	0
Miszewko	7	9	2	4	0	0	5	0	11	1	0	2	0
Piecki Migowo	16	15	15	3	1	1	14	1	17	0	0	5	4
Rębiechowo	14	6	1	0	1	0	3	0	12	0	0	2	0
Tokary	0	1	1	1	1	0	1	1	1	0	0	0	0
Zabornia	4	4	5	0	0	0	3	0	4	0	0	2	0
Total frequency	**146**	**129**	**144**	**75**	**8**	**4**	**129**	**7**	**179**	**16**	**6**	**59**	**10**
% in the number of plans	**62.4**	**55.1**	**62**	**32**	**3.42**	**1.71**	**55**	**2.99**	**76.5**	**6.84**	**2.6**	**25.2**	**4.27**

Source: own study based on planning documents of the analyzed municipalities (as of January 1, 2021).

In the areas around airports in Gdańsk, the most common functions, aside from roads, included in the LDPs related to housing – 146 plans included a housing function, and 129 areas had mixed residential and service functions. It is important to note that these are often not areas of "old housing," but rather newly emerging neighborhoods. For example, in the village of Rębiechowo, the land directly adjacent to the airport was de-agriculturalized for residential use, resulting in building residential housing in the analyzed area. At the same time, very few areas were designated for industrial or agricultural use. Considering the potential for conflicts in space, it can be concluded that the high number of areas designated for residential purposes in the airport vicinity, coupled with the lack of industrial and agricultural areas less affected by airport operations, may be considered an error in local planning.

A similar analysis was conducted for the airport-proximate areas in Kraków (Table 6).

Table 6.
Number of plans in which the particular function occurred – Kraków (plans from 2004-2022)

Area	MN	MNU	U	UP	R	P	Z	WS	KD	KK	KL	T	I
Aleksandrowice	1	1	1	0	1	0	1	0	1	0	0	1	0
Balice	1	1	1	0	1	0	1	1	1	1	0	1	0
Dzielnica IV Prądnik Biały	19	19	18	1	7	0	22	9	25	1	0	14	0
Dzielnica VI Bronowice	12	9	11	0	6	0	12	6	13	7	0	8	0
Dzielnica VII Zwierzyniec	18	13	17	1	8	0	18	7	19	1	0	11	1
Mników	2	1	2	3	2	1	3	2	3	0	0	0	0
Morawica	1	1	1	2	1	0	2	2	2	0	2	0	0
Total frequency	**54**	**45**	**51**	**7**	**26**	**1**	**59**	**27**	**64**	**10**	**2**	**35**	**1**
% in the number of plans	**83.1**	**69.2**	**78**	**11**	**40**	**1.54**	**91**	**41.5**	**98.5**	**15.4**	**3.1**	**53.8**	**1.54**

Source: own study based on planning documents of the analyzed municipalities (as of January 1, 2023).

In the areas surrounding Krakow Airport, residential functions were frequently included in the plans (83% of all plans), as well as mixed residential and service functions (almost 70%). Somewhat surprising is the relatively low designation of areas for industrial or mixed-use purposes in these plans, which is considered one of the best ways to utilize space around airports in the literature. At the same time, many plans included green and agricultural areas. Considering both the potential for spatial conflicts and environmental benefits (e.g., noise reduction), such land use planning around the airport is beneficial.

To compare the planning processes for airports in Gdańsk and Krakow, data for overlapping study periods (i.e., 2004-2020) were analysed. The frequency of designating a specific land use function in the plans was compared. Since the total number of plans in both areas differed, the analysis used the percentage share of the frequency of designating a specific function to the total number of plans in a given area (Figure 5).

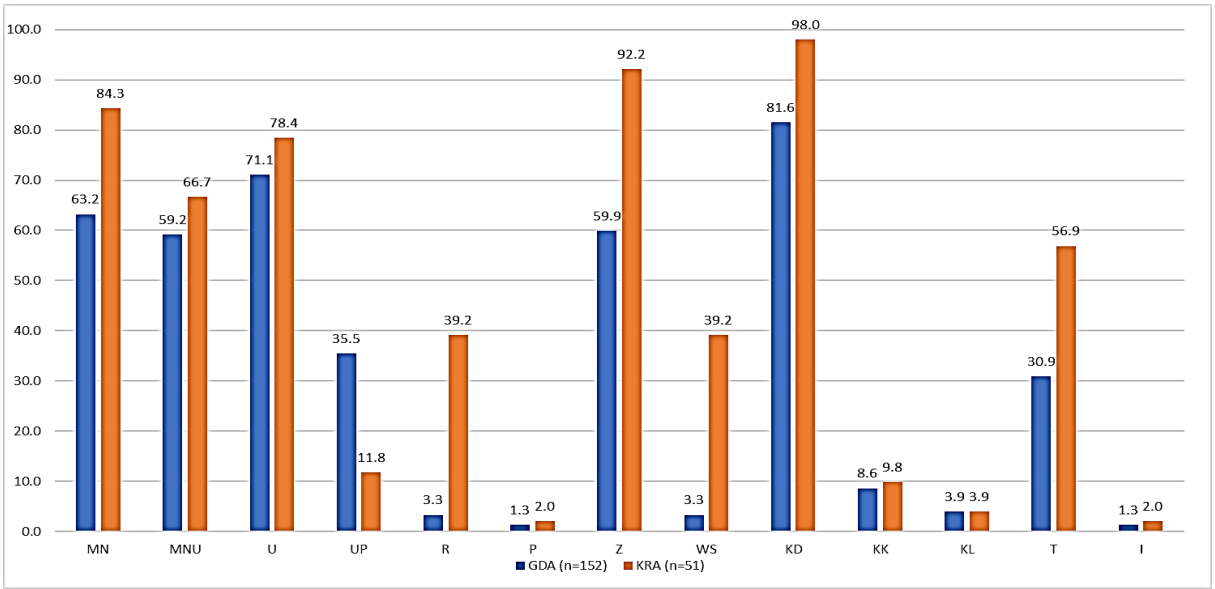


Figure 5. Comparison of the frequency of functions in the plans established for Gdańsk (GDA) and Kraków (KRA) in 2004-2020.

Source: own study based on planning documents of the surveyed communes.

By comparing the provisions of planning documents in both areas, it is possible to indicate the approach of the authorities of the areas studied to determine the functions of airport-proximate areas. In the case of the Krakow airport, the authorities more often decided on agricultural functions of the areas, and green areas were also planned more often. Municipal authorities managing the areas around the airport in Gdańsk more often decided to allocate the areas for service and industrial functions. In the airports in Gdańsk and Kraków, too many areas were assigned a residential function. Such local planning will cause urban sprawl and is perceived in the literature as a negative phenomenon, which can be observed in Gdańsk (Figure 6).

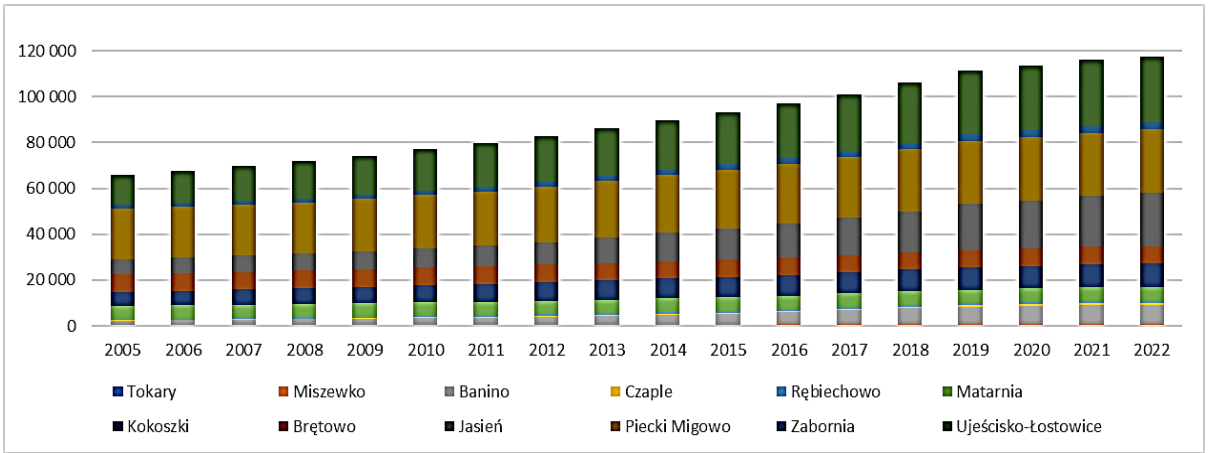


Figure 6. Number of inhabitants in selected areas around Gdańsk airport (2005-2022).

Source: Gdańsk in numbers, https://www.Gdańsk.pl/Gdańskwliczbach/mieszkancy,a,108046, 2023.09.08.

The leading areas in terms of population growth in 2005-2022 are Banino (363%), Czaple (245%) and Jasień (232%). The only population decrease was noted in Brętowo (-1%). In Krakow, the phenomenon of population growth in the analyzed area is not observed (Figure 7).

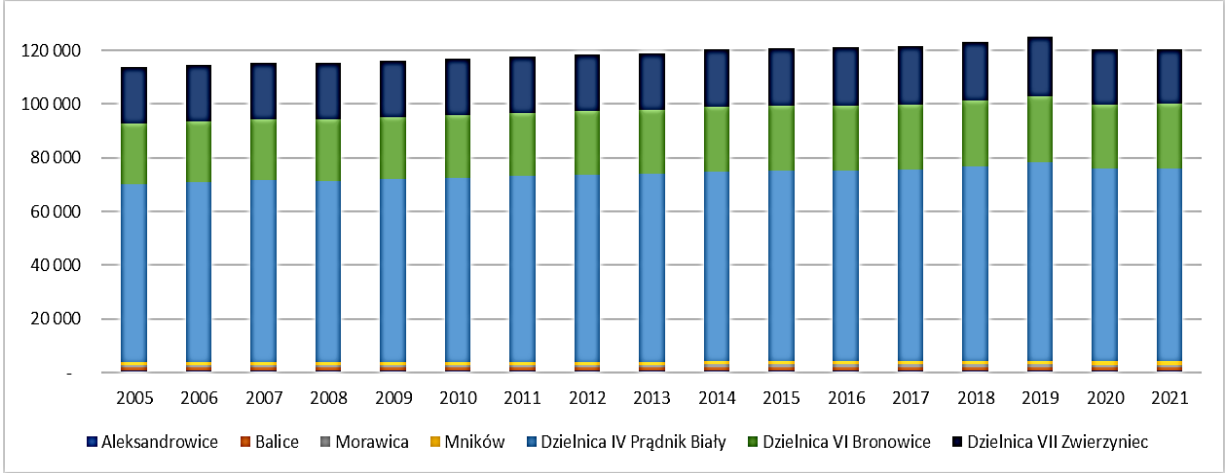


Figure 7. Number of inhabitants in selected airport-proximate areas in Krakow (2005–2021)

Source: own study based on information from municipalities, Hybrid demographic forecast for Krakow and 18 auxiliary districts for 2020-2050 https://www.arcgis.com/apps/dashboards/06f7496273614c588f97560cdcef0010, 2023.09.07.

6. Summary

The specific development of airport-proximate areas, which should be a tool or, in a sense, an indirect goal of development (while the primary goal is to improve the quality of life), appears in this context as a result of the actions taken. Airport-proximate areas should be planned and designed at the initial investment stage to fit into the framework of an appropriate model in the future. However, in practice, airports are built as independent investments without considering the neighborhood as their functional part, which constitutes a gap in local planning. The development of airports attracts investors. As a result, commercial and residential buildings are developing; emerging investments change the space around airports, and the airport itself becomes, at the same time, the cause and effect of development. In the context of the local development of the airport and its neighborhood in Gdańsk, the Airport City model has been only recently identified as the target development model in the airport development investment plans. This indicates acceptance of the status quo or the trend of functionally diversified development, where residential functions are also performed in addition to industrial and commercial functions (with certain restrictions set by the RUA). A similar situation can be described at the Kraków-Balice airport. Its development is claimed to refer to the Airport City model, implemented by global hubs, central and regional ports worldwide (Wróbel, 2020). However, it is not certain whether the model will achieve spatial order (Bajwoluk, 2022).

As mentioned above, one of the effects of the gaps in the form of a lack of integrated and long-term planning might be spatial conflicts, especially between aviation-related functions and residential functions and/or industrial functions, naturally located in airport-proximate areas and residential functions. Thus, it can be concluded that the intervention of public authorities using the LDP in Gdańsk is not effective since the purpose of local planning is to counteract the problem of uneven local development of the city, promote rational planning of public services and infrastructure, prevent conflicts related to the implementation of investments, sustainable development, and the maintenance of spatial order. In the case of Gdańsk, this cannot be confirmed. However, it can be claimed that local planning, which is supposed to be a tool for resolving spatial conflicts, is their source. This is the second gap in local planning. Although in both analyzed cases, the city's activity in the planning process is greater than that of neighboring municipalities, it seems that in Kraków, local planning that invalidates plans from the 1990s and which covers larger areas and includes green and agricultural areas, indicates a more thought-out development vision, which does not mean that local planning, in this case, is effective.

Thus, the identified gaps in local planning based on the conducted research include a lack of a defined development vision and acceptance of the status quo; lack of planning activity; lack of updating local plans; planning for single plots and small areas; a small number of plans

allocating areas to industrial and industrial-services functions; excessive assignment of residential functions to areas; and a shortage of green and agricultural areas.

Possible actions improving the effectiveness of interventions in the form of LDPs are widely described in the literature, but, as it turns out, they exist in theory only. In particular, proper local planning, preventing spatial chaos, consistent with sustainable development and preventing conflicts, consists in formulating and implementing a development vision through the adoption of local plans and their updates, resisting the pressure of property owners to transform agricultural land into residential land, especially in the vicinity of burdensome investments, with the active participation and cooperation in the local planning process of interested parties.

The limitation of the conducted research is that the analysis is based on the number of LDPs and the frequency of given land functions, without detailed consideration of the size of the areas covered by the plans. However, the analysis allows to conclude that local plans for the airport-proximate areas in Gdańsk are characterized by significant fragmentation compared to those for the airport-proximate areas in Kraków. The heterogeneous area identification in documents and on websites (provinces, districts, and units) posed a technical limitation in the research and made it difficult to assign LDPs to the studied areas, particularly in the case of Gdańsk.

Finally, it is necessary to indicate, that on July 7, 2023, the Sejm passed the Act amending the Act on local planning and development and certain other acts, which will enter into force on September 24, 2023. The amendment introduces several changes, including the introduction of a new planning tool – the general plan of the municipality, which will be adopted obligatorily for the entire municipality (excluding closed areas), as an act of local law. All municipalities in Poland must establish such a plan by 2026. A new form of local plan has also been introduced – the integrated investment plan, as a tool that gives municipalities greater opportunities in locating investments, taking into account social participation and the principles of local order (Ministry of Development and Technology, 2023).

The further direction of airport-proximate areas management research relates to addressing the area of LDPs and comparative studies of other civil airports in Poland and selected foreign airports to verify the experience of foreign airports in this area, taking into account legal orders and local planning systems that differ from the Polish one. In the future, the analysis will also focus on the new general plans of airport-proximate municipalities in the field of planning further development of the studied areas.

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WORK EXPECTATIONS ON THE CONTEMPORARY LABOR MARKET FROM THE PERSPECTIVE OF WOMEN – GENERATIONAL APPROACH

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Purpose: The purpose of this paper is to identify expectations of women active in the labor market from the generation perspective (Generations X, Y, Z).
Design/methodology/approach: The presented research comprises results of pilot studies carried out among women in active employment in the contemporary labor market representing the following generations: X, Y and Z, and forms part of a larger research project. The pilot study used an original online survey questionnaire (CAWI) made available to respondents via the survio.com portal. The analyzes were performed using Statistica version 14.0.
Findings: The research shows that there exist differences in terms of expectations regarding work among women. The older generation of women focuses on keeping their current jobs, while the younger generations (Y, Z) focus on finding their own professional path. The research shows how much the salary, the type of contract and benefits offered by employers are important among employees, no matter to which generation they belong.
Research limitations/implications: The results presented in this paper comprise data collected during pilot studies. They are a contribution to further research in the presented area.
Practical implications: The research shows that employers need to develop personalized job offers for specific groups of employees (taking into account their generational affiliation, seniority, experience, stage of professional development).
Originality/value: The article focuses on identifying current needs and expectations among women in active employment.

Keywords: Generation X, Generation Y, Generation Z, labor market, employees' expectations.

Category of the paper: Research paper.

Introduction

Issues raised in this paper are a voice in the discussion on aspects regarding the labor market. The modern labor market is powered by four active generations – Baby Boomers, X, Y and Z, and each of them brings not only their competences and skills, but also a number of expectations

of a varied nature (Mazur-Wierzbicka, 2016). They result from experiences and conditions in which these respective generations were brought up, but also from individual needs, values and capabilities. The purpose of the article is to look for an answer to the question of how women's expectations and needs are shaped in the today's labor market, from the perspective of three generations – X, Y and Z – dominant on the market, however living differently. The results presented in this paper show the outcome of pilot studies, forming part of a larger research project.

Issues related to the situation of women in modern labor markets are constantly addressed by researchers (Wilk, 2018; Winkler, 2022; Flaszyńska, 2020; Misiak-Kwit, 2020, Melich-Iwanek, 2021), who analyze not only the challenges and fears faced by women in relation to combining professional and social roles (Szyszka, 2015), but also in the context of the professional potential with which they can feed today's extremely dynamic and changeable labor market. The area of women's activity in the professional space is gaining importance, especially since contemporary Europe, and therefore also Poland, is struggling with demographic problems that influence the structure of employment (Gwiazda, 2015; Drela, 2017). Therefore, the question arises not only about who will supply the labor market, how to create employment opportunities for young employees, but also how to use the potential and value of employees among women who, despite their age, are still able to work and at the same time the estimated length of their life is higher than in men (GUS, 2022). Research conducted in this area shows that leaving the labor market is influenced by many factors, such as health condition, uncertainty of maintaining a job, and chronic fatigue. The employer's pressure and the willingness not to take away jobs of young generations is also important (Lucius, Simińska, 2015). This raises significant challenges for employers who, in order to maintain employment in their organizations, will have to create solutions that will attract and retain women for longer.

Review of the literature

The Baby Boomers generation, i.e., the generation of post-war baby boom cohorts, means people who were born between 1946 and 1964. It is the oldest group of employees and the level of activity of this employment group in Poland is among the lowest in the European Union (Chomątkowska, Żarczyńska-Dobiesz, 2018). The BB generation, from being contributors to society, are now becoming consumers of pensions and services. Because of their size in numbers, it has been recognized that aging boomers will pose major challenges for Western welfare states (Slagsvold, Hansen, 2021). The attention of this generation is no longer focused on developing noticeable occupational activity, although some employees of the BB generation still remain active in the labor market and perform various organizational roles. Generation X, which dates from 1965 to 1982, is a generation that is described as one that finds the present

more important than the future. Its members look for quick ways to make money, are ready to take on risks and work for themselves. Individuality is the feature that determines their decisions (Stanišauskienė, Urbonienė, 2018). The literature points out to the fact that Generation X members are firmly established and engaged in their careers and, due to their need for financial security, will be interested in opportunities to advance their careers and earning power (Sandeen, 2008).

Considerable changes in the labor market were brought by the two youngest generations – Generations Y and Z, which today attract the attention of employers (Moczydłowska, 2018; Hetig, 2019; Stanimir, 2020; Allard et al., 2007). In the literature, the image of Generation Y is highly different from that of previous generations (Kraus, 2017). Generation Y, also known as the Millennium generation, born between 1981 and 2000, has already entered the labor market with full power. Its representatives have their own distinct set of values, beliefs, work styles, attitudes, and preferences with regard to seeking employment. Their entire childhood and adult life is a period of innovations, therefore technology is something that strongly determines how they function (Calloway, 2018). The youngest, but already active in the labor market generation includes members of Generation Z, whose way of functioning in the labor market is significantly different from all previous generations. People born after 2000 grew up during the global digital revolution (evolution of the Internet, popularization of Youtube, Facebook, Twitter, mass propagation of e-learning, e-commerce, tablets, smartphones). There is no doubt that these innovations have had a great impact on the lifestyle and needs of this generation. Currently, Generation Z, instead of looking at a world full of new opportunities, is looking at an uncertain future. Many of members of this generation will live in the Industry 4.0 era, which will require a transformation of the world market to meet the new needs with regard to the type of their behavior, consumer culture, values, and mentality (Entina et al., 2021). It is the members of this generation that are nowadays the greatest challenge for many organizations, by bringing changes that redefine the to-date methods of managing, organizing and planning work, building loyalty schemes, commitment, cooperation, but also asking questions about the meaning and value of work in the modern world.

There is a strong diversification of age groups observed on the labor market, which means significant generational differences, demonstrated in attitudes towards work and professional career (Smolbik-Jęczmień, 2013). Expectations regarding work depend on many different factors, such as individual needs, work ambitions and aspirations, skills and predispositions of a given person, but also beliefs and ideas about oneself (Wronowska, 2015; Sak-Skowron et al., 2017; Myjak, 2019). In their negative aspect, they can also be an expression of what the environment expects from a person and what the pressure is directed at. They will be manifested through acts, activities or attitudes, to a large extent shaping the way employees will think about the employer and what they will look for within specific structures. Expectations of employees can and certainly will change together with the changing labor market, economic and social situation, but also with changes happening in their own lives related to, for example, age,

predispositions, new social and family roles. As pointed out by B. Sajkiewicz, what is important is to notice differences in employees' goals resulting from the fact that they belong to different generations. The author draws attention to the identification, analysis and description of differences in the ways of acting, effectiveness, learning abilities, and perception of issues important for a company also in expectations of employees coming from different age groups (Sajkiewicz, 2016). The analysis of the literature shows that the young generations, i.e., Y and Z, are perceived by employers as taking too much for granted, who in their pursuit for understanding of themselves and their needs are not afraid of crossing borders and asking questions about how the employers can contribute to their own development on various levels (Gajda, 2017; Nikonowicz et al., 2019; Kopertyńska et al., 2014). Satisfaction from work from the perspective of the young generations (Y, Z) is associated with a sense of independence, flexible working time, respect and conviction about being someone special (Kawka, 2018). R. Muster points out that the generation of people who enter the labor market will actively create the culture of the organization, instead of just adapting to already existing norms and values (Muster, 2020).

The way of perceiving one's own work and related expectations is completely different in the case of the older generations (BB, X), which are characterized by stability, expectation of job security, lack of requirements in the area of taking up new challenges. The literature also indicates high loyalty to one employer (Dolińska-Weryńska, 2016). The BB generation is considered as characterizing with low work and geographical mobility, they are seen as supporters of a traditional career who want to pursue it preferably with one employer and, what is also worth paying attention to, have problems with defining their own expectations. In turn, for Generation X, work is a value in itself, a change of job is considered as a need, and training enables stabilization of employment (Hysa, 2016). However, what should be underlined here is that perceiving employees' expectations only through the prism of what generation they belong to gives a lot of place for abuse, including in particular creating stereotypes. This may lead to searching in a given group of employees of features and expectations that they actually do not have. In this context, in today's market realities, it is useful to ensure that personalized job offers and development paths are built on the basis of needs and expectations of a given employee, so as to use the potential of an individual as accurately as possible.

Research methods

The purpose of the research was to identify work expectations in a group of women representing Generations X, Y and Z. An analysis was carried out to see which aspects related to employment are particularly important for employees from respective generations. Research issues were presented in the form of questions:

1. What aspects are of particular importance in the current workplace from the perspective of women representing Generations X, Y, Z?
2. Which employment-related aspects have impact on the willingness to change jobs from the perspective of women representing Generations X, Y, Z?
3. What are the biggest professional challenges from the perspective of women representing Generations X, Y, Z?

The results presented in this article are pilot studies carried out as part of a larger research project. The research took place in February-March 2023. The data was collected using a proprietary online survey (CAWI), which was developed for the purposes of this research and published on the survio.com portal. The survey was distributed to the respondents via social networking sites, i.e., LinkedIn and Career Offices of universities in Poland. Only fully completed surveys were taken into account in the analyses. The pilot study involved 10 women from Generation X (5.10%), 35 from Generation Y (17.86%), and 151 from Generation Z (77.04%).

Analysis and discussion

According to the pilot studies carried out, work expectations from the perspective of women representing Generations X, Y and Z are very similar, although the literature points out to much greater differences. Members of Generation X paid particular attention to aspects related to stability of employment, i.e., a permanent contract and salary (90% of respondents), atmosphere at work (40% of respondents), development and career opportunities (20% of respondents), and finding meaning in the work they do (20% of respondents). Among the representatives of Generation Y, the results are similar – stability of employment (80% of respondents), atmosphere at work (48.57% of respondents), and development and career opportunities (25.71% of respondents) are of key importance. On the other hand, among members of the youngest generation currently working on the market, i.e., Generation Z, what is particularly important is atmosphere at work (64.90% of respondents), stability of employment, i.e., a permanent contract and salary (64.24% of respondents), and development and career opportunities (29.80% of respondents). Detailed data is presented in Table 1.

Table 1.
Aspects important at work from the perspective of women from Generations X, Y, Z

	X		Y		Z	
	N	**%**	**N**	**%**	**N**	**%**
Stability of employment – a permanent contract and salary	9	90	28	80	97	64.24
Atmosphere at work	4	40	17	48.57	98	64.90
Team/manager relations	0	0	2	5.71	18	11.92
Development and career opportunities	2	20	9	25.71	45	29.80
Promotions	0	0	1	2.86	9	5.96
Bonuses	1	10	5	14.29	21	13.91
Employment flexibility (remote and/or hybrid work)	1	10	5	14.29	35	23.18
Finding meaning of the work you do	2	20	5	14.29	14	9.27
Possibility of development in the area of my choice, pursuit of my own professional interests	1	10	2	5.71	20	13.25
Trust between me and the team/manager	1	10	3	8.57	6	3.97
Kindness and understanding that I get at work	0	0	3	8.57	23	15.23
Acceptance I feel from the team/manager	0	0	3	8.57	19	12.58
Other (what?)	0	0	0	0	0	0

Source: own elaboration.

The results analyzed in this area show that the expectations towards work among members of Generations X and Y are the same. The only difference is among members of Generation Z, who pay attention to the atmosphere at work in the first place, although it should be noted that the difference between the assessment of the atmosphere at work and the stability of employment (contract + salary) is small. The reasons for such answers can be sought by analyzing the current economic situation in Poland. A period of high inflation, economic slowdown, and thus much greater uncertainty in terms of employment in organizations, difficulties in finding or changing a job may convince respondents to keep, above all, work stability in this uncertain period on the market. In these circumstances, other aspects may be of definitely less importance, although it is worth noting that members of Generation X also paid attention to finding meaning in the work they do (20% of respondents), which allows concluding that the soft aspects related to functioning at work and considering it as satisfactory are still important to them, although not decisive in the assessment of employment conditions. Members of Generation Z consider the atmosphere at work as particularly important, which to a large extent coincides with the results of research presented in the literature devoted to this subject. Younger generations tend to look for a job that will not only let them earn, but also feel good in a much wider dimension.

Respondents were also asked what would make them change jobs. Members of Generation X chose the salary as being of key importance (90% of respondents). This aspect was considered the most important by all surveyed groups (X, Y, Z). Additional benefits, such as training, courses, certificates, are also important (50% of respondents), and so is the possibility of changing the scope of duties (20% of respondents). In the case of Generation Y, salary is also the most important factor determining the willingness to change jobs (94.29% of respondents). Other important factors indicated by them include the possibility of flexible work (remote or hybrid work – 17.14% of respondents), change in the scope of duties (14.29% of respondents),

and the possibility to change the boss (14.29% of respondents). In the case of these two groups, i.e., Generations X and Y, the willingness to change the scope of duties draws attention, which raises the question of how duties are formulated, to what extent they are adapted to the person's capabilities, skills, competences, but also ambitions and professional aspirations, and finally, to what extent they fit to the current stage of their career. It may be expected that one of key aspects for female employees at a more advanced stage of their career will be, on the one hand, the possibility to perform new, more challenging roles (such as managerial roles) or quite the contrary – roles adapted to other duties required of them at this stage of life (especially in the case of members of Generation Y, who at this stage of their lives may be intensively involved in building a private life (the roles of a mother, wife), which will not necessarily be that important for members of Generation X, whose current age is about 58 years for the oldest ones and about 41 years for the youngest ones. In the case of representatives of Generation Y, attention was also drawn to the willingness to change the boss (14.29% of respondents), which also prompts questions about how teams are managed and who performs managerial roles – what leaders are promoted by organizations and, in the end, how they are assessed by employees. Members of Generation Z, similarly to respondents representing Generations X and Y, pay particular attention to the salary (82.12% of respondents), benefits including training, courses, certificates (45.70% of respondents), and flexible work options (remote, hybrid work – 31.3% of respondents). Detailed results are presented in Table 2.

Table 2.
Factors that have impact on the willingness to change jobs in the perspective of women from Generations X, Y, Z

	X		Y		Z	
	N	**%**	**N**	**%**	**N**	**%**
Possibility of obtain a higher salary	9	90	33	94.29	124	82.12
Possibility to change the scope of duties	2	20	5	14.29	26	17.22
Possibility to change the boss	0	0	5	14.29	9	5.96
Possibility to work on a flexible basis (remote work, hybrid work or other model)	0	0	6	17.14	47	31.13
Possibility to work abroad	0	0	3	8.75	17	11.26
Possibility to set up own business and becoming self-employment	1	10	2	5.71	30	19.87
Possibility to change the contract to a long-term one	1	10	2	5.71	22	14.57
Possibility to work in a corporation	0	0	1	2.86	6	3.97
Additional benefits (training, courses, certificates)	5	50	4	11.43	69	45.70
Other (what?)	0	0	Higher position		Work without time pressure and stressful atmosphere; Meaning of work; Nothing	

Source: own elaboration.

During the research, respondents were also asked about the biggest challenge for them today in work-related terms. The results show how important it is to match relevant employment conditions and benefits to the stage of one's career. Member of Generation X focus their attention on the possibility of receiving a higher salary (70% of respondents), keeping a job (40% of respondents), and building relationships in the team (30% of respondents). Especially the issue of building relationships in the team raises the question of what diversity management in the team looks like and how it is implemented in practice. The problem of cooperation between representatives of different generations is stressed by many researchers (cf. e.g., Sidor-Rządkowska, 2018; Waligóra, 2018; Bojarczuk et al., 2018). This research shows that this problem may have a much broader context in practice. The greatest challenge for representatives of Generation Y is professional development (40% of respondents), finding their own professional path that will be consistent with their expectations and skills (37.14% of respondents), the possibility of receiving a higher salary (37.14% of respondents), keeping a job (20% of respondents), and working on the basis of a permanent contract (employment contract – 20% of respondents). This result suggests that at the stage of intensive career development, which definitely takes place at this age, there may be issues related to building one's professional identity and creating one's own career path. These are questions about who I am, in what direction I want to develop, what I am looking for in terms of work, what my work prospects are. The youngest generation active in the labor market, i.e., Z, focuses primarily on finding their own professional path (49% of respondents), which is also consistent with the stage of their professional development. It is an intense time of searching for answers to questions about who I want to be, how I want to work, what will bring me true fulfillment. As the second important aspect, this generation indicated the possibility of obtaining a higher salary (30.46% of the respondents) and professional development (21.85% of the respondents). Detailed results are presented in Table 3.

Table 3.
Work-related challenges in the perspective of women from Generations X, Y, Z

	X		Y		Z	
	N	**%**	**N**	**%**	**N**	**%**
finding a job	0	0	5	14.29	64	14.38
keeping a job	4	40	7	20	27	17.88
changing a job	1	10	3	8.57	26	17.22
finding one's own professional path (a job consistent with one's expectations and skills)	2	20	13	37.14	74	49
professional development	2	20	14	40	33	21.85
building relationships in the team	3	30	5	14.29	12	7.95
building relationships with the manager	1	10	1	2.86	3	1.99
receiving a higher salary	7	70	13	37.14	46	30.46
receiving a permanent contract (employment contract)	2	20	7	20	19	12.58
finding meaning in one's work	1	10	2	5.71	27	17.88
trust in the employer	0	0	3	8.57	18	11.92
Other (what?)	0	0	0	0	Nothing; Finding a job that inspires and brings joy; Resilience	

Source: own elaboration.

The results presented in this article indicate aspects that may significantly influence attitudes towards work and women's professional satisfaction. Analyzes developed by a team of researchers from the Polish Institute of Economics and presented in the report *The situation of women in Poland from a socio-economic perspective* from April 2023 clearly show that the level of women's employment is moderate compared to the European Union, and at the same time the data indicate that Poland belongs to 1/3 countries with the lowest level of women's employment (Polish Economic Institute, 2023), which only proves that undertaking research in this area may be significant in the context of shaping job offers, taking into account the perspective of professionally active women. As M. Christoph and E. Krause point out, women, when thinking about choosing a career path, still focus mainly on traditional career patterns, the aim of which is to maintain stability, fixed working hours and combine social and professional roles (Christoph, Krause, 2019), which is also confirmed by research presented in this work. On the other hand, the modern labor market offers great opportunities to pursue career paths that build independence, self-reliance and flexibility, as exemplified by own business activities. However, research shows that there are significantly fewer self-employed women than men (Turczak, 2017), which is surprising because the level of education of women in Poland is higher than that of men, and yet there is no tendency to start their own companies. In the opinion of A. Broniszewska and B. Ślusarczyk, starting their own company for women is often easier than obtaining a higher managerial position in another company. This work model is also a way to combine family and professional responsibilities (Broniszewska, Ślusarczyk, 2017), therefore it is worth promoting entrepreneurship among women, regardless of generational affiliation.

Summary

The results of the pilot studies presented in this paper, although having some weaknesses resulting, for example, from the size of the surveyed groups, point out to the need to continue and deepen research in the presented area. The research results show how important it can be to match employers' benefits and expectations to needs, abilities, but also concerns of female employees at a given stage of their career. During the research, it was observed that although expectations between representatives of respective generations differ to some extent, there are also many common aspects that remain important regardless of the generational affiliation. In the context of the research, the present social and economic situation can be of particular importance, as it is characterized by high uncertainty, unpredictability of employment, and thus prompting to ask questions about how safe and stable a given workplace is. At the same time, the results show the picture of female employees, especially among members of the younger generations (Y, Z), as looking for their own place in the work sphere. The question of how to

create jobs that merge expectations of employees and employers, building on the one hand satisfaction among employees and, on the other hand, business value for the organization, is still open.

The issue of employing women is an important problem in the social, economic, economic and psychological dimensions and largely influences the shape of today's labor market. For this reason, it is important to continue research in this area, covering various aspects of this issue in order to create new solutions for both employees and employers. Research considerations worth focusing on in the future should include, among others, how to stimulate and create entrepreneurship, especially among representatives of young generations, for whom flexibility and independence in the area of professional functioning may be important while simultaneously fulfilling social roles (mother, wife). It also seems important to conduct research considerations on the issue of using the potential of women aged 50-60+, which will be of significant importance, especially in the context of demographic problems from which Poland is not immune.

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COMMUNICATION MANAGEMENT IN MULTI-CHANNEL MARKETING OF A SPORTS ORGANISATION

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Purpose: The main purpose of the article is to identify the ways in which sports organisations communicate online, mainly using social media. An additional objective is to find differences in the target audience in social media on the basis of the numbers determining the activity of the audience of the communication pages. The reason for the article was also to identify a relatively novel and easy mathod to measure the effects of communication through these media.
Design/methodology/approach: To achieve the intended purpose, a method of desk research and numerical data covering the activity of selected sports clubs (organisations) on the most popular portals in the period from 1 to 31 July 2023 was used. The data will be statistically analysed using standardised indicators to enable comparison. The subjects of the study were the three leading sports clubs of the highest men's football competition class in Poland, as the most active in the online space and generating the highest interest.
Findings: The outcome of the study was to establish a ranking of the use of social networking sites in the clubs' communication with their stakeholders and the differences between the effects of messages in these media.
Research limitations/implications: The main limitations of the study are the variety of factors that can influence communication management in sports organisations, as well as the multichannel nature of the methods of reaching stakeholders. The main focus of the paper is on social media and how to use data from this source. In the future, this approach can be adapted in solving communication management problems.
Practical implications: The method used in the article is flexible, allowing it to be used freely to find out the effectiveness of companies' social media activities. Companies operating in homogeneous markets receive, thanks to the presented one, a tool for recognising their competitive position in terms of marketing communication and the effectiveness of its tools on the Internet.
Social implications: It is assumed that with the optimal application of the proposed survey method, a tool is gained for the objective evaluation of the communication management policy through social media. The method replaces a qualitative assessment of this management, showing the position among different types of media or competitors.
Originality/value: The article is aimed at various companies active in the online space in multiple social media. The novelty is that publicly available data is standardised and thus comparable. This in turn influences communication management not only at the social media level, but also in multi-channel marketing.

Keywords: social media, management, communication.
Category of the paper: Research paper.

1. Introduction

With social media constantly evolving, dynamic and flexible, there is a need to study the effects of the activity of companies, entities and organisations in these media. In doing so, tools are required to enable the efficient management of communication and its changes according to the results. Therefore, this topic is very important, as its development makes it possible to avoid losses resulting from unnecessary activities and too much and ineffective communication. The topic of studying the effects of communication via social media is also very topical, because despite many studies, science does not always keep up with trends. Media and content audiences change, and consequently the organisation must change, adapting to these changes.

To begin with, it must be said that in an age of development, it is virtually impossible to exist without the internet and its associated marketing means. Companies' online marketing efforts are primarily influenced by the proliferation of mass communication media. The Internet, like other media, has become an effective method of reaching audiences. The use of the Internet for marketing purposes is influenced by such features of the Internet as:

- unlimited time accessibility to resources from anywhere in the world,
- low cost of information transmission,
- high level of information capacity,
- possibility to update information quickly,
- perception of entities operating on the Internet as modern and innovative,
- higher level of efficiency of activities (Łysik, Machura, 2014).

The Internet has caused a revolution in marketing concepts because it provides a two-way message between sender and receiver. This, in turn, makes it possible to maintain relationships with advertisers. The importance of online marketing activities is evidenced by the emergence of a new concept - internet marketing, which also functions under other names such as:

- e-marketing,
- virtual marketing,
- internet marketing,
- cybermarketing (Pudełko, 2020).

The Internet is the most complex communication medium in the world and is changing rapidly (King, Hall, 2022). Many companies have discovered the opportunities that the Internet offers. Unlike traditional marketing, which provides a one-way message.

Online, consumers have a voice, they can comment, suggest ideas, give advice, but also complain. This provides a wealth of knowledge about the consumer and allows companies to extend analytics. There is a personal dimension to customer contact and access to information is unlimited. Unlike television, a company's marketing activities on its website, for example, are available all the time. The structure of shopping is also changing - customers have noticed that the Internet provides them with significant time savings, so they buy online. This is because, via the Internet, they can check products, compare offers, look at pictures and buy products without leaving home.

Marketing activities carried out on the Internet are characterised by:

- instant circulation of information,
- rapid updates,
- low distribution costs.

A special role in online marketing is played by social media, which use websites and applications operating on the Internet and created by its users (Chojnacki, 2020).

It should be noted that new social media sites are emerging online all the time, offering further functions and opportunities.

The essence of social media is to bring users of these sites together in groups, where bonds and a sense of belonging are established and information can be exchanged in text, graphic, audio or video form. Each user can create his or her own profile on which they can post content of their choice.

The essence of social media is to bring users of these sites together in groups, where bonds and feelings of belonging are established and information can be exchanged in text, graphic, audio or video form. Each user can create his or her own profile, where he or she can post content of their choice. Social media are constantly evolving, which makes it difficult to define them clearly. The most common definition considers social media to be a set of tools that use online media and mobile technologies for the exchange of information and dialogue among their users (Sadowski, 2012). Selected definitions of social media are presented in the table 1.

Table 1.
Overview of social media definitions

Autor	**Definicja**
K. Polańska (2010)	the form in which user-generated information on social networks is transmitted through websites and applications
M. Moroz (2010)	the part of virtual media that brings users together in groups
D. Kaznowski (2011)	socially controlled media, which can be used on any scale, containing message content and opinions
C. Treadaway, M. Smith (2011)	a set of technologies for initiating communication and transferring content between people, their friends and social networks, which include
A. Kaplan, M. Haenlein (2012)	a group of applications based technologically and ideologically on Web 2.0 and allowing the creation and exchange of user-generated content
W. Gogołek (2017)	a form of natural, unrestricted online exchange of information between individuals on common interests

Source: Own compilation based on (Stawarz, 2017).

The proliferation of social networks means that their functionality is expanding all the time. Social media make it possible to present oneself, a company or the products one offers. Profiles can contain all kinds of information on the subject, as well as enabling contacts to be made, information to be exchanged and relationships to be maintained with members of the site. In this way, companies can maintain relationships with their customers, as well as receive feedback from them containing opinions on products or services. Social media also allow for the observation of activities undertaken by users, and therefore provide an opportunity for businesses to present their activities, investments or volunteering. In this way, they are becoming a tool for creating a corporate image. Each service, although providing similar functions, is based on the different nature of the links and contacts that exist between its users.

2. Use social media for marketing

One of the biggest advantages from the point of view of entrepreneurs is the possibility to use social media for marketing. The term social media marketing (SMM) has emerged, which is defined as promotion through social media consisting of running profiles, publishing posts, organising competitions, etc. Social media are a way to implement your marketing strategy and promote yourself. They make it much easier and quicker to find customers and reach them with advertising. Through social media, companies maintain relationships with their customers as well as selling their products and services. These media are also used to build a brand-customer relationship, create a corporate image and present the company's activities (Gręboszet al., 2016). In addition, it is possible to build a contact and customer base, initiate cooperation between companies, and find sponsors. Paid activities in social media, on the other hand, constitute ongoing advertising campaigns using dedicated marketing tools.

The use of social media and its use in business management also depends on generational differences (Karasek, Hysa, 2020).

Social media engagement can be understood in many ways. Each social media can also be assessed separately. Engagement is then examined as the intensity of interactions and their implications, towards the offers and activities of a brand, product or company, regardless of whether the initiator is an individual or a company.

Alongside traditional marketing channels, social networks are integrated as part of the marketing mix. Social media have changed the dynamics of interaction between companies and consumers that favour this relationship.

Among the methods of studying online consumer behaviour, the predominant ones measured are through so-called online engagement metrics, including the number of users, click-through rates, page views, content likes and comments, depending on the platform (Muñoz-Expósito et al., 2017). It is also possible to take as a basis the motivation of the

individual resulting from their experience with the object, manifested in object behaviour, and viewer engagement understood as the attitude towards the brand in terms of likes, comments and shares (Segijn et al., 2019). This approach will be the basis for this article.

The diversity of approaches to social media engagement confirms that there is no uniform approach to measuring social media engagement.

Research on social media engagement metrics can be grouped and divided into different categories (Trufno, Rossi, 2021).

One of these is the most widely described 'quantitative metrics'. These predominantly assess the impact of social media engagement based on the number of comments, likes, shares, followers, etc. (Yoon et al., 2018; Khan et al., 2019; Medjani et al., 2019). This approach is also the method used in this article.

The second group of studies are those that identify indicators of social media engagement by developing a 'set of indicators'. These may be using three social media metrics to measure engagement with a particular behaviour, for example conversation. In detail, conversation rate measures the number of comments or reviews in response to a post, amplification rate measures the amount of online content. (Li et al., 2019).

The third group of studies are 'normalised metrics', where an average measure of user engagement is obtained by dividing the sum of interesting shares by the total number of posts or other factors like liking, sharing or commenting. (Zanini et al., 2019; Osokin, 2019; Mariani et al., 2018).

The last group of engagement studies is a qualitative approach, where contemporary social media and social research indicators are considered (Abuljadail, Ha, 2019).

This article is intended to include elements of the approach and methodology of mainly the first group of studies, especially as there have been few attempts to date to quantitatively analyse stakeholder engagement on club profiles based on standardised characteristics.

Research subjects can be different organisations. Against this background, sports companies are specific subjects, as they hardly compete with each other. The primary method of communication management here is benchmarking, a method that involves comparing the processes and practices of one's own entity with those of companies considered to be the best in the field being analysed. Another peculiarity of sports organisations is the high level of activity on social media. This is due to the nature of the content viewer (fan), for whom sport is associated with personal emotions. Social media satisfies the need to be close to sporting events related to the club and its current activities. Mostly in other companies this need is not present.

3. Research methods

The basis of the consideration is to determine the level of development of the clubs' communication with stakeholders through the social medium of Facebook (Meta).

Statistical indicators were used in the analysis regarding:

- number of posts,
- number of reactions to posts,
- number of comments on posts,

The datasets cover the activity of the three leading football clubs in Poland on the most popular social media (Instagram, TikTok, Youtube, Meta). The study period is 1 to 31 July 2023. Bearing in mind that the activities of the football clubs surveyed are similar to each other and that they are mainly active in sporting events, it is not necessary to extend the time span. As it can be seen from our own research, the activity of the sports clubs is similar in later and earlier periods.

All necessary calculations were carried out in an Excel spreadsheet using its calculation capabilities.

The statistical method used in the study is taxonomic analysis.

This procedure consists of the following steps (Bak, Szczecińska, 2013):

- preparation of numerical data,
- selection of variables for analysis,
- ordering and grouping.

For the construction of the taxonomic measure of development, the benchmark method in the classical approach was used. The classic measure is based on standardised zij values of diagnostic characteristics.

$$z_{ij} = \frac{x_{ij} - \overline{x}_j}{S_j}, \ (i = 1,2, ..., n, \ j = 1,2, ..., m). \tag{1}$$

The distances of each test object (di) were then determined with the form shown in the Formula (2).

$$d_i = \sum_{j=1}^{m} \left| z_{ij} - \varphi_j \right|, \ (i = 1,2, ..., n), \tag{2}$$

where:

φj = max zij for stimulants,

φj = min zij for destimulants.

It should be recalled here that a stimulant is a statistical characteristic whose increase in value leads to an increase in the value of the explanatory variable. A destimulant, on the other hand, is a statistical characteristic whose increase in value leads to a decrease in the value of the explanatory variable.

The final step was the calculation of the synthetic measure of development - Formula (3).

$$\mu_i = 1 - \frac{d_i}{d_-}, \tag{3}$$

where: d_ - a variable calculated as the sum of the arithmetic mean of the coordinates of the distance vector (d) and the doubled value of the standard deviation of these coordinates.

This procedure was also used to determine synthetic measures of development for the communication activity of the three leading football clubs in the Polish Ekstraklasa (Raków Częstochowa, Legia Warszawa, Lech Poznań), in order to determine how the effectiveness of individual clubs on social media (Instagram, TikTok, YouTube, Meta) evolved over the indicated period. In addition, the effectiveness of these media in managing stakeholder communication on social media was determined.

4. The study results

The research was conducted in two stages, in relation to the two research objectives (club ranking and media ranking). The first stage of the research was the presentation of basic information on the activity of the surveyed football clubs on social networks. In the second part of the research, a method of data standardisation was applied based on the statistics of the three mentioned clubs of the Polish Ekstraklasa. It standardised selected data such as the number of posts, reactions to these posts, comments and its links to data on the clubs' communication with stakeholders on the portals. This procedure was repeated for both research objectives. This made it possible to find out which club is using social media most effectively and which media is currently the most effective.

It presents the medians and standard deviation of their posts, comments and reactions on Instagram, YouTube and Meta. The data relates to the three clubs surveyed from 1 to 31 July 2023, and was obtained through the use of Web scraping, a technique that involves manually or automatically downloading data from the Internet. The figures are presented in Table 2.

Table 2.
Factors related to the communication of selected sports clubs on social media

	Number of posts	Median of reactions	Median of comments	Standard deviation of reactions	Maximum of reactions	Minimum of reactions
Instagram						
Raków Częstochowa	62	4313	9	3055	4962	383
Legia Warszawa	53	5244	39	2512	16000	2199
Lech Poznań	192	1185	13	900	22500	192
TikTok						
Raków Częstochowa	23	2473	75	4839	21900	974
Legia Warszawa	10	6295	115	2950	11700	1141
Lech Poznań	9	1944	67	2386	7047	1366
YouTube						
Raków Częstochowa	29	221	24	84	419	89
Legia Warszawa	10	874	41	119	1000	654
Lech Poznań	12	703	37	2386	7047	1366
Meta						
Raków Częstochowa	73	347	21	581	2900	73
Legia Warszawa	53	778	27	885	536	0
Lech Poznań	83	609	31	1024	7000	90

Source: Own compilation based on data from social media of Ekstraklasa S.A. clubs.

In the first approach (Table 3), three leading football clubs were studied - Polish Champion Raków Częstochowa, Legia Warsaw, and Lech Poznań. Despite the similarity of the message, the most effective club in social media is Legia Warsaw with a standardised μ-index of 0.60. The next club is Lech Poznań (μ = 0.38), and the last is Raków Częstochowa (μ = 0.22). The calculated standardised indices therefore show a very large difference between the use of opportunities by the clubs studied.

The second approach (Table 4) considered social media (Instagram, TikTok, Youtube, Meta) and the differences in their use in the communication strategy of the indicated clubs (number of posts) and the effects of their use (number of reactions and comments). The results of the calculation of the standardised development index indicated that Instagram and TikTok are the most effective in July 2023 (μ = 0.66 and μ = 0.57 respectively). In third place is Meta (μ = 0.35) and the least effective is YouTube (μ = 0.17). Significant differences can be observed between these groups, which allow us to conclude that short forms of communication that do not require a lot of time and commitment are increasingly important for active audiences.

The results of the calculations are presented in Table 3 and Table 4 and the calculated indicators show that, despite significant similarities between the communication strategies of the leading Ekstraklasa S.A. sports clubs, there are significant differences in the effects of social media activities. This is probably influenced by the size of the centres' tradition of being active in the media by fans. However, the research focused on two approaches. The first is the approach from the competitive side between clubs and the second is the effectiveness of individual social media.

Table 3.

Synthetic development indicator for Ekstraklasa S.A. clubs in terms of social media

	Social media of sports clubs													
	Instagram			TikTok			YouTube			Meta				
	number of posts	median of reactions	median od comments	number of posts	median of reactions	median od comments	number of posts	median of reactions	median od comments	number of posts	median of reactions	median od comments	sum of indicators d	synthetic development index μ
Raków Częstochowa	62	4313	9	23	2473	75	29	221	24	29	221	24	15,58	0,22
Legia Warszawa	53	5244	39	10	6295	115	10	874	41	10	874	41	8,03	0,60
Lech Poznań	192	1185	13	9	1944	67	12	703	37	12	703	37	12,36	0,38

Source: Own compilation based on data from social media of Ekstraklasa S.A. clubs.

Table 4.

Synthetic development index for social media in terms of selected Ekstraklasa S.A. clubs

	Sport clubs										
	Raków Częstochowa			Legia Warszawa			Lech Poznań				
	number of posts	median of reactions	median od comments	number of posts	median of reactions	median od comments	number of posts	median of reactions	median od comments	sum of indicators d	synthetic development index μ
Instagram	62	4313	9	53	5244	39	192	1185	13	8,61	0,57
TikTok	23	2473	75	10	6295	115	9	1944	67	6,85	0,66
YouTube	29	221	24	10	874	41	12	703	37	16,56	0,17
Meta	73	347	21	53	778	27	83	609	31	13,05	0,35

Source: Own compilation based on data from social media of Ekstraklasa S.A. clubs.

The results of the research indicate that an image (Instagram) and a short, mostly entertaining video (TikTok) are increasingly important to social media audiences, while forms that require more attention and sometimes even more engagement are less and less important. Further research, more extended by qualitative analysis or quantitative analysis based on other factors, also offers great research opportunities.

5. Discussion

The research has shown that with the method used, it is possible to measure the effects of communication by showing differences in the effectiveness of different clubs on social media and differences between these media.

The aim of the article was to create a tool to measure the effects of communication. In this case, the subjects of the study were the leading football clubs playing their matches in the top division - Ekstraklasa SA. The research shows that the use of social media by the currently strongest sports clubs is changing. Each media has a different use in the club's communication. The result is a different management of these media. The research shows that over time there is a shift away from static media (YouTube, Meta) in favour of flexible and fast media (Instagram, TikTok). Further monitoring using the methods used here will help confirm such a trend.

Noteworthy in the article is the statistical method used for the first time in Poland by the Author of the article. It is the result of research into the effectiveness of social media activities. While the topic has been addressed by other Authors, this is the first time in sport that the statistical method of synthetic development index has been applied in Poland. Much of the research to date has focused exclusively on content, a qualitative approach. This article shows that this can be deepened by quantitative capture and the use of statistical methods.

The use of these statistical methods makes it possible to continuously monitor the ranking in cyclical studies based on the same factors in other periods. By calculating the synthetic development index, you can determine your place in the competition and also manage your communication by modifying your online activities. In this way, specific, mostly ineffective actions can be taken, modified or not taken.

An additional aim of the article was to create a tool to measure the effects of communication. In this case, the subjects of the study were leading football clubs playing their matches in the top division - Ekstraklasa S.A.

As a result of the research, it was shown that in addition to ad hoc results, the research method can be used as a basis for comparing communication management activities in social media. The statistical method used can also be used to measure the effectiveness of reaching and communicating with stakeholders. It should also be noted that the acquisition of competitor

data can be done using specific algorithms (scraping), which is simple and only requires periodic reprogramming of the data.

Among the advantages of the method are:

- high flexibility in the use of data sets,
- possibility to compare one's communication policy with similar actors,
- the possibility of systematic monitoring of the effectiveness of communication activities over different time intervals,
- the ease of obtaining data, which are publicly available and there is the possibility of automating the system of their acquisition,
- ease of application of the method to other forms of online communication activities,
- the possibility of comparing the effectiveness of other social media.

The drawbacks of the method, on the other hand, are the difficulty in selecting data relevant to the identified problem and the high variability of the studied environment. The researcher must have specific objectives in mind. Depending on what is to be investigated, specific data can be substituted, while maintaining the principles of logic, representativeness and objectivity. Thus, this method can be used in sports clubs when studying communication, their sporting effects, factors influencing attendance, etc.

There is no phenomenon of increased competition in the sports club market. The method used in the article provides an opportunity to compare one's communication policy with similar entities.

In applying the method, it is important to use variables that are relevant to the problem and to recognise the variability of the environment. For communication management, it is worth mentioning that during the off-season, interest in a sports club used to be much lower than during games (Kowalski, Łazorko, 2020). This is now changing and social media management is a year-round job.

The method used is an attempt to fill a research gap and can be successfully applied to manage the way sports clubs communicate with their environment, to use the free tools available online effectively. The need to use them more effectively stems from the fact that the internet is not so much about being on the internet, but about directing attention to the information desired by communication managers.

In further steps, an attempt should be made to improve the method by automating it (Web scraping tools) and incorporating it into an automated application that allows for the ongoing analysis of the effectiveness of individual activities. Through research, in the future, a tool can be obtained for modifying one's activities and adjusting to the competition (benchmarking).

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CHANGES IN THE MANAGEMENT OF HEALTHCARE FACILITIES IN THE TIME OF COVID-19 PANDEMIC ON A SELECTED EXAMPLE

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Purpose: The aim of the article is to answer the question whether the COVID-19 pandemic, which began in China and spread around the world at the beginning of 2020, has affected the management of healthcare facilities. An example of such a change in strategic and operational management, especially in the field of patient service and rules related to personnel management, is JST Sp. Z o. o. CM Klara in Częstochowa.
Design/methodology/approach: The study was based on a purposive, pilot study. The survey tool was a questionnaire. Contact with the facility took place by e-mail correspondence and direct meetings with the management of the facility. The Supreme Audit Office's (NIK) report on the functioning of hospitals in the COVID-19 pandemic was analysed.
Findings: The study can serve as a small contribution to the development of rules for the conduct of healthcare facilities in the event of a pandemic or other global health threats. On the basis of the study, it was possible to identify areas that require special attention, places in the management of the facility that are bottlenecks and elements that are well adapted to the fight against the pandemic.
Research limitations/implications: The study in its current form is a pilot study. In the future, this study could apply to both Polish and other countries affected by the COVID-19 pandemic in order to develop general rules of conduct in the management of facilities in the era of pandemic threat.
Practical implications: An extended study could help to develop general rules of conduct for the management of healthcare facilities in the era of pandemic threat.
Social implications: A well-managed healthcare facility, especially at a time of enormous challenge such as the pandemic, can significantly contribute to saving the lives and health of many people, preventing the spread of the pandemic, limiting its impact on medical staff and educating the population related to the fight against the pandemic.
Originality/value: The issue related to the management of healthcare facilities in the era of the COVID-19 pandemic is a unique issue. It can be particularly helpful for managers of health care facilities as well as for the state authorities to which these facilities are subordinate.

Keywords: Healthcare facilities, management, pandemic, internal marketing, medical staff, patients.

Category of the paper: Research paper, case study.

1. Introduction

The COVID-19 outbreak began in Hubei Province, China, Wuhan City on November 17, 2019, in early 2020 and spread worldwide (WHO, 2020a). On March 11, it was declared a pandemic by the World Health Organization (WHO) (WHO, 2020b). SARS-CoV-2 infections have been recorded in Poland since 4 March (Ministry of Health, 2020). On 13 March, the WHO reported that Europe is considered to be the epicentre of the coronavirus pandemic (Puls Medycyny, 2020). The patients have been registered on all continents except Antarctica.

From 14 to 20 March, a state of epidemic emergency was in force in Poland, and from 15 March a sanitary cordon was introduced at Poland's borders, significantly restricting border traffic (gov.pl, 2020). From 20 March 2020 to 01.07.2023, an epidemic state was in force in Poland, according to a regulation of the Minister of Health. (Nocuń, 2023) This involved a number of restrictions on both citizens and businesses, cultural institutions, sports, science and higher education, health care. These restrictions were introduced or lifted depending on the epidemic situation in the country. The pandemic affected all areas of human activity. These elements further complicated the management of treatment facilities. Treatment facilities, in order to operate correctly in the current market, must apply marketing and market principles to become competitive in the area of health services (Bukowska-Piestrzyńska, 2009). Proper management seems to be one of the factors that allows to increase the quality of patient service and raise the internal satisfaction and motivation of employees (Mruk, 2009). The directions of management of medical establishments, which they should follow, are indicated by J. Holub in his publication (2001). This is based on general marketing and management principles taking into account the specifics of the sector. Issues related to the management of healthcare facilities have been addressed by, among others, Ph. Kotler, pointing to the specificity of operations and the need to provide value for patients (Kotler et al., 2002), M. Kautsch, M. Whitfield, J. Klich (2001), presenting a classic approach to management and emphasising the specificity related to the saving of health and human life by these facilities comprehensive study of management issues concerning the operation of health facilities especially on the Polish market is proposed by A.K. Kaplinski, M.R. Łysiak, T.S. Pięcińska (2001). Among foreign authors, apart from Ph. Kotler, we can mention D.N. Lombardi, J. Schermerhorn Jr., K. Neckermann (2017), describing the management of human resources in health facilities, delivery system, financing. L. Swayne, W.J. Duncan, Ginter (2017) in their publication describe health facility management from the perspective of strategic management, the introduction of appropriate organisational development strategies and their development. A practice-based approach to managing healthcare facilities including leadership, organisational culture, financial management, facility IT and the healthcare system is described by K. Darr and J. Walker (2015). The above publications are concerned with operating under normal market conditions.

During the pandemic, strategic and operational management was disrupted by additional requirements imposed by the supervisory authorities and the very fact that the epidemic required an innovative approach to the management of medical facilities, especially in terms of patient care and staff policy. The issue of strategic and operational management during a pandemic can be considered crisis management. This aspect of management has been dealt with, among others, by K. Andruszkiewicz (2007), B. Buzowska (2008) pointing to problems associated with the commercialisation of health services. K. Holla, J. Ristviej, M. Titko (2018), described the phenomenon of crisis management. A specific approach of crisis management is presented by D. Lamond (2004). On the Polish market, crisis management is described by J. Ziarko, Walas-Trębacz (2010).

Publications on the management of healthcare facilities in the era of the COVID-19 pandemic are still few and concern mainly the situation outside Poland. This issue has been described, among others, by L. Latts, C. Edwards (2021) presenting leadership during a pandemic, communication, crisis management, and decision-making Patient safety, telemedicine, and labour management during the pandemic were addressed by P. Lawrence, C.D.A. Asch, K.A. Kyanko (2021). The analysis of the topic reveals research gaps regarding the operation of healthcare facilities in Poland during the pandemic. In particular, they concern:

- Areas of operational and strategic management of a healthcare facility requiring special attention.
- Elements of the management of healthcare facilities in the field of operational management that are "bottlenecks".
- Elements of operational management introduced during the pandemic that improve the operation of the healthcare facility also in non-pandemic times.
- Elements of management that are the responsibility of the institution and elements independent of it.
- Factors hindering the introduction of changes in the management of the facility.

The above issues are intended to answer the question of whether the COVID-19 pandemic, which began in China and spread around the world at the beginning of 2020, has affected the management of healthcare facilities. As an example of such a change in strategic and operational management, especially in the field of patient service and principles related to personnel management, CM Klara in Częstochowa was presented.

2. Methods

To analyze the adaptation of the rules of management of a healthcare facilities to the challenges posed by the COVID-19 pandemic, an interview was conducted using a questionnaire. The questionnaire consisted of 31 open-ended questions. Due to the clearly

defined objective, thematic scope as well as time and budget constraints, the study was based on a non-random, targeted study with a choice of typical units. Inquiries were sent to healthcare facilities regarding their willingness to participate in the study. The study was voluntary. Contact with the facility took place by e-mail correspondence, a meeting with the management of the facility took place. In addition, when developing the research tool, the report of the Supreme Audit Office on the functioning of hospitals was analyzed. This report was also referred to in case of possible applications. The survey was participated by the selected healthcare facility that answered the questions on time. In addition, while developing a research tool, we analyzed the report of the Supreme Audit Office on the functioning of hospitals in the conditions of the COVID-19 pandemic. The study was a pilot study.

3. Results

The survey was conducted at the turn of June and July 2023. This study is a pilot study. Earlier, letters were sent to healthcare facilities asking for the possibility of conducting the survey. the existence of hospital care outside the outpatient care in the facility was the selection criterion. Of the 7 inquiries sent, two institutions responded positively. The others did not express a willingness to participate in the study. Ultimately, the study was carried out in one facility, which has an established position in the Częstochowa market. The study concerns ex-post activities and its main task is to look at whether the actions taken were optimal, what should be improved in the future, and how to prepare for possible further management problems related to the pandemic. The examined healthcare facility is JST Sp. z o.o. The facility was established in 2012. In Częstochowa, it offers two places where it provides services. The scope is 42 specializations, both outpatient and part of hospital services. On the website of the institution you can get acquainted with the mission and values of the institution. They are:

- Our mission is to provide patients with full medical care.
- We provide the care of doctors and medical staff and various diagnostic methods.
- The patient is the most important for us.
- We pay attention to prevention and promotion of a healthy lifestyle (https://cm-klara.pl/o-nas/, 2023).

JST sp z o.o. is a private institution, and the general body is the Management Board of the company. 46 people are employed under a contract of employment. Other persons are employed on the basis of civil law contracts. The staff includes office workers, registration workers, nurses, doctors, and cleaning staff.

Employees have clearly defined competencies and tasks:

- Office workers are responsible for administrative and office services.
- Registration staff are responsible for handling the registration (arranging and supervising appointments, submitting documents, etc.).
- Nurses are responsible for providing medical services within the prescribed scope.
- Doctors are responsible for providing medical services within the prescribed scope.
- Cleaning staff responsible for maintaining cleanliness.

Each employee has clearly defined rights and obligations. At the same time, functional and substantive dependencies overlap. Unfortunately, the knowledge of those responsibilities in the field of facility management, through further training, is not deepened. Before starting, basic marketing research was carried out in the field of the market and demand for medical services. The main scope of medical services includes services in the field of specialist clinics, occupational medicine, rehabilitation, and planned hospital treatment in the field of orthopedics, general surgery, and neurosurgery. Patients of the facility are people from Poland and abroad. The facility has several contracts with insurance companies and institutions.

When marketing activities are analyzed, it may be observed that the company is running a profile on Facebook and Instagram, a website, and leaflets are available in the facility.

The announcement of the COVID-19 pandemic made it necessary to adapt the facility's performance to the applicable recommendations. The introduced changes included both actions imposed by the Ministry of Health and changes taken on the initiative of the facility's management. Elements of crisis management have been introduced, i.e. preventing the effects of the pandemic, preparing for it, adequate response and reconstruction after.

At the time of the announcement of the pandemic, staff were provided with personal protective equipment. After the advent of COVID-19 testing, screening tests were introduced for all employees. After the COVID-19 vaccine appeared, staff were allowed to get vaccinated (first). Procedures for employees were agreed upon and implemented. Employees were trained in this area. In relation to patients, questionnaires regarding the current state of health and control body temperature measurements were introduced. In the hospital part, mandatory screening tests for patients planned for admission and a prohibition of visits were introduced. The facility has been equipped with air filters, bactericidal lamps, and air ozone generators as well as generally available dispensers with disinfectant. Glass covers were installed at the registration stations. Social distancing rules have been applied. Isolation has been set up for people suspected of being infected with coronavirus.

Some of these actions were imposed by the Ministry of Health:

- equipping employees with personal protective equipment,
- possibility of vaccination against COVID-19,
- the use of social distancing,
- equipping the facility with publicly available dispensers with disinfectant,
- no visitors allowed.

Activities carried out on the initiative of the Management Board of the facility:

- screening tests have been introduced for all employees,
- procedures for employees have been prepared and implemented- questionnaires on the current state of health were conducted as well as control body temperature measurements for patients using the services of the facility,
- in the hospital part, mandatory screening tests for patients planned for admission and a prohibition of visits were introduced,
- healthcare facility has been equipped with air filters, bactericidal lamps, and air ozon generators,
- glass covers have been installed at the desks,
- isolation has been set up for people suspected of being infected with coronavirus.

The management of the facility wanted to maintain the continuity of services provision while maintaining the safety of employees and patients.

Among the special management decisions addressed to staff, apart from establishing and implementing procedures for employees, equipping them with personal protection, testing, and the possibility of vaccination against COVID-19, social distancing rules were applied, remote work (medical tele counseling) was introduced and employees were separated without mixing shifts.

As the biggest organizational challenge of the pandemic period, the facility points to maintaining the continuity of service provision while maintaining the safety of employees and patients. Fortunately, the premises – a relatively new building built especially to fulfill the requirements of a healthcare facility, according to the latest standards – allowed to ensure this safety.

Factors hindering operations during the pandemic include a lack of availability of disinfectants and personal protective equipment, and the high price of these products. These elements were beyond the possibility of control by the facility. However, they were one of the bottlenecks of management. Another significant problem pointed out by the manager and threatening the continuity of the facility's operation was employee absenteeism resulting from the need to stay in quarantine or SARS-Cov-2 infection. In addition, at the beginning of the pandemic, there were no clearly defined recommendations on how to organize work and deal with patients. This problem has been solved as the pandemic has developed, also thanks to the close exchange of information between such institutions in Poland and abroad, as well as the implementation of government recommendations.

From patients, the employees of the facility had to face a lack of understanding regarding the restrictions introduced applied. During the pandemic, the facility provided medical services all the time, with the exception of the first 14 days of the pandemic, in which it was preparing to increase the safety of employees and patients and waiting for guidelines from the Ministry of Health. That can definitely be indicated as a major success.

The facility made optimal use of resources thanks to a professional operating system that applied best practices.

4. Discussion

Comparing the above results of the survey with the results obtained by the Supreme Audit Office (NIK) in the audit report "Functioning of hospitals under the conditions of the COVID-19 pandemic" (NIK, 2022), it should be noted that especially external factors, independent of the institution, coincide with the results of the NIK audit. According to the NIK report (NIK, 2022, p. 5), the main problem was:

- lack of personal protective equipment for medical staff and patients,
- disinformation related to changes in the organization of work of the health care system (…),
- quarantine of medical staff of healthcare entities,
- change in the organisation of work of wards and outpatient clinics,
- restrictions on planned treatment, cancellation of consultations and examinations requiring the patient's personal appearance.

The recommendation on the management of COVID-19 patients was not published until the end of April 2020. It was a detailed study of the data available at that time, prepared with the participation of Polish specialists (NIK, 2022). Until that time and later, healthcare facilities developed their own schemes of conduct, often exchanging solutions on the Internet. The examined facility also operated in this way. Her undoubted success is the development of such a scheme of action that allowed her to function uninterruptedly during the pandemic.

According to the NIK report, the managers of all audited healthcare entities tried to adjust the organisation of work as well as the premises and sanitary conditions in order to ensure the safety of staff and patients. Due to its modern building and high standards of premises, the surveyed facility did not have any major problems with providing this type of activities. NIK points out that in many cases there were significant architectural barriers. Staff and patients were also not tested for the SARS-CoV-2 virus everywhere. Due to the fact that the examined facility is a non-public facility, it is likely that all patients admitted to the ward as well as medical staff were tested there. The requirements of contracts with the National Health Fund did not apply in the examined facility. The above comparison of the research results confronted with the NIK report concerns the specificity of the Polish market.

In the article by E.K. Hossny et al. (2022) indicate similarly to the results of the study, saying that crisis management requires the integration of three levels: strategic, executive and operational, which gives coordination between institutions, optimal use of resources through

a professional operating system applying best practices, and the support and presence of many opportunities and local factors thanks to which it is possible to act quickly and effectively. Quoting their research results, it can be confirmed, as well as the manager of CM Klara, that the biggest challenge was to ensure the continuity of operation of health care facilities, and it was associated with problems related to staff absenteeism caused by quarantine and infections, as well as a temporary lack of personal protective equipment for medical staff and patients. This problem is also confirmed by other researchers, including N. Mattew and colleagues (2021).

Another problem related to disinformation related to changes in the organization of the work of the health care system, raised by the facility manager and included in the NIK report, was also pointed out by foreign authors (Mattew, 2021; Cinelli et al., 2020) as well as national (Adamczyk, Maison, Jaworska, 2021). Changes in the organization of hospital wards and outpatient clinics, as well as restrictions on planned treatment, cancellation of consultations and examinations requiring the patient's personal appearance, which were reported in CM Klara, were also indicated by authors in other countries: S. Conti, P. Ferrara, C. Fornari (2020). The problem of tele medical advice was addressed by R.P. Gupta, A. El-Mohandes (2021).

An issue that appears in the literature related to the COVID-19 pandemic, and not addressed in the study, is the management of the drug among medical professionals. This problem was also not reflected in the NIK report. However, this type of problem can significantly affect the operations of the facility. This topic has been addressed by m.in. T. Shanefelt, J. Ripp, M. Trockel (2021) and I.J. Labrague, J.A.A. De los Santos (2020). As you can see, it needs to be further developed in the future with regard to facilities in Poland.

However, looking at the above list, it can be presumed that there is a possibility to develop a model for managing healthcare facilities in a pandemic situation, which can be applied in many countries.

5. Summary

Undoubtedly, the COVID-19 pandemic has changed the management of healthcare facilities. This is confirmed by the author's own research, as well as the report of the Supreme Audit Office and available studies from other countries. One of the biggest challenges of that period was, and perhaps still is, ensuring the continuity of medical services while ensuring the health safety of employees and patients. A comparison of the NIK report and the research shows that non-public institutions not burdened with a contract from the National Health Fund had greater opportunities to flexibly adapt to the requirements of the pandemic. However, both were affected by external factors beyond the control of the facility, i.e. shortages related to personal

protective equipment, tests, etc. The next big problem was the attitude of the patients to the actions taken. It wasn't always an attitude of acceptance.

Summarizing the results of the research and the literature review, the following areas of strategic and operational management that required special attention can be indicated:

- changing the strategy to a crisis management strategy,
- introduction of changes in the organization of work,
- the need for strict procedures to protect patients and staff,
- introduction in the areas of operation of assistive devices,
- the use of telemedicine and remote work,
- When the vaccine became available, it was available,
- trainings were conducted.

A number of measures that were implemented during the pandemic in the surveyed facility have been introduced on a permanent basis, i.e. generally available hand disinfectants, organization of registration desks, a separate isolation room, the use of devices ensuring disinfection and filtration of air in rooms. Unfortunately, this study is only a small part of the area that is interesting to study from a scientific point of view. As far as the innovativeness in the approach is concerned, it is possible to point to the topic of management in Polish health care facilities and the desire to point to the possibility of creating a full, universal model of conduct of this type of facilities in the world in the future. The available literature contains only excerpts from the management of a health care facility and does not treat the issue comprehensively. In the future, this pilot study should be expanded to include a much larger number of healthcare facilities. This study could cover both Polish and other countries affected by the COVID-19 pandemic in order to develop general rules of conduct in the management of facilities in the era of pandemic threat. This approach seems to be the right one, because according to the WHO's predictions, we can expect more pandemics in the near future, and drawing on the experience of the past ones will allow us to avoid the undoubted mistakes and chaos that appeared at the beginning of the pandemic.

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RESOURCES AND ORGANIZATIONAL RESILIENCE

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Purpose: Identification of internal resources and their role in the generation of organizational resilience.
Design/methodology/approach: The study was based on a systematic review of the subject literature regarding organizational resilience, with particular focus on the issues of internal resources in the context of resilience.
Findings: The information contained in this study allows concluding that resilient organizations are those which appreciate the role of resources and invest in them so that they can be used in a crisis. The authors emphasize that an organization's ability to restore or resume critical functions is highly dependent on their resources.
Practical implications: The study can provide guidelines for entrepreneurs, enabling them to better prepare their entities to cope with a dynamic and dangerous market. The ability to build organizational resilience increases the chance of effective functioning in the event of various threats and crises.
Socials implications: Identification of resources important for organizational resilience is a crucial aspect in social and economic matters. Practical use of this knowledge may affect the stability of many entities, and, in consequence, the stability of their workers' employment.
Originality/value: This paper provides a synthetic overview of organizational resources in the context of resilience, which contributes to a better identification of resources important from the point of view of organizational resilience by identifying and highlighting the multiplicity and variety of resources that determine resilience as well as their potential areas of influence.

Keywords: organizational resilience, resources, adaptation.

Category of the paper: Viewpoint, Literature review.

1. Introduction

Resilience is the capability of a system or society exposed to threats to adapt to a new situation by resisting or making changes in order to maintain an acceptable level of functioning (United Nations, 2005). Nowadays, this concept is of key importance as it represents a new

approach to studying and dealing with potential threats and their effects. Current research on resilience is seeing a shift towards an internal perspective and shock prevention (e.g. Khlystova et al., 2022; Linnenluecke, 2017), whereas resilience in previous investigations was mainly seen as a form of reaction to external threats and shocks (Forliano et al., 2023; Soluk et al., 2021). It is emphasized that resilience may concern not only the restoration of organizational functionality, but also the improvement of organizational processes and the creation of new competencies (e.g. Duchek, 2020; Fietz, Hillmann, Guenther, 2021; Waerder et al., 2021).

In the literature, both world and Polish, one can find numerous studies on resilience (including Kahn et al., 2018; Buyl, Boone, Wade, 2019; Olekalns, Caza, Vogus, 2020; Ingram, Bratnicka-Myśliwiec, 2019; Sienkiewicz-Małyjurek, 2020). However, resilience is such a complex and ambiguous concept that there is still no consensus with regard to the basic definition or determinants of the phenomenon of resilience. This allows for further exploration of this issue.

This paper is focused on internal resources in the context of resilience. The authors have attempted to identify resources that are important for resilience and their role in the process of building organizational resilience. To achieve this specific goal, the study was based on a systematic literature review.

Although literature reviews on resilience are already available on the market (e.g.: Linnenluecke, 2017; Saad et al., 2021; Ingram, 2023), this approach can be considered justified due to the continuous development in the field of resilience and the possibility of using a specific approach, which in this case is the perspective of resources.

2. Organizational resilience and resources - a systematic review of the literature

Organizational resilience is a strategic necessity for organizations if they want to thrive in a dynamic and ever-changing world. The ever-increasing interest in resilience and the determinants of its growth justifies continuous studies and the search for new knowledge in this area. This requires an analysis of the previous achievements described in the subject literature and justifies its systematic review.

For the needs of this study and more extensive research on various approaches to resilience undertaken at the Department of Enterprise Management at the University of Economics in Katowice, the subject literature was subjected to a systematic review. The review in the area of organizational resilience, taking into account categories of resources, was conducted in April 2023 on the basis of the Scopus and Web of Science (WoS) databases so as to find publications of the highest scientific value. For this purpose, the PRISMA Group methodology was applied (Moher et al., 2009). The conducted research process has been illustrated in Figure 1.

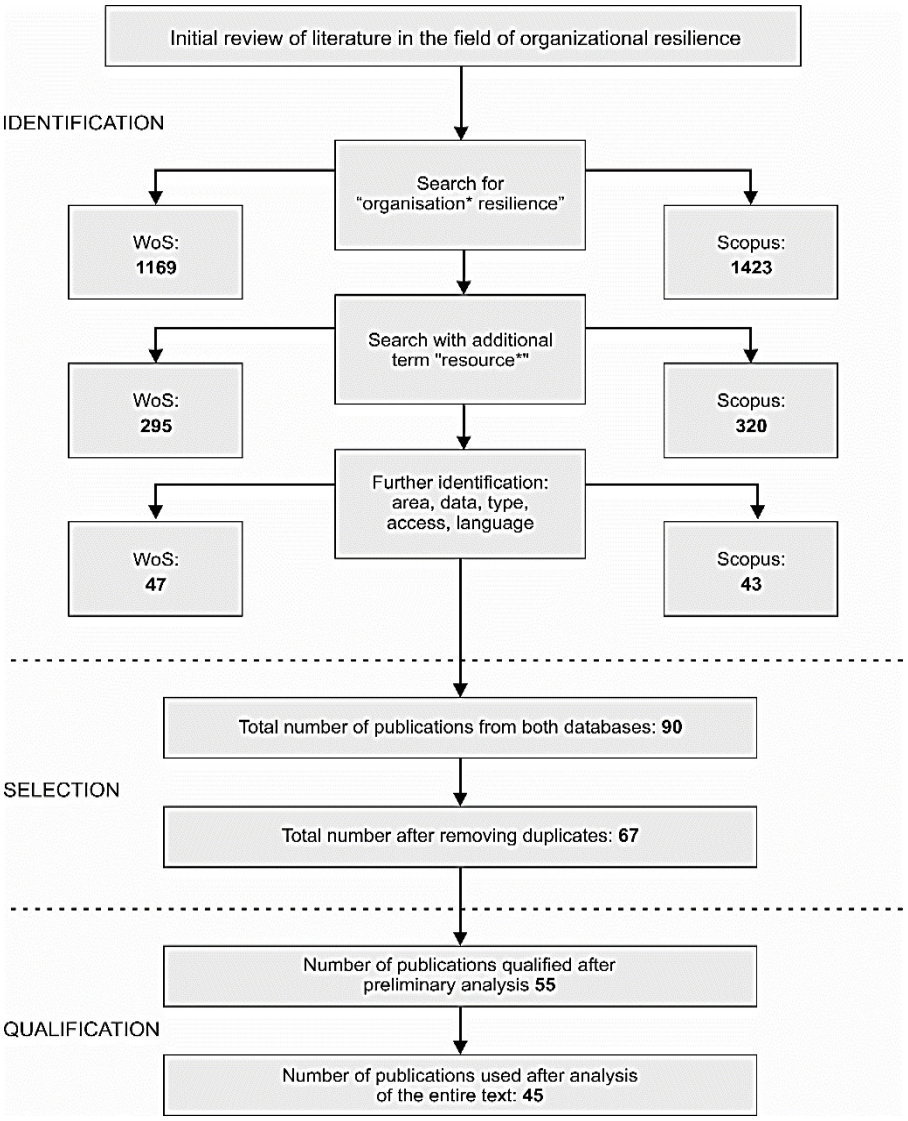

Figure 1. Research procedure applied.

Source: own study based on (Moher et al., 2009).

The initial search for the term "organisation resilience" returned 1,169 entries in the Web of Science (WoS) database and 1,423 in the Scopus (Sc) database. After the word "resource" was added, this number dropped to 295 and 320 items, respectively. In order to further narrow the list, other filters were used: to select articles related to the area of management and quality sciences, the number of studies subjected to analysis was reduced to those indexed in the field of 'Business, Management and Accounting' in the Scopus database, and in WoS - to the areas of 'Management' and 'Business'. In addition, publications since 2010, English-language texts, scientific articles and chapters of books in open access were included, which resulted in the identification of 47 items in the WoS database and 43 in the Scopus database. After excluding duplicate items, 67 publications were submitted for further analysis. A graphical presentation was prepared for this sample - a map of keywords, which is shown in Fig. 2.

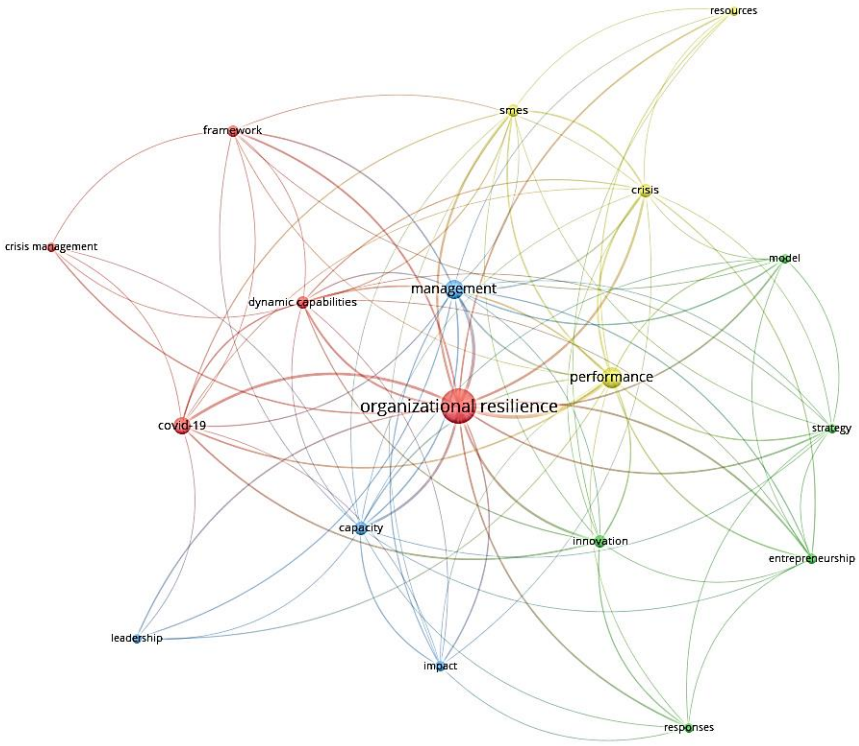

Figure 2. Map of key words in the articles subjected to analysis.

Source: own study based on the VOSviewer software.

It can be concluded from the chart that important issues for resilience researchers are management and performance (the latter especially in the context of SMEs). The role of capabilities, in particular dynamic competences and innovation, should also be emphasized. The chart indicates that the authors of studies are frequently interested in resilience in the context of the importance of entrepreneurship in crisis situations. In their publications, they also attempt to build theoretical frameworks for the phenomena subjected to analysis. The topic of resilience is the most often raised also in the context of crisis situations related to Covid-19.

The content of the diagram indicates that until present the authors have rarely dealt comprehensively with the category of resources in the context of resilience. The diagram includes elements of internal resources, such as: dynamic capabilities, innovations and proper management. Although there are studies in the literature that address the relationship between resources and resilience more broadly (Bostock, Breese, 2021), this topic has not yet been thoroughly analysed, which justifies the rationale behind the approach adopted in this study.

After taking into account the above considerations and the results of the preliminary analysis, i.e. the analysis of titles, abstracts and key words, the authors decided to leave 55 items on the list. Ultimately, this publication was based on 45 items considered to be of key importance (Table 1).

Table 1.
Summary of key publications regarding organizational resilience and internal resources based on a systematic literature review

No.	Source	Goal	Research methodology
1.	Adamides et al. (2022)	Demonstrating how the Viable System Model and the VIPLAN method can be used for strengthening organizational resilience with regard to dynamic climate change through design and organization that enable continued resilience owing to adaptation	Qualitative research (action research)
2.	Aitken-Fox et al. (2022)	Answering the question how organizations (and in particular professionals in HR departments, managers and leaders) made sense of the COVID-19 crisis, took decisions and developed appropriate responses of the organization and the HR department during the pandemic	mixed research (interviews, managerial narratives, survey in the initial phase)
3.	Al-Ayed (2019)	Exploring the impact of strategic human resources management on resilience	quantitative research (survey)
4.	Anwar, Coviello, Rouziou (2021)	Answering the following questions: does having resources in the form of individual resilience and cross-functional coordination make young ventures resilient, and does organizational resilience affect the performance of young companies during a crisis?	quantitative research (survey)
5.	Appiah, Amankwah-Amoah, Liu (2022)	Development of the conceptual model of organizational resilience architecture	conceptual article + case study
6.	Audretsch, Belitski (2021)	Conducting a theoretical discussion and empirical tests, firstly, of the extent to which the interaction between managerial, strategic and operational knowledge facilitates the company's performance, and, secondly, of the role which organizational resilience plays in the relationship between the interaction of knowledge domains and company performance	quantitative study
7.	Bostock, Breese (2021)	Answering the question of how organizational resilience can best be conceptualized theoretically for sports management research and practice	conceptual article + case study
8.	Branicki, Steyer, Sullivan-Taylor (2019)	Inductive theorizing about the relationship between individual and organizational resilience	conceptual article + case study (semi-structured interviews, non-participant observations, focus groups)
9.	Burnard, Bhamra, Tsinopoulos (2018)	Empirical exploration of organizational processes at the beginning of disruptions and exploration of factors that determine different configurations of resilience building	qualitative research (interviews, observations, documentation analysis)
10.	Buyl, Boone, Wade (2019)	Answering the question about the role of CEOs (and, in particular, their greed and recklessness) and corporate supervision in the shaping of banks' resilience in the face of shocks caused by crises	quantitative research
11.	Cappelen, Pedersen (2021)	Answering the question of how time orientation shapes processes of constructing organizational identity	case study
12.	Conz et al. (2022)	Addressing the question of how entrepreneurs respond to and build organizational resilience in a crisis environment	case study

Cont. table 1.

13.	Duarte Alonso, Kok, O'Brien (2020)	Answering the questions of how Spanish winery owners perceive the impact of Brexit on their operations, how Spanish winery owners responded to minimize the impact of Brexit and how they built the resilience of their organizations	case study
14.	Eriksson, Heikkilä, Nummela (2022)	Answering the question of how SMEs with international growth strategies introduce innovations to their business models so as to increase organizational resilience	case study
15.	Fietz, Hillmann, Guenther (2021)	Answering the following question: which (and how) cultural dimensions influence organizational resilience	quantitative research
16.	Forliano et al. (2023)	Examining the impact of a company's technological orientation on its resilience to Covid-19, while considering the maturity of the company's digital strategy as a mediator of the relationship between the company's technological orientation and resilience to Covid-19	quantitative research
17.	Gerschberger Melanie, Ellis, Gerschberger Markus (2022)	Building and enriching the theory in the area focused on how individuals contribute to resilience	qualitative research
18.	Hoegl, Hartmann (2021)	Determining challenges in resilience research	conceptual article
19.	Huang, Xing, Gamble (2019)	Understanding the factors that determine employees' well-being (Chinese retail) in the context of resilience. Analysis from a gender perspective.	quantitative research (survey)
20.	Hung et al. (2022)	Demonstrating the usefulness of the Lean Daily Management System (DMS) method in medical institutions for responding to threats and crises	qualitative research (semi-structured interviews)
21.	Kahn et al. (2018)	Developing a theoretical model that maps how social processes occurring in parts of an organization influence its members' responses to adversity and, ultimately, how they influence organizational resilience	conceptual article
22.	Kennedy, Linnenluecke (2022)	Development of research on circular economy, proposing a research agenda that links circular economy with resilience at multiple levels	conceptual article
23.	Kim et al. (2022)	Summary of research on the role of human resources management in the era of environmental disruption, as well as identification of problems and directions for further research and practical implications	conceptual article
24.	Lee et al. (2022)	Presentation of the impact of global talent management in international corporations on the organizational resilience of domestic subsidiaries during a crisis and discussion of their practical implications	quantitative research
25.	Manab, Aziz (2019)	Research on the moderating effect of knowledge management on the relationship between critical SRM (Sustainability Risk Management) factors and company survival among the listed companies (PLCs) in Malaysia	quantitative research
26.	Mihotić, Raynard, Sinčić Ćorić (2023)	Development of theoretical understanding of how family businesses cope with unexpected and highly disruptive events by examining how family resilience capacity is transformed into organizational capacity in various ways	case study
27.	Minbaeva, Navrbjerg (2023)	Initiating the process and focusing future research on strategic human resources management (SHRM) in the context of environmental crises	qualitative and quantitative research, interview and survey
28.	Mitsakis (2020)	Creating the foundations of the concept of Human Resources Development (HRD) in the context of resilience so as to initiate a dialogue on its ability to make a significant contribution to organizational resilience	conceptual article

Cont. table 1.

29.	Njuguna, Maingi, Kiria (2021)	Examining the role of HRM practices in the process of shaping organizational resilience	quantitative and qualitative research
30.	Ozanne et al. (2022)	Identification of social capital (SC) and dynamic capabilities (DC) as determinants of resilience	survey research, partial modelling of structural equations
31.	Pham et al. (2021)	Conceptualization of the role of social networks in the building of resilience to disasters and crises in hotel and tourist companies	conceptual article
32.	Reyes et al. (2021)	Identification of leadership behaviours important for the effectiveness of actions in crisis situations	conceptual article
33.	Rodriguez-Sanchez et al. (2021)	Analysis of the role played by corporate social responsibility in relation to employees (CSRE) in the promotion of resilience at work and of how resilience translates into organizational learning capacity (OLC) and company performance	quantitative research – survey, modelling of structural equations
34.	Roffia, Dabić (2023)	Demonstrating the impact of managerial control tools, of the availability of additional financial resources and of the use of integrated ERP systems on the organization's resilience	quantitative research - survey
35.	Sakellarios et al. (2022)	Identification of factors enabling micro- and small businesses to cope with the effects of a long-term crisis and developing a conceptual model	qualitative research and interview
36.	Santoro et al. (2021)	The aim of the article is to assess the impact of organizational resilience on the perception of entrepreneurship, including the presentation of the moderating role of stakeholders	quantitative research
37.	Simms et al. (2022)	Exploring the impact of effectuation and causality logic on the resilience of small and medium-sized enterprises in the face of disruption caused by Covid-19	case study
38.	Shepherd and Wiliams (2022)	Analysis of data regarding resilient organizations' response to the crisis of COVID-19 and proposing a model of the organisation's response paths leading to resilience	qualitative research
39.	Singh et al. (2022)	Analysis of literature in order to identify adaptive capacity in non-profit organizations and presentation of a conceptual framework for adaptive capacity in these organizations	conceptual article
40.	Soluk et al. (2021)	Explanation of adaptive and behavioural changes in family businesses responding to external shocks	qualitative research, interviews
41.	Stötzer et al. (2022)	Demonstrating resilience mechanisms (i.e. all types of resilient behaviours, resources and capabilities) that were helpful in overcoming the challenges of the pandemic	conceptual article and interviews
42.	Trieu et al. (2023)	Exploring how SMEs can use information technology (IT) to overcome crises, implement innovative ideas, adapt to changing conditions and take new initiatives	quantitative research
43.	Waerder et al. (2021)	Analysis and evaluation of the contribution of non-profit and private companies to the resilience of non-profit companies in the context of the refugee crisis in Germany	case study
44.	Zhou et al. (2022)	Taking into account the perspective of HRM as a basic factor influencing the building of organizational resilience, Developing a model for the assessment of how high-performance work systems build organizational resilience while taking into consideration the perspective of HRM as a basic factor influencing the process of building the organization's resilience	quantitative research
45.	Zighan et al.	Analysis of operational practices used by small and medium-sized enterprises to support resilience in the face of the Covid-19 threat	qualitative research, interview

Source: own study.

The analysis of the content presented in the finally qualified publications provided a basis for identifying resources important for resilience and their role in the process of building organizational resilience.

3. Organizational resilience - the essence

Organizational resilience is understood primarily through the prism of the organization's ability to cope with shocks (adaptation, persistence) and bounce back to the previous path after shocks caused by threats (e.g. Adamides et al., 2022; Branicki, Steyer, Sullival-Taylor, 2019; Buyl, Boone, Wade, 2019; Gerschberger, Ellis, Gerschberger, 2022).

The analysis of approaches to organizational resilience contained in the subject literature allows classifying it into two categories, i.e. 'rebirth' and 'precursor'. The first approach, which illustrates an organization's ability of responding to single threats so as to return to the previous situation, is reactive in nature. The second approach, which refers to the ability of getting used to changes and identifying new opportunities as part of a crisis event, is tantamount to a proactive response to new conditions (Mitsakis, 2020). Similarly, Lee et al. (2022) describe two different approaches to the problem of building organizational resilience, the first of which indicates the relationship between the resilience process and the return of an organization experiencing a disturbance to the equilibrium process. In the second approach, resilience is defined as a process of learning and adapting to current disturbances, as well as preparing for upcoming ones (Teo et al., 2017).

A 'resilient' organization is therefore understood as one being able not only to identify and respond to critical changes and potential threats, but also able to learn and introduce changes and innovations after a crisis situation has occurred (Duchek, 2020), and capable of looking for new opportunities in a crisis situation.

Moreover, organizational resilience is generally described as the organization's ability to anticipate, plan in advance and deal with unexpected potential events through the SRM (Sustainability Risk Management) approach so as to ensure the long-term survival of the company (Manab, Aziz, 2019, p. 587). The emphasis here is on the relationship between resilience and the long-term implementation of strategic assumptions. Zighana et al. (2022) describe organizational resilience as the ability to adapt to destructive threats in the short term in order to meet long-term needs.

From the psychological point of view, resilience is largely defined as individuals' ability to effectively cope and adapt in the face of loss, difficulty or adversity (Shin et al., 2012), which suggests appreciation of the role of human resources in creating organizational resilience (Huang, Xing, Gamble, 2019; Zhou et al., 2022). The definitions primarily emphasize the importance of competences, while the perception of organizational resilience emphasizes its

process side rather than its resultant side. For example, Anwar, Coviello, Rouziou (2021) perceive organizational resilience through the prism of competencies viewed as processes enabling the use of resources to gain a competitive advantage. There are also approaches that depart from this tendency. For example, Bostock & Breese (2021) define resilience as the ability to consistently achieve high results in relation to system goals in the presence of major stressors and over a given period of time, and do not refer to the survival and prosperity of the organization. Worth mentioning here is the fact that the concept of resilience is not only linked to specific threats, but it is also considered in the context of everyday situations (Branicki, Steyer, Sullival-Taylor, 2019).

The presented approaches to organizational resilience emphasize its dynamic and process-based nature. Such an approach is presented by some authors of research conducted in the area of organizational resilience (Kim et al., 2022). Williams et al. (2017) claim that it is a process of building the ability to interact with the environment and, then, using it in a way that ensures the functioning of the organization before, during and after the occurrence of a disturbance. As emphasized by Simms et al. (2022), resilience in the process approach includes a few phases: anticipatory adaptation, exposure, healing and reconstruction, and, next, calibration of the company's defence mechanisms.

The process approach is also intended to shed light on the cognitive, affective and behavioural mechanisms occurring in the face of difficulties, which may enable or prevent individuals from achieving a resilient outcome (Hoegl, Hartmann, 2021, p. 458). However, the process approach is considered in relatively few studies (Duchek et al., 2019)

It is important to draw attention to the specific nature of the perception of resilience, depending on the type of threats encountered by an organization (Kahn et al., 2018). Full-scale crises, natural disasters or attacks usually involve the entire organization, bringing all members together so as to face existential threats (James, Wooten, 2010) and support each other (Powley, 2009). However, such events are rare; more common, though less spectacular, are growing demands that pose the risk of losing the ability to satisfy them (Williams et al., 2017). In such cases, the main actor in the context of resilience is not the organization as a whole, but its individual parts and individual resources. Hence, some of the opinions emphasize the role of selected resources, e.g. Anwar, Coviello, Rouziou (2021) support the position that resilience is a set of competencies based on psychological capital (1st type of resource) and relational resources (2nd type of resource) that helps the organization respond to unexpected disruptions. In the case of the organizational resilience approach, (Conz et al., 2022), the reference to the concept of relational resources by Dyer and Singh (1998) becomes extremely important.

A review of the literature allows concluding that the studies conducted so far assume different contexts for the above considerations, but the specificity of a given context does not evidently affect the approach to defining the notion of resilience.

This article is not aimed at providing an in-depth review of the literature in order to define resilience, which has already been defined in many different contexts and fields, as demonstrated by numerous references to sources. The authors have merely attempted to present examples of various approaches, while referring to interesting issues related to the role of resources in the shaping of resilience.

4. Resources in the context of resilience

The role of resources in the shaping of resilience according to Adamides et al. (2022, p. 2) becomes visible in the recommendation that resilience to crisis events must be built across all assets/resources of the organization (human and non-human). Stötzer et al. (2022) emphasize that resources, in addition to resilient behaviours and abilities, referred to as resilience mechanisms (Hillmann et al., 2020), determine a flexible response to disturbances. Theoretical approaches include those that comprehensively consider the requirements and the role of individual resources in the process of building organizational resilience. For example, Bostock and Breese (2021) offer a theoretical framework based on the concept of organizational resource conversion (Bostock, Breese, 2021, p. 2), which can be applied to any organizational context (Bostock, Breese, 2021, p. 3). This concept is used to build a framework adequate to the adopted perspective, which requires that recommendations for organizational resilience be supported by an understanding of the relationship between organizational features, processes, and outcomes (Bostock, Breese, 2021). What seems to be particularly important in this respect is the need to ensure business model flexibility so as to enable organizations to adapt routines and processes in response to threats (Appiah, Amankwah-Amoah, Liu, 2022, p. 30). In the context of discussion about resilience considered against the background of the potential of an enterprise's resource conversion, Santoro et al. (2020) indicate that organizational resilience itself is an organizational resource mobilized in the event of disturbances. Chen et al. (2021) emphasize the need to consider it in five dimensions, i.e. in the capital approach (capability of serving the debt), strategic approach (product features), cultural (social) approach, relational approach (strengthening the bonds) and learning ability approach (Sakellarios et al., 2022). The above mentioned categories may provide a basis for the classification of resources which build the organization's resilience. The literature also indicates the need to consider resilience in the context of the involvement of stakeholders who offer resources of knowledge and social capital to the organization (Santoro et al., 2020). Stakeholders are therefore assigned the role of an important source of unique company resources. In their research, Shepherd and Williams (2022) have demonstrated that higher resilience is typically observed in organizations which possess significant resources (Lengnick-Hall et al., 2011) and decision-making processes characterized by an appropriate level of

flexibility (Rahmandad, Repenning, 2016), the ability to learn on a continuous basis as well as innovation and creativity (Dewald, Bowen, 2010). When considering the role of resources in the process of building a resilient organization, it should be emphasized that the organization's adaptive ability depends not only on having resources, but also on their skilful usage (Singh, Martins, 2022), which, in accordance with the dynamic approach to the resource theory, is determined by taking into account the mutual influence of resources and the ability to distribute them in an appropriate way (Trieu et al., 2023).

The presented approaches to organizational resilience frequently emphasize the significance of the human factor. It is stressed that at the most basic level, leaders and managers in organizations undergoing crisis must make sense of what is happening and respond as quickly as possible (the degree to which this happens can be conceptualized as resilience in action (Aitken-Fox et al., 2022, p. 3). What turns out to be important in response to a crisis is learning by doing, as different practices, policies and processes need to be tried, and HR professionals prove to be crucial for the performance of this task (Aitken-Fox et al., 2022).

The role of human resources management (in strategic terms - SHRM)[1] in the process of shaping the organization's resilience has also been positively verified in the study of Al-Ayed (2019) and Minbaeva, Navrbjerg (2023), as well as in the study of Kim et al. (2022). In addition to emphasizing the importance of investing in human resources and employee empowerment (as well as investing in the modernization of technological resources), Appiah, Amankwah-Amoah, Liu (2022) draw attention to the role of soft managerial skills (but also, e.g., to the use of external network resources and alliances). On the other hand, Adamides et al. (2022), while stressing the role of a quick response to threats, note that organizations should develop a number of capabilities, including anticipatory adaptation, impact absorption capacity, coping capacity, restorative capacity and adaptive capacity (Adamides et al., 2022, p. 5). J.Y. Lee, D. Yahiaoui, K.-P. Lee, F.L. Cooke (2022), drawing attention to the importance of the resilience building process, also emphasize the need to invest in time before destructive events occur, so as to prepare to overcome the problems (Linnenluecke, 2017). A particularly important role in the process of building the organization's resilience is attributed by the authors to the process of developing human resources and building the resilience of employees, which they consider crucial for creating organizational resilience (Lee et al., 2022).

In previous studies, the need for further research on the relationship between human resources management, employee well-being and resilience strategies (Lengnick-Hall et al., 2011; Linnenluecke, 2017) has been highlighted. There is also an area of new research exploring the development of human resources as a success factor in the shaping of organizational resilience (Mitsakis, 2020) and research on the general importance of HRM practices for shaping organizational resilience (Njuguna, Maingi, Kiria, 2021, Kim et al., 2022).

[1] SHRM has been defined as a model of planned deployment of human resources and activities aimed at enabling an organization to achieve its goals and determine its long-term survival (Minbaeva, Navrbjerg, 2023).

As regards the role of human resources in the process of shaping resilience, attention was drawn to another important concept, namely the relationship between corporate social responsibility (CSR) and human resources management (HRM). Traditionally, CSR and HRM have been considered independent disciplines. However, these two areas are interconnected due to their positive organizational effects for internal and external stakeholders. HRM research focuses primarily on the internal aspects of the company, while CSR is typically focused on external elements (environment, local community, etc.). Nevertheless, these two functions overlap (Rodríguez-Sánchez et al., 2021). CSR and HRM are related to ethical professional conduct towards employees and other stakeholders, which is referred to as the concept of corporate strategic responsibility towards employees (CSRE). Employee-oriented CSRE encompasses a set of 'good' HRM practices the aim of which is to demonstrate that a company recognizes the needs and concerns of its employees. HRM practices included in CSRE, such as flexible work organization, working teams or information exchange mechanisms, are intended to increase employees' internal motivation. In other words, such CSRE practices will have a positive impact on employee behaviour while promoting the atmosphere of resourcefulness in the organization (Rodríguez-Sánchez, Vera, 2015), which leads to increased organizational resilience.

Also knowledge is a special type of resource that can play an important role in creating organizational resilience. As regards organisation's resilience, it was among others found that the managerial component of knowledge (referring to the managerial understanding of structures and processes within the organization) is crucial for building the company's resilience to external shocks and making the company more agile so as to achieve better results and sales (Audretsch, Belitski, 2021). In particular, the knowledge of managers may help to define factors that threaten the organization. It allows managers to spot weaker signals, such as increasing differences in the results or growing anxiety among employees (Kahn et al., 2018). Such symptoms may constitute warning signals to be noticed in order to prevent a crisis and loss of resilience of the entire organization. In the discussion of knowledge, the role of knowledge management should also be emphasized, as it is also a strategic resource of the company, which supports better risk identification and mitigates potential future events, thus ensuring the company's survival (Manab, Aziz, 2019). In this context, it is also worth emphasizing the importance of effective management of talents (Lee et al., 2022), which create a resource of knowledge supported by unique abilities to apply it in practice.

As pointed out by Fietz, Hillmann, Guenther (2021), in the case of competencies important for survival, the following are also emphasized: the role of individuals and cognitive capability endowments, a strong sense of identity and purpose, behavioural capability endowments and relational capability endowments, including trust as an important intangible resource (Lengnick-Hall et al., 2011; Williams et al., 2017). The approach emphasizing the role of an individual is developed in the work of Gerschberger Melanie, Ellis S., Gerschberger Markus (2022). However, the general conclusions from the study allow assuming that organizational

resilience cannot be improved only through organizational competences, but also through the competences of individual employees (Gerschberger, Ellis, Gerschberger, 2022). According to Lee et al. (Ya, Lee, Coo, 2022), an important factor that supports the building of resilience is developing the resilience of the employees. It is therefore advisable to shape strategies of human resources development that take into account the impact of these resources on the level of organizational resilience (Lengnick-Hall et al., 2011). It has also been noted in the literature that certain leadership behaviours and traits are particularly important for maintaining the effectiveness of the organization in crisis situations (Reyes et al., 2021). They include among others: optimism, empathy and transparency, the ability to adapt to changing conditions and the ability to utilise relational resources.

Appiah, Amankwah-Amoah, Liu (2022) emphasize the role of appropriate organizational architecture, i.e. processes, people, structure but also culture, in the process of building organizational resilience. Hung and co-authors (2022), on the other hand, highlight the role of proper management in the building of resilience. They draw attention to the usefulness of the Lean Daily Management System (DMS) method for responding to crisis phenomena. The right approach of managers can help to implement appropriate management methods that support quick communication and coordination of actions, which are so important in situations of threat and uncertainty.

Resilience is sometimes also associated with the construct of organizational identity. Cappelen and Pedersen (2021) conclude among others that the organization's past is not only a strategic resource for constructing identity, but also a temporal anchor in which the organization can look for its goals and prepare for future change. They point out that their research shows enabling factors which the past provides for organizational resilience and survival. The researchers indicate that with a clear organizational identity, individuals will appreciate the organization and will be more motivated to engage in prosocial behaviour and cooperate with other groups (Kahn et al., 2018), which will help to strengthen organizational resilience. If only a group identity is developed (concerning some part of the organization), individual groups may compete rather than cooperate in their fight for resources. This situation may lead to a reduction in the resilience of the organization as a whole. Regarding the issue of cooperation, researchers Lee et al. (2013) in their resilience model drew attention to the importance of reducing the role of silos in the process of building adaptive capabilities (Singh et al., 2022). Silos, which are beneficial in the process of building commitment to a specific unit, may have a negative impact and reduce the level of internal cooperation with other teams. It should be emphasized that the effectiveness of internal cooperation is considered a determinant of building organizational resilience (De Waal et al., 2019; Singh et al., 2022).

Other internal determinants of organizational resilience include social capital (SC) and dynamic capabilities (DC). Research findings (Ozanne et al., 2022) show that social capital (SC) is a key resource that can be mobilized by an enterprise to use resources embedded in internal and external relationships so as to respond to disruptions, whereas DCs play a key

mediating role in the ability of enterprises to mobilize SC resources to increase their organizational resilience. Here, an important role is played by social networks, which are a key factor helping to revive micro and small businesses after external shocks by providing greater access to multiple resources (natural, physical, financial, human, social) (Pham et al., 2021).

Duarte Alonso, Kok, O'Brien (2020) emphasize that adaptive competences are represented by quickly available resources and have dynamic attributes. Competencies, which represent what a company can do, are strongly tied to resources and play a crucial role in the development of resilience. The categories listed by Mallak (1999) (vision, values, flexibility, empowerment, coping, connections), internal factors and resilience-enabling factors that have been presented in the discussed theoretical framework together with resources and combinations allow for the identification of different ways of building resilience, which include adding value, innovation, experimenting and organizational learning (Duarte Alonso, Kok, O'Brien, 2020; Flint et al., 2011).

Market threats prompted many companies to increase flexibility, which allowed them to reconfigure their business models adequately to the new situation (Mihotić, Raynard, Sinčić Ćorić, 2023). This theory is consistent with the approach presented by Eriksson et al. (2022), where building resilience is a dynamic process in which enterprises adapt their business models and reconfigure their resources in order to meet challenging market conditions in the future. Attention was also drawn to the key importance of digital competences. The study by Forliano et al. (2023) confirms that a strategic approach to digitalization is important, even in companies with a high level of technological orientation.

An issue that is particularly highlighted in research on resilience is the role of so-called slack resources for developing organizational resilience. It is obvious that the availability of additional financial resources provides an opportunity to take additional actions or obtain additional resources necessary for an appropriate response to crisis situations. However, mere possession of such resources does not guarantee success, as it is necessary to use them in a proper way. Fietz et al. (2021) demonstrate the significance of linking competences and resources. They maintain that competences for sustainability are related to the utilization of slack resources because resilient organizations are those that have more resources and constantly invest in the configuration of resources in order to be able to quickly use them in crisis so as to cope with the situation or even gain an advantage (Fietz, Hillmann, Guenther, 2021). Studies on how entrepreneurs develop organizational resilience in order to maintain business continuity by using slack resources, and research on the entrepreneurial attitude allow concluding that slack resources (the first type, i.e. business resources, and the second type, i.e. family resources) alone are insufficient to turn adversities into opportunities. This requires a strong entrepreneurial attitude (Conz et al., 2022). Bournard et al. (2018) note that the building of resilience depends on an organization's ability to adapt (to flexibly allocate resources in order to respond to a disruption) and to prepare (develop a systematic approach to risk management). How the response process is applied depends on the event itself and the organization's ability

to collect, interpret and effectively use information. The extent to which the organization is prepared thanks to having detailed crisis management plans, and able to adapt by quickly reallocating resources (including the potential use of a greater amount of resources, for example in the event no plans have been prepared) indicates what approach to resilience will be the best for the organization (Burnard, Bhamra, Tsinopoulos, 2018, p. 26). The article is therefore strongly rooted in the situational approach to management and focuses on explaining why organizational responses vary depending on the situation.

The researchers have also found a positive impact of management control tools (budgeting, business continuity plans) on the growth of organizational resilience (Roffia, Dabic, 2023). Companies that prepare monthly economic and fiscal budgets can better predict and manage situations of economic and financial stress, thus increasing their resilience.

In the subject literature, one can also find studies presenting a specific approach to the analysis of the impact of circular economy[2] on the resilience of the company and branch, where it is argued that reduced dependence on raw materials and increased access to exchange partners may contribute to enhanced resilience (Kennedy, Linnenluecke, 2022). In this case, the resources which increase the organization's resilience are specific organizational solutions, relational capital and, again, the knowledge of managers. This is an important new approach to resilience due to growing concerns about issues such as climate change, biodiversity loss and, more broadly, sustainable development. In this situation, it becomes extremely important to study resilience at different levels, in order to examine how changes in resilience at one level can influence resilience at other levels of the economy.

Another interesting topic is also research on family businesses (Zellweger, Sieger, 2012), which presents a specific set of resilience determinants. Studies conducted in this area indicate various determinants of family business resilience, but due to their specific nature, they do not have attributes of universality and, as such, will not be analysed in more detail in this study.

5. Summary

The authors of this study have presented major approaches to organizational resilience, demonstrating its reactive and proactive nature. Above all, however, attempts were made to highlight internal resources involved in the process of creating organizational resilience.

An extensive analysis of the literature allowed concluding that organizational resilience per se is an organizational resource that is mobilized in the event of disturbances (Santoro et al., 2020). It also enabled identifying a number of various factors (resources) determining the organization's resilience. These included, among others: human resources, intangible

[2] Circular economy is an approach based on the separation of economic activity from the negative environmental impact of production and consumption (Ellen MacArthur Foundation, 2013).

knowledge resources, organizational and management skills, and financial resources. Each of them has a specific impact on the process of building organizational resilience. Attention was also drawn to the role of slack resources, which may be particularly useful for creating organizational resilience and implementing its functions. In the course of the discussion, the issue of variability of business models in the context of resilience was also raised.

The analysis of the literature allows concluding that resilient organizations are those that have numerous resources, can properly utilize them and skilfully invest in their development in order to be able to use them quickly in crisis. However, the results of the research presented in the subject literature so far do not allow the resources indicated as resilience determinants to be prioritised in a way that seems to result from the opinions of management practitioners. The available studies usually concern a specific type of resources, analysed by individual authors. Therefore, there is no synthetic approach that would enable presenting a set of resilience determinants. This gap is to a certain extent filled by this article, which identifies and highlights the multiplicity and diversity of resources determining resilience as well as their potential areas of influence. Thus, it allows setting the direction for future research, the aim of which will be to identify resources considered as determinants of resilience in the examined companies, while taking into account their importance and the role played in these entities. The following questions need to be answered: How to design, create and maintain resilience processes? What are the dynamic capabilities of individual companies? Which resources do companies perceive as crucial for the process of building their resilience? Which management systems or practices will be important for building resilience? To what extent should an organization have excess resources so as to achieve resilience, and what costs can this generate in relation to the potential benefits?

Creating such a synthetic list will help company managers and administrators to determine their strategies for creating and strengthening resilience, create plans of business continuity and reconstruction in the event of crisis events or other challenges that may pose a threat to the functioning of the organization.

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UNCERTAINTIES AND CHALLENGES IN HUMAN RESOURCE MANAGEMENT IN THE ERA OF ARTIFICIAL INTELLIGENCE

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Purpose: The aim of this article is to discuss the impact of Artificial Intelligence (AI) on various areas of the Human Resources Management (HRM) and to indicate whether there are uncertainties and challenges associated with it.
Design/methodology/approach: The article attempts to answer the following research questions: RQ1: What changes and uncertainties related to the HRM await modern enterprises?; RQ2: How do enterprises assess their ability to use AI in different areas of the HRM?; RQ3: Are enterprises ready for changes related to the implementation of AI in the HRM? Bearing the above in mind, the analysis of domestic and foreign literature sources and the author's pilot study using the online survey questionnaire as a research tool were adopted as a research method. The survey was carried out among a selected group of medium and large enterprises.
Findings: The evaluation of the collected data has shown that companies are mostly aware of changes and uncertainties associated with the issue of human resources management (HRM) in the era of evolution of modern technologies using AI but, due to the fact that this is a completely new situation for them, it is impossible to refer to further consequences of AI interference with the HRM.
Research limitations/implications: The study was a preliminary one. It is scheduled to be extended in the future to cover a wider scope of impact of AI technology on the HRM. AI is a constantly unwinding topic, so the actions taken by the company or analyzed by researchers related to the use of AI in the HRM may turn out to be outdated in the near future.
Practical implications: The use of the AI technology in the HRM means in practice accelerating the implementation of the HRM activities and obtaining better work efficiency, thus achieving the HRM's goals in a shorter time. This is still associated with hybrid human-and-AI work, but it is possible that human work in some HRM tasks will be completely replaced in the future by modern technology.
Social implications: The article indirectly addresses the issue of the prevailing anxiety and uncertainty about maintaining some jobs in the face of the development of AI tools. The hitherto research indicates that some of them may be justified, especially when it comes to repetitive analytical tasks in the HRM area.
Originality/value: The article discusses the current topic of the use of AI-based solutions in business.
Keywords: HRM, artificial intelligence, human, uncertainty, changes.

Category of the paper: research paper**.**

1. Introduction

Terms such as data mining, machine learning, deep learning and neural networks that were unknown in the past have become popular terms in the present, as has artificial intelligence (AI) itself. Many organizations have already begun to adopt AI technology with its benefits in mind. As a result, AI is no longer a concept of the future, treated as science fiction, but a real consequence of technological evolution (Tewari, Pant, 2020). The main reason why organizations are embracing modern technologies and accepting digital transformation is the realization of the enormous power of data and the decisive role that AI plays, affecting the speed of activities related to the transfer and analysis of data and, consequently, boosting performance of the organization. AI is now widely used in many fields of science, economy and business. as well as in everyday life. Its use is particularly visible in production, marketing, e-commerce, and the latest trend is the use of AI in the Human Resources Management (HRM). AI is a technology that enables intelligent machines to do work that humans used to do. Does this mean, then, that human work will be completely replaced by modern technology in the near future? There is no definite answer to this question, and for many researchers it is a contentious issue, but they are sure about a few things: some modern professions are already and will be performed by intelligent machines and new professions requiring new skills and qualifications meeting market requirements will appear and, most importantly, man will have to learn to cooperate with the machine. However, there are already some forecasts for professions that are particularly vulnerable to elimination from the labor market, due to the use of AI in business.

Accordingly, the article attempts to answer three research questions: RQ1: What changes and uncertainties related to the HRM await modern enterprises?; RQ2: How do enterprises assess their ability to use AI in different areas of the HRM?; RQ3: Are enterprises ready for changes related to the implementation of AI in the HRM? On the other hand, the discussion of the impact of AI on various areas of the HRM and uncertainties and the challenges associated with it was set as the research goal. The article uses both secondary data obtained from literature and online sources, as well as own research, for which an online questionnaire sent to a selected group of medium and large enterprises was used. This article in an overview tries to shed light on the applications of AI in the field of HR with particular attention to uncertainties, benefits, challenges and future opportunities that AI offers in this area. The evaluation of the collected data has shown that companies are aware of the changes and uncertainties associated with the issue of HRM in the era of evolution of modern AI-enabled technologies. Due to the fact that this is a completely new situation for them, it is impossible to refer to further consequences of AI interference with the HRM. Therefore, further research on this topic is advisable.

2. Literature review

2.1. Influence of Artificial intelligence for the labor market

There are less optimistic forecasts and a lot of uncertainty related to the use of Artificial Intelligence (AI) technology in business, which Human Resources (HR) departments must take into account when managing personnel, especially when planning and selecting training, so it is matched to the AI solutions used in the company. These forecasts suggest that professions performed by women are more vulnerable. For example, Goldman Sachs predicts that AI technologies such as ChatGPT "have a potential to transform the labor market, exposing most jobs in the country to automation" (Praca dla 80 proc. kobiet zagrożona…, 2023), which was confirmed by experts from Kenan-Flagler Business School at the University of North Carolina, who published a report according to which 79% of working women in the US (nearly 59 million) now have jobs "susceptible to disruption and effects of automation" that AI development could cause. According to researchers, 58% of employed men may be at risk from AI. On the other hand, an analysis by Revelio Labs suggests that AI can take over the work of accountants (82.9%), specialists in payroll and HR (79.7%), secretaries (74.3%), text editors and typists (65.4%) and auditors (65%). As many as 71% of workers in these professions in the US alone are women (Sztuczna inteligencja…, 2023). In Poland, too, many women perform clerical and administrative work which may indeed soon be automated. Therefore, it will be crucial for them to change their profession or improve their qualifications (Mazur, 2023).

According to a study by McKinsey Global Institute conducted in 46 countries, more than 800 million workers worldwide will lose their jobs and be replaced by robots by 2030. Thus, about 1/5th of the world's workforce will have to find new jobs or radically improve their technical, digital, traditional and interdisciplinary skills. These skills include programming, work flexibility, and adaptability. In practice, this means that even primary school students will need to be prepared for changes, because 85% of them will work in professions that do not yet exist by 2030. However, over the next 5 years, "growth" will be included in the AI use index as an indicator within the global economic growth indicators, as well as the per capita technology of the fourth industrial revolution, along with indicators of national income, GDP, inflation and other indicators that measure the economic strength of the state (Abdeldayem, Aldulaimi, 2020). Research by the World Economic Forum shows that AI will radically change the way work is done and competence requirements for as many as 44% of jobs. Based on the data of the RocketJobs.pl job portal, addressed to office workers, it can be concluded that in Poland this trend is just germinating, but employers are beginning to appreciate this type of competences (AI a praca biurowa…, 2023). Experts identified seven challenges for the labor market in the perspective until 2030 and mentioned AI in the first place. They pointed out that the list of professions threatened by robotization and AI includes, among others: cashiers and retailers, customer service employees and telemarketers, telephone exchange operators, taxi and

van drivers, air traffic controllers, production and assembly workers, warehouse and logistics workers, insurance agents and credit intermediaries, bank employees, secretaries and office assistants, legal assistants, construction and repair workers, farmers, security and monitoring staff, and translators (Oto 7 największych wyzwań…, 2023).

What is also crucial for the labor market and running a business are legal regulations regarding the use of AI. It was not until June 2023 that the European Parliament voted on the AI Act, which is supposed to regulate the use of AI-enabled systems throughout the European Union. The regulations, the final shape of which will still be negotiated with the Member States, are to ensure that AI developed and used in Europe will be in line with the rights and values of the EU. One of the important elements of the regulations will be the requirement for transparency of tools such as ChatGPT or deepfake technology. In addition, developers of AI-based systems will be required to disclose the content and data used to train AI tools. The new rules will also introduce risk classification for AI tools (Walczak, 2023).

2.2. New challenges for Human Resources Management in the era of Artificial Intelligence

The ability to efficiently manage human resources is an extremely important issue in every organization. It largely determines the direction of the organization's development and the building of its intellectual capital. Researchers interpret the notion of HRM in different ways, which makes it difficult to find a universal definition of the HRM. For some, it is simply: "(…) disposing of the organization's resources through action with and through people, to the extent determined by the owner of these resources" (Rutka, 2001). Others interpret the HRM as: "a source of potential opportunities, benefits and tangible and intangible profits (…). It is based on the belief that man should be put in a place where his or her individual abilities meet the unique opportunity to do something special. It is an expression of an optimistic vision based on the conviction that work is a place where human success meets the success of the world" (Adamiec, Kożusznik, 2000).

Armstrong explains the HRM as: „a strategic, coherent and comprehensive view of the problems related to the management and development of human resources within the structure of the enterprise, and every aspect of this process is an essential part of the management of the organization as a whole (Armstrong, 1996). Regardless of the interpretation of these the HRM definitions, it is important to invest in development of human resources and to increase skills and competences of employees. It seems to be a natural and necessary thing for modern organizations to create innovative solutions. Especially in the context of the use of AI solutions, there is an urgent need to develop new skill sets aimed at interacting with AI-enabled technology.

AI can also be defined in various ways, for example as the ability of a system to correctly interpret external data, learning from such data and using this knowledge to achieve specific goals and targets through flexible adaptation (Kaplan, Haenlein, 2019). AI can also be seen as

computational technologies that simulate or imitate intelligent behaviors of to humans, even though AI behaves differently (Bhave et al., 2020). In contrast, the main categories of AI functions include: extraction of useful data, that is, discovering knowledge, representing relevant information in a way that machines can recognize, and use it to solve complex problems; developing new knowledge based on represented knowledge and techniques for finding solutions; and word and speech processing (Huang, Rust, 2018). Consequently, the development and use of AI solutions has led to significant changes in the way people work and, thus, in organizational forms, procedures and functions (Bondarouk et al., 2017). Therefore, there has emerged a need to have a new generation of workforce. This has become a key factor in the survival and transformation of enterprises in the changing environment (Ertel, 2018).

The theory and applications of the AI technology is a constantly evolving topic, despite the fact that many AI tools, such as artificial neural networks, intelligent decision systems, and fuzzy sets, are already in use in various fields (Holland, 1992). For a past few years, companies specializing in enterprise resource planning software have started to build AI modules to automate various business functions, which, in turn, requires that employees using the software should be able to operate the software or at least manage AI algorithms, for example in design. In the field of the HRM, this means that companies still lack staff with sufficient knowledge in the analysis of HR data to be able to effectively interact with algorithms integrated with business software (Sakka, Maknouzi, Sadok, 2022). AI is therefore helpful in various business areas where it can reduce the burden and pressure on employees in the workplace. It is obvious that rapid changes in business require quick reactions (Yawalkar, 2019) and AI represents a real breakthrough in business management and will have a huge impact on the way employees work, especially in the HR sphere (Abdeldayem, Aldulaimi, 2020).

The development of AI is one such transformation with far-reaching implications, especially in areas such as engineering, industrial organization and the HRM. AI in the HRM is still in the exploration phase (Sheila, 2018). It is expected that automated devices, such as machines, robots and software, may be able to perform routine tasks that humans have traditionally performed (Danysz et al., 2019; Scherer, 2015). With regard to the HRM, this means that a number of activities such as recruitment, performance management, planning compensation and benefits, training and development may become largely automated in the near future (Sakka, Maknouzi, Sadok, 2022). AI will revolutionize traditional HR functions. Of course, there are benefits, some negative effects and huge challenges to the HRM, including obsolescence of certain professions (Malik et al., 2019; Lariviere et al., 2017). But researchers on AI in the HRM have noted that, at the same time, deep learning algorithms, intelligent objects, and the Internet of Things (IoT) are particularly useful for businesses operating across borders because such solutions can foster more productive coordination and cooperation between people (Cooke et al., 2019).

Some examples of how AI can be used in HRM.

Recruitment and selection

AI represents a real breakthrough in business management and will have a huge impact on the way employees work, especially in the domain of the HRM (Abdeldayem, Aldulaimi, 2020). AI-based tools help recruiters improve quality of the candidate acquisition process: it will be faster, more precisely and objective (Murphy, 2006). AI selects candidates suitable for a given position by analyzing their skills, experience and personal predispositions. Importantly, it is also easier for the candidate to contact the prospective employer and get through the application process. AI-powered bots are used to contact candidates, answer their concerns, and keep them in touch and connected throughout the recruitment process (Upadhyay, Khandelwal, 2018). AI-powered assistants or bots are well-equipped with natural language processing (NLP) capabilities, so they play a leading role in all types of communication with candidates. The NLP can easily convert speech to text in microseconds, which increases the recruiter's efficiency by eliminating typing work (Jia et al., 2018). Although the use of AI tools improves the whole process, it is obvious that a human recruiter is still necessary, because nothing can replace a person's intuition regarding the candidate's fit into the organizational culture or the assessment of soft skills (Kambur, Akar, 2022).

Either way, research shows that more and more companies are using AI tools in the recruitment. According to Career Angels, more than 61% of job advertisements for managers use application process tracking systems (ATS), and another 38% come from services such as EasyApply or Linkedin. ATS systems allow for effective filtering and evaluation of candidates. In addition, tools that analyze CVs help in searching for key words and information, which facilitates the selection of the candidate. This is very useful for large companies that sometimes receive thousands of applications for one position. According to Jobscan, already in 2019, about 98% of Fortune 500 companies in the US used ATS systems, which only confirms their growing popularity and impact on the current labor market (Marteklas, 2023).

Evaluation, promotions and dismissals

The implementation of electronic HR information systems and other cutting-edge technologies offers a number of opportunities to improve and reduce the cost of the HRM operations including the assessment of candidates (Bondarouk et al., 2017; Cooke et al., 2019) and employee performance (Abraham et al., 2019; Parry, Tyson, 2011). Systems supported by AI have made the evaluation of the employee's work faster and more effective. Scientific assessment methods, such as the 360-degree assessment, are now applied automatically. Employee evaluation criteria are entered into the system along with other useful data to obtain results based on the collected data (Otley, 1999). AI also helps an organization retain employees. By using AI-enabled software, it is easier to find employees who may be thinking about leaving the organization, and this is analyzed by observing patterns of activity while browsing the employee's activity in the computer system. So-collected data, for example over a period of a month, helps to detect a less active or efficient employee and to take appropriate steps for his the employee's further career in the company, for example promotion (Ahmed,

2018). AI can therefore predict the promotion potential of employees based on the captured data, because it can easily screen the characteristics of successful employees in specific positions (Jantan et al., 2010). The AI also receives information from its database to find out if the employee's skills have improved. Employees who fall below their performance targets are reported to the manager who can refer them to personalized training or development programs. As a result of the re-evaluation of the results, if the performance of these workers has not reached the average, they may be dismissed due to the lack of improvement (Eubanks, 2019).

While it has become a widespread concern that AI will soon replace humans as employees, AI really does contribute to layoffs, and in a literal way. Research conducted by the French consulting company B2 shows that already every tenth employment termination is generated by AI. According to HR staff, using an algorithm is a very appreciated opportunity when you need to do something as unpleasant as firing someone from work. This is also associated with saving the time of HR specialists. According to calculations, even one work hour per week counts, which can be devoted to other, productive, activities (Urbaniak, 2023).

Remuneration and reward system

An important part of the HRM is the payroll and reward system directly related to the performance of employees at work. It is a process of setting employees' compensation based on established standards. An effective compensation management system in an organization strengthens both individual and group performance. A technology called "artificial neural networks" can be a useful tool in determining the level of reliability in the process of estimating remuneration. A neural network system can recognize dependencies in large data sets, mimicking the functioning of the human brain (Tewari, Pant, 2020; Jia et al., 2018). This means that AI can help develop compensation metrics to reward employees' efforts. When determining remuneration, a large amount of data is required, such as information from the CV of each employee, the results of psychometric tests carried out during selection, information collected during and after the training and development process, which also reflects specific skills of the employee. In addition to this data, continuous feedback is obtained on the performance of employees when determining remuneration. Employee compensation can be determined based on the feedback received. It is a machine learning program that defines the compensation of employees. This program offers the manager suggestions on how much the company should pay. However, the final decision belongs to the manager (Das et al., 2020). In addition to machine learning, neural networks also help in fair salary management. The neural network system can be used to create a system for fair salary assessment and to design an intelligent decision support system based on big data sets (Jia et al., 2018). Some time ago, IBM developed an application called Planning Analytics which determines the compensation of its employees based on results of performance evaluation (Goldfarb et al., 2020).

Training and development

Researchers claim that AI applications could be crucial in the HRM for training purposes. Simulations, defined as AI environments, can provide a high degree of interactivity with users and improve their learning opportunities (Bell et al., 2008). AI is about information processing, logical reasoning, and mathematical skills, among other things (Huang, Rust, 2018). For employees, these demanding skills can be acquired through expertise and training. Thanks to digitalization, training and development processes can be carried out and measured online or using mobile applications. According to the results of a study conducted by Burg (2015) on 650 senior the HRM managers, with the integration of AI into the training and development process, fast, efficient and almost flawless training was achieved. According to Shanmugam (2015), an organization with an average of 500 employees loses about 3000 hours per year to evaluate performance, especially after completing training. When development assessments are carried out using the conventional method, both the manager and the employee devote a lot of time to them. Shanmugam found that incorporating AI into this process saves 50% of time in the evaluation process and 60% over the entire evaluation period. The same study claims that compensation and rewards will also be judged based on employee performance (Shanmugam, 2015).

3. Study

3.1. Research method

The study was conducted among 62 medium-sized and large companies in the period from February 2023 to May 2023 using the CAWI method. The study was a preliminary (pilot) one, aimed to explore the situation related to the research objective. The respondents (mainly HR managers) were asked to complete the online survey. 47 completed questionnaires were received. The study concerned the use of AI tools in the HRM. By way of selection, questions were selected thanks to which three research questions were answered: RQ1: What changes and uncertainties related to the HRM await modern enterprises?; RQ2: How do enterprises assess their ability to use AI in different areas of the HRM?; RQ3: Are enterprises ready for changes related to the implementation of AI in the HRM? The research goal was to analyze the impact of AI on various areas of the HRM and the uncertainties associated with it. Secondary studies presented in domestic and foreign literature sources and the authors' pilot study using the online questionnaire were used to analyze these matters. The characteristics of the respondents are presented in Table 1.

Table 1.
Study sample characteristics (in %)

Enterprise size					
	Medium			Large	
Sample size	28			72	
Business type					
	IT technologies	Media & communication	Life sciences	Production	Other
Sample size	58	30	6	4	2
Business track record					
	Less than a year	1-5 years	6-10 years	Over 10 years	
Sample size	2	6	32	60	
Market					
	National			International	
Sample size	35			65	

Source: own research.

Most of the surveyed companies were large 72%. The mid-sized ones accounted for 28% of the sample. They represented the following industries: IT services (58%), media and communication (30%), life sciences (6%), production (4%), others (2%). The track record of 60% of the companies was longer than 10 years and the rest, 32%, had been active between 6 and 10 years. 65% of the companies were international and 35% domestic (Table 1). The next part of the paper attempts to answer the three research questions.

3.2. Research results

The collected research material was used to answer the three research questions. The obtained results and their short characteristics are presented below.

RQ1: What changes and uncertainties related to the HRM await modern enterprises?

In an attempt to answer the first research question, the answers received from the respondents regarding issues related to the use of modern AI technologies for the HRM were analyzed – first of all, whether they see concerns and uncertainties related to changes in the HRM that are a consequence of using AI solutions (Tab. 2).

In most cases, the respondents showed high awareness of the consequences of implementing AI into the HRM. 89% of the mid-sized and as many as 94% of the large enterprises were concerned about the urgency of acquiring new skills related to the use of AI by their employees. Following technological changes also forced delivery of training in AI technology, including that used in HR departments, as evidenced by 87% of "yes" answers for medium-sized companies and 89% for large companies.

Table 2.

Changes, concerns and uncertainties related to the implementation of AI to the HRM (%)

Enterprise size	Compulsion to acquire new skills related to the use of AI technology		Numerous training courses in AI technology for use in the HRM		Increasing investments in the implementation of AI solutions to the HRM		Possibility of loss of jobs due to replacement of human work in the HRM with solutions offered by AI – AI taking control		AI's bias in the HRM activities	
	yes	no	yes	no	yes	no	yes	no	yes	no
Medium	89	11	87	13	74	26	57	43	34	66
Large	94	6	89	11	91	9	78	22	46	54
Total	**183**	**17**	**176**	**24**	**165**	**35**	**135**	**65**	**80**	**120**

Source: own research.

Beyond any doubt, there is also the issue of increasing financial investments for the purpose of implementing AI in the HRM. 91% of the large companies considered it necessary, slightly less, 74%, of the medium-sized companies also answered "yes". As it turns out, financial issues are not the biggest problem with the implementation of AI, but, according to a global study conducted by IBM, these are limited skills, knowledge or experience in the field of AI (34%), However, for 29% it is too high a price, and for 25% the barrier is the lack of tools or platforms for developing models (Sztuczna Inteligencja rozlewa się…, 2022). Quite a pessimistic picture is presented by the answers to the question about the concern of AI taking control in the HRM and, thus, losing jobs. 57% of the medium-sized companies and 78% of the large ones were afraid of this. It can be concluded that knowledge about AI and opportunities for using it is the greater, the larger the company. The medium-sized companies were a bit skeptical about changes after the implementation of AI. In both cases (large and small companies), and rather in the majority, the respondents were not very much concerned about biased AI in the HRM. Man is more often biased than a machine using learned algorithms, which is why this issue does not raise so much uncertainty.

RQ2: How do enterprises assess their ability to use AI in different areas of HRM?

The second research topic was analyzed based on data collected from the questionnaires concerning the most common areas of the HRM in which AI is used and their assessment by the respondents (Tab. 3).

Table 3.

In which areas of the HRM is AI technology used most often? (in %)

Enterprise size	Recruitment and selection	Evaluation, promotions and dismissals	Remuneration and reward system	Training and development
Medium	26	20	13	28
Large	70	32	38	68

Source: own research.

Due to the larger number of big companies in the study, their performance was relatively better than the average when it comes to the HRM in which AI technology is used. Most of the respondents from large and medium-sized companies chose recruitment and selection plus training and development. In both cases, AI was used less often in the areas of salaries, rewards

and assessments, promotions and dismissals. The selected options show a quite popular trend among the respondents. According to global research, as presented in literature, these are the areas of the HRM in which HR specialists are willing to get support from the AI technology (Tab. 4).

Table 4.
Assessment of the possibilities of using AI in different areas of the HRM? (in %)

Enterprise size	Very slight	Slight	Average	Good	Very good
Medium	0	2	2	2	21
Large	0	2	6	9	56
Total	0	4	8	11	77

Source: own research.

The respondents also rated the AI technology used in HR departments as good and very good. It can be concluded that they are already somewhat familiar with it, and it positively affects their work efficiency. Each change seems difficult to implement, especially one that is related to the support of modern, often complicated, technology. It can cause a lot of stress to the HR staff, setting new requirements for them, which they can meet with their commitment, good intentions and awareness of the need for faster work and better results. So, as in the case of implementing any other innovation to the company, what is needed is strong motivation and promotion of changes by superiors.

RQ3: Are enterprises ready for changes related to the implementation of AI in the HRM? (in %) (Tab. 5)

Table 5.
Readiness for changes related to the implementation of AI in HRM

Enterprise size	Definitely yes	Rather yes	No opinion	Rather not	Definitely not
Medium	11	9	4	2	2
Large	45	23	0	2	2
Total	56	32	4	4	4

Source: own research.

Due to the small size of the research sample, it is not possible to clearly state whether companies are already ready to implement and use AI in their HR departments. It can be concluded based on the answers that "yes" (45% of large companies, 11% of medium-sized ones), but the results cannot be generalized. This should be treated as an individual matter for each company. Hurry is not advisable because, as with any investment and change, a detailed analysis of AI tools is required, which in the opinion of managers will be necessary to improve the work of people.

4. Conclusions

The Polish market is far behind the world in the use of AI technology. Currently, only 15% of companies use it, and 13% of other companies have declared plans to implement it (according to a report by KPMG and Microsoft). Meanwhile, the global average use of AI is 35-37%, which shows great untapped potential (Pasławski, 2023). Although these results are not impressive in the case of Polish companies, it should be remembered that this is a constantly developing topic and in the near future AI will be used in every company, regardless of its size or place of origin. Advances in globalization will bring these changes like any other that global markets have faced in recent decades. The only question is what changes will companies, society and the economy still have to face? And what impact will AI technology have on human work? Hybrid work based on complementary human-and-artificial intelligence seems the most sensible, but will it be implemented in the next decade? Many unknowns and uncertainties that will probably bring about further questions, concerns and struggles of civilization with the adaptation to new living and working conditions. Companies should already be striving to modernize their ways of managing resources, including HR. AI is changing market needs, and new professions will require skills and competences that employers do not yet know. AI is a fascinating, demanding and debatable topic, which is why it requires attention of researchers, hypotheses and attempts to find answers. Therefore, this paper is an introduction to a continuation of further research in the field of the use of modern AI solutions in the HRM.

The review of domestic and foreign literature, as well as own research, has shown that companies are mostly aware of the impact of AI on human work in HR departments. The use of AI solutions is inevitable. It is a consequence of technological development and, sooner or later, companies will have to incorporate AI into their departments. Although the study has provided answers to the three research questions (RQ1, RQ2, RQ3), it can only be considered an introduction to the relevant research, due to the small size of the research sample, but it has given an overview of the issues involving AI in the HRM area.

The initial analysis of the collected research material allowed for partial achievement of the research goal: assessing the impact of AI on various areas of the HRM and identifying uncertainties and challenges associated with it. The biggest challenge or uncertainty turned out to be the acquisition of new skills by the HR staff and the training in AI technology, as well as the concerns about incurring larger financial investments in order to implement AI solutions in the HRM, which, again, can be explained by concerns regarding budget cuts in other areas of the company's operation. The surveyed companies appreciate their existing AI technologies in the HRM and use them primarily for recruitment, selection, training and development of employees. A majority of the surveyed companies are aware of benefits of AI and are ready for further innovative solutions in this area. It would be good to assume that most modern companies will share this optimistic approach to AI, recognizing its advantages and potential.

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DIGITALISATION OF PUBLIC ORGANISATIONS AS A TOOL FOR A RESPONSIVE REACTION TO A CRISIS SITUATION

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Purpose: This study aimed to determine the impact of digitalisation tools on the results of the work in public administration and the quality of the services provided.
Design/methodology/approach: A diagnostic survey method was used. 357 local government units were surveyed. Highly competent individuals with long years of work experience, in the public sector participated in the study. The findings are embedded in the field of public crisis management.
Findings: The research indicates that respondents generally hold a favorable perception regarding the influence of digitalisation tools and working methods on the quality of public services and the outcomes attained at work. Across all surveyed areas, opinions are divided between respondents who strongly highlight the positive role of digitalisation tools and those who acknowledge a positive impact, but have not firmly established their opinions.
Originality/value: The results of the research can be addressed to those involved in public crisis management, both local authorities and public bodies, as well as units responsible for practical actions in crisis situations.

Keywords: digitalisation, crisis management, crisis situations.

Category of the paper: research paper.

1. Introduction

Maintaining safety and order is one of the priority public services. According to the classification of contemporary public services, it belongs to the category of social services (Kozuch, Kozuch, 2011, p. 41). There is a regularity in management science that practice significantly precedes the emergence of scientific output. As Kożuch and Kożuch (2011, p. 32) point out, this lag is particularly large when it comes to public services, in polish literature, this issue is almost unrecognised.

A state that respects its territory and citizens strives to maintain a high level of security (Maślanka, 2021). This is possible by preventing and mitigating threats. In view of this, one of the priority functions of a modern state is to guarantee its citizens basic conditions of protection against possible and real dangers related to the occurrence of natural disasters and other similar events caused by forces of nature, technical failures or armed actions. A properly organised society is prepared to function in a variety of situations, while it is the duty of public administration to have systemic solutions compatible with each situation, i.e. appropriate laws and forces and resources to enable effective crisis management (Sobolewski, 2021).

Ensuring the efficiency of operations at each stage of crisis management cycle (delivery time, quality and cost) requires crisis management actors to properly coordinate, integrate and effectively manage operations. Digitalisation tools are useful in this context. Digitalisation tools can be defined as programmes, websites, applications and other online and computerised resources that facilitate, improve and implement digital processes and general digitisation activities (Dash, 2022). Digitalisation of the public sector is a complex process and can be defined as the adaptation and increased use of digital or computer technologies (Pieriegud, 2016, p. 12). Digitalisation supports the responsiveness of the public sector. More broadly, a responsive public administration is one that is responsive to the diverse needs of the of the community for which it carries out its functions (Encyclopedia of Public Administration).

In order to respond quickly to hazards, governments have begun to implement early warning systems. In India, for example, early warning systems are in place so that those involved in rescue operations can monitor the information provided by the system and communicate with each other. Communication must take place at regular intervals in order to have access to the most up-to-date information on the onset and progress of a disaster (eGyanKosh, 2007).

It is also important to inform communities at risk immediately. The Federal Emergency Management Agency (FEMA), in collaboration with the Federal Communications Commission (FCC) and various wireless service providers in the United States, uses the Integrated Public Alert and Warning System (IPAWS) to disseminate warning messages (Bennett Gayle, 2019). The Wireless Emergency Alerts (WEA) system allows geo-targeted dissemination of messages to mobile phones in the area of direct threat (Federal Communications Commission). Such systems are also beginning to be implemented in Poland. Early Warning Systems (EWS) allow to warn residents of threats to life, health and property or about immediate evacuation and enable cooperation with police, municipal police, fire brigade, ambulance and other security services (Walek, 2013).

It is assumed that the digitalisation of the public administration is an important aspect in improving the functioning of local government. Therefore, the aim of this article is to determine the impact of digitalisation tools on the results of the work performed in public administration and the quality of the services provided. This objective will be achieved by seeking answers to the following research questions:

1. What is the impact of digitalisation tools on the results of work in local government units?
2. Do digitalisation tools improve the quality of public services?
3. Do digitalisation tools affect the level of inter-organisational cooperation?
4. Do public administration employees have the knowledge and skills to use digitalisation tools at work?

The answers to the research questions above are based on a study conducted in 2022 within local government units in Poland. The diagnostic survey method was used. The theoretical background and reference context of the conducted research is public crisis management. According to Krzeszowski (2023, p. 102), crisis management is listed as one of many scientific sub-disciplines of management and is systematically developing, gradually forming its own doctrine. Following the example of crisis management institutions organised in Europe, appropriate organisational and legal foundations have also been created in Poland, which protect the system of the state and citizens against crisis situations (Krzeszowski, 2023, p. 102).

2. Crisis situations - basic definitions

When acquainting oneself with the subject of crisis situations, it is valuable to highlight the distinctions between several terms that may seem similar but hold distinct meanings. Catastrophe (gr. katastrophḗ) is a term that has not always had a negative connotation, as it is one of the words that have found their way into the general language from literature - until the mid-19th century, 'catastrophe' in Polish functioned only as a theoretical and literary term (National Cultural Centre, 26.08.2023). The Cambridge Dictionary (26.08.2023), on the other hand, defines disaster as an event that causes very great trouble or destruction. There is no definition of disaster in Polish legislation, but a similar concept of natural disaster is explained as: "a natural disaster or technical failure, the consequences of which endanger the life or health of a large number of people, property on a large scale or the environment on a significant area, and the assistance and protection of which can be effectively provided only by means of extraordinary measures, in cooperation with various bodies and institutions and specialised services and formations acting under unified leadership" (Dz.U. 2002, nr 62, poz. 558).

Research by Roy (2010) shows that natural disasters lead to an increase in crime, especially property crime. However, some studies have found a decrease or stagnation in crime following natural disasters (Hombrados, 2019). For example, qualitative data collected one month after Hurricane Andrew in Florida shows that while the hurricane increased the number of criminals, it also increased the informal security force made up of civilians, leading to a sharp decrease in crime rates in the weeks following the hurricane (Hombrados, 2019).

Currently, the discussion on the climate crisis and related changes is intensifying. Empirical data and analyses eloquently demonstrate that anthropogenic climate change is real and that its consequences - such as coastal flooding or fires resulting from heat waves and droughts - threaten the livelihoods of people mainly in southern countries, but are also increasingly felt in northern countries (Krywult Albanski, 2018). Anthropogenic catastrophes, natural disasters and many other hazards result in human casualties, destruction of private and public property and environmental pollution. Marcinkowski (2019) defines a hazard as a potential situation characterised by randomness and intentionality, but with a negative impact on the level of safety.

Threats can lead to crisis situations. In order to better understand the definition of a crisis situation, it is first necessary to familiarise oneself with the word crisis (Gr. krisis - I make a distinction, I resolve) sensu largo, which means a turning point, a turning point that causes a change in the existing system (Wilińska, 2015). According to the Polish dictionary definition, a crisis is "a situation that is unfavourable for someone or something", mentioning housing, worldview and government crises. A crisis is 'a disruption that physically affects the system as a whole and threatens its basic assumptions and existential core' (Al.-Dahash, Thayaparan, Kulatunga, 2016). According to the Trans Adriatic Pipeline Organisation (2017), a crisis is any event that leads or may lead to an unstable and dangerous situation affecting individuals, groups, communities or whole countries, resulting in negative economic, political, social or environmental changes, especially when it occurs suddenly with little or no warning.

Some people understand the crisis in the same way as a crisis situation. Such an understanding is wrong. A crisis situation is a superior concept and its meaning is superior to a crisis. A crisis situation occurs both before and after a crisis. A crisis is a component of a crisis situation (Wilińska, 2015). According to Fajczak-Kowalska (2014), a crisis situation is a state of increasing destabilisation resulting in an intensive, permanent and long-term deterioration in the functioning of society and the state. It is characterised by the escalation of the threat, the loss of control to limit the impact of the event (crisis situation) by specific services, inspections or guards.

A crisis situation causes a lot of damage by limiting development and hampering the economic processes of the region in which it occurs. The residents experience enduring impacts from such events. A crisis situation is associated with uncertainty, inevitability, high dynamics and rapidity of events. When disaster strikes, time is of the essence. The first step is to send a team to assess the needs of the affected community, the extent of the damage and the resources required. Typically, this response should be very rapid, within 12 to 36 hours of a disaster (Agostinho, 2013). This involves mobilising resources, setting up an emergency response team and a logistics team. Next, it is necessary to ensure the delivery of: food, medicines, vaccines, tents, etc. These resources can come from pre-established stocks, local and international suppliers, as well as donations (Agostinho, 2013). Donations are even more challenging because they often involve large quantities of products that are shipped without any planning, causing bottlenecks at ports. In addition, there are times when donated resources do not match the actual needs of those affected (Agostinho, 2013).

3. Digitalisation of public administration

Digitalisation of public administration is a very broad term that covers a variety of issues (Drgas, 2019, p. 194): e-government, electronic government, electronic public services. E-government, as defined by Szyszka and Śliwczyński (2004), is an electronic information and communication relationship externally: office-citizen, office-entrepreneur, office-service provider, and internally: office-office, office-employee. Electronic government helps to "develop new relationships between public sector institutions, citizens and businesses through the use of information and communication technologies that enable the dissemination and collection of information and services within the public sector and for service delivery, decision-making and increased accountability" (Drgas, 2019, p. 195). The electronic public services are delivered in a partially or fully automated manner using information technology (Kapler, Piersiala, 2014). Examples of e-services are epuap.pl, sekap.pl, e-deklaracje.gov.pl.

When it comes to protecting citizens from threats, what is the right balance between keeping citizens safe and respecting privacy standards? Digital solutions must simultaneously keep citizens safe and respect their fundamental rights (Larsson, Teigland, 2020, p. 183). Researchers wonder what level of data encryption can be considered responsible, respecting citizens' legal rights to privacy while monitoring the activities of potentially dangerous actors. On the other hand, to what extent should citizens be privy to military plans, crises, operations and spending information (the prevalence of digital data leaks) (Larsson, Teigland, 2020, p. 183).

Despite doubts about the use of digitalisation tools, it is the way forward for both private and public organisations. Digitalisation leads to significant improvements: merging of data sources, optimisation of business processes, real-time processing (Bartkiewicz, Czerwonka, Pamuła, 2020). The management of modern organisations, including public sector organisations responding to crisis situations, requires complex decisions to be made in a short period of time. It is basically impossible to make them without integrated IT support and operational and analytical information resources (Bartkiewicz, Czerwonka, Pamuła, 2020). Digitalisation is implemented through the introduction of digitalisation tools.

Digitalisation tools make it possible to share information with citizens. In terms of citizen safety, this is for example RCB Alert. RCB Alert is an emergency alert system. The messages are distributed via short SMS messages. RCB Alerts are generated on the basis of information about potential threats received from ministries, services (e.g. police, fire brigade), central bodies and institutions (e.g. IMGW and provincial offices). The Government Security Centre, as the national crisis management centre, monitors the situation 24 hours a day, 7 days a week for the occurrence of various types of threats (gov.pl).

Digitalisation tools also improve the flow of information between agencies and institutions. This is crucial when responding to an emergency. The Supreme Audit Office report (NIK, 2017) describes the tempest that hit several provinces on the 11th and 12th of August 2017.

The Wielkopolska Crisis Management Centre did not have the IT tools to provide immediate notification of threats. The Gniezno County Crisis Management Centre of the Gniezno Starost did not use all means of transmitting messages to municipalities, which resulted in the city and commune of Gniezno not receiving a meteorological warning. Due to the lack of information about the impending threat, the municipal crisis management structures did not take any action to warn the population before the tempest hit. It should also be noted that the crisis management centres of the audited counties did not receive any information about the actual threat and its consequences from other crisis management centres through whose area the tempest had already passed, nor did they send such information themselves (Supreme Audit Office, 2017).

In its report, the Supreme Audit Office (2017) identifies a number of other problems in addition to the ineffective threat information system, including the disregard of crisis management plans, the lack of substantive qualifications of staff, the downplaying of recommendations and incomplete reports, and the lack of analyses and forecasts of the development of the situation. Therefore, on the initiative of the Minister of Interior and Administration, a draft law has been prepared to eliminate or reduce the identified problems in the field of civil protection in the broad sense, including crisis management. The main objective of the project is to create a legal act that comprehensively regulates the issue of civil protection; previously, such a task was assigned to the Crisis Management Act (Ministry of the Interior and Administration, 2023). The draft of the Ministry of the Interior and Administration identifies specific solutions to increase the safety of citizens by providing means, methods and resources to bodies providing direct and indirect assistance to the affected. Planned investments include the technical upgrade of the analogue civil alarm and notification system to digital (PLN 1,406,300,000) and the expansion, modernisation and integration of existing IT and communication systems (PLN 1,311,640,000).

Typically, emergency situations are characterised by a high degree of uncertainty, volatility and dynamics in the development of events, and the use of technology greatly improves emergency response (Frąckiewicz, 2023). Preparedness for emergency response includes establishing authorities and responsibilities for action and gathering adequate resources to support them: personnel (existing and/or additionally recruited), designating or purchasing facilities, equipment, and equipping with digitalisation tools.

4. Research methodology

The aim of the research is to determine the impact of digitalisation tools on the results of work in public administration and to embed these results in the field of public crisis management. The study started on 6.12.2022 and was completed on 21.12.2022. The study was carried out using the LimeSurvey software, in which the survey tool was entered. The sample

was created using data from the Public Information Bulletin, which contains a list of local government units in Poland. In order to ensure that the sample was representative and that all types of units were represented, stratified random sampling was used. The distinguishing feature of local self-government units (JSTs) was their membership of the NUST macro-region (Table 1).

Table 1.
List of NUST units in Poland

Macroregions	%	n
MR Centralny	12.6%	45
MR Południowo-zachodni	13.2%	47
MR Południowy	13.7%	49
MR Północno-zachodni	16.8%	60
MR Północny	14.8%	53
MR Wschodni	16.5%	59
MR Województwa mazowieckiego	12.3%	44
total	100.0%	357

Source: gov.pl.

Each stratum had a structure corresponding to the differentiation of institutions according to their type (urban municipal office, urban-rural municipal office, rural municipal office) (Table 2).

Table 2.
Type of municipality

Typ of municipality	%	n
urban municipal office	21%	76
rural municipal office	50%	177
urban-rural municipal office	29%	104
total	100%	357

Source: own elaboration.

To select units for the study, a non-repeating random number algorithm created in an Excel spreadsheet was used. The dataset of local government units was transferred to the CATI studio and totaled 1500 records. The response rate was around 25%, which means that approximately one in four or one in five questionnaire interviews was successful. In the end, 357 local government units were interviewed. The average completion time per questionnaire interview was 57 minutes. The distribution of units surveyed by province is shown below (Table 3).

Table 3.
Surveyed units by province

Province	%	n
dolnośląskie	9.52%	34
kujawsko-pomorskie	5.60%	20
lubelskie	7.28%	26
lubuskie	3.08%	11
łódzkie	7.84%	28
małopolskie	7.28%	26
mazowieckie	12.32%	44

Cont. table 3.

opolskie	3.64%	13
podkarpackie	5.32%	19
podlaskie	3.92%	14
pomorskie	4.76%	17
śląskie	6.44%	23
świętokrzyskie	4.76%	17
warmińsko-mazurskie	4.48%	16
wielkopolskie	8.12%	29
zachodniopomorskie	5.60%	20
total	100.00%	357

Source: own elaboration.

The questionnaire was addressed to mayors, presidents and heads of municipalities. The respondent could also be a person designated by the above-mentioned persons as being competent for answering the questionnaire (Table 4).

Table 4.
Positions of respondents

Current positions	%	n
Mayor	22%	79
President	0%	0
Mayor of a rural municipality	26%	93
Other	52%	185
total	100%	357

Source: own elaboration.

In the questionnaire's header, questions regarding the respondent's years of work experience, years of experience in the public sector, and the number of mandates in the current position were also included (tables 5-7).

Table 5.
Length of service of respondents

Length of service in year	%	n
up to 5 years	24.09%	86
from 6 to 10	20.45%	73
from 11 to 15	12.89%	46
from16 to 20	8.96%	32
from 21 to 25	8.40%	30
more than 26 years	25.21%	90
total	100.00%	357

Source: own elaboration.

Table 6.
Length of service in the public sector

Length of service in the public sector	%	n
up to 5 years	3.36%	12
from 6 to 10	13.45%	48
from 11 to 15	14.29%	51
from16 to 20	21.57%	77
from 21 to 25	16.81%	60
more than 26 years	30.53%	109
total	100.00%	357

Source: own elaboration.

Table 7.
Number of mandates in current position

Number of mandates in current position	%	n
1	29%	103
2	27%	97
3	13%	48
4	10%	34
Other	21%	75
total	100%	357

Source: own elaboration.

5. Results

The questionnaire included the following statements:

1. The digitalisation of work has an impact on improving the results of your work.
2. The digitalisation of work has an impact on the quality of services provided by the public sector.
3. The digitalisation of work has an impact on improving working conditions in the public sector.
4. The implementation of digitalisation tools and methods has enhanced your ability to serve citizens, allowing you to better meet their needs.
5. The introduction of digitalisation tools and working methods has helped you to cooperate better with other public services/businesses and third sector organisations.
6. The implementation of digitalisation tools and working methods has enhanced performance monitoring within your organisation.
7. Utilizing digitalisation tools at work accelerates task completion for you.
8. You have had the opportunity to gain knowledge and skills in using digitalisation tools in your office.
9. You have the necessary resources (software and hardware) to use digitalisation tools.
10. The new skills required by digitalisation enrich your personal abilities.

The response scale was 5, with 5 being strongly agree and 1 being strongly disagree. Figures 1-10 show the percentage breakdown of the survey results.

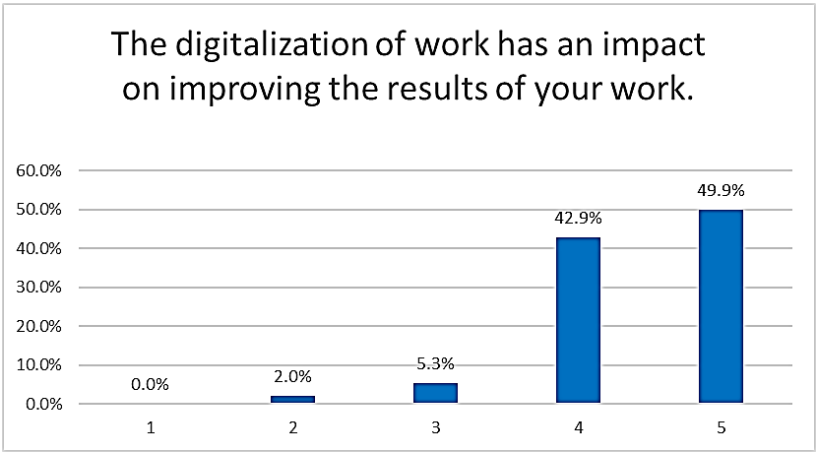

Figure 1. The impact of digitalisation on public sector work outcomes.

Respondents believe that digitalisation has had a positive impact on improving the results of their work. Half of respondents strongly agreed with this statement. The percentage of those who were uncertain about their opinion was also high at 42.9% ('rather yes'). One in twenty respondents had no opinion in this area and one in fifty felt that digitalisation was unlikely to have an impact on improving work performance (fig. 1).

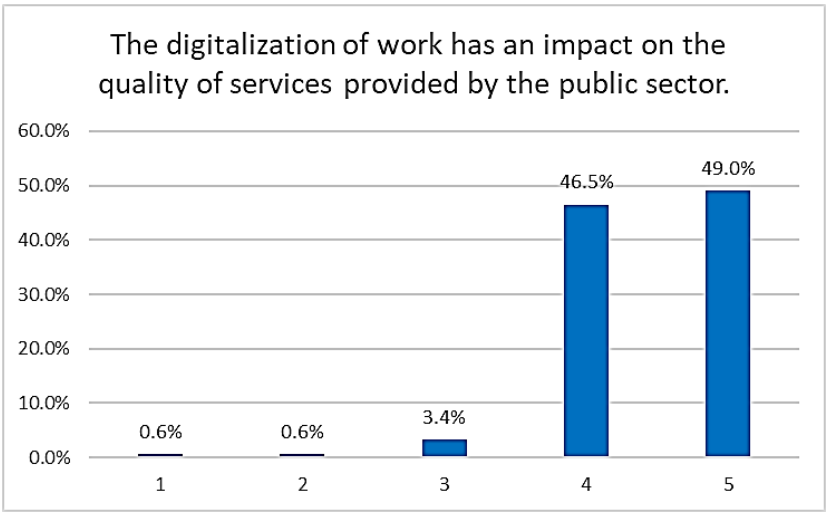

Figure 2. Impact of digitalisation on the quality of public service delivery.

The majority of respondents say that the digitalisation of work has an impact on the quality of public services. Almost half of the respondents expressed their opinion with conviction. A significant proportion of respondents (46.5%) agree with this statement, but express it with uncertainty. A small proportion of respondents (3.4%) have no opinion in this area (fig. 2).

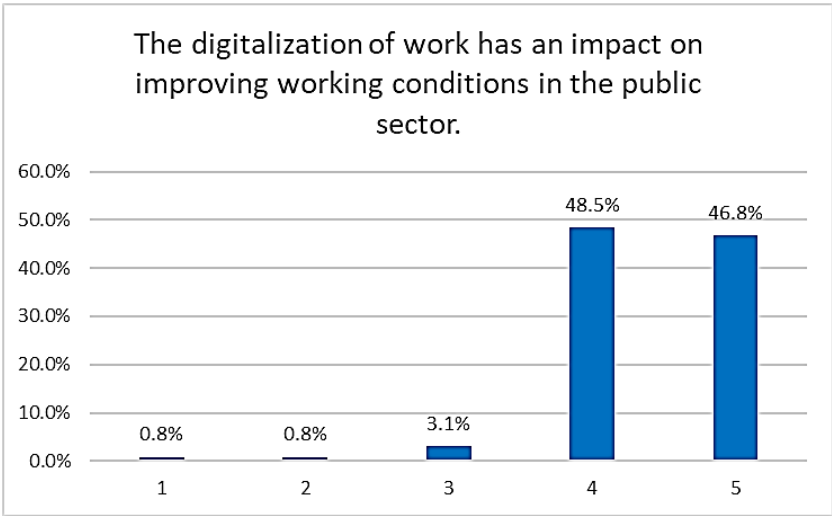

Figure 3. Impact of digitalisation on improving working conditions in the public sector.

It appears that the digitalisation of work improves working conditions in the public sector according to respondents. However, the majority of those who agree with this statement are unsure of their opinion. The difference between 'definitely yes' and 'rather yes' is small at 1.7%. Almost two per cent of respondents said that digitalisation had not improved working conditions (fig. 3).

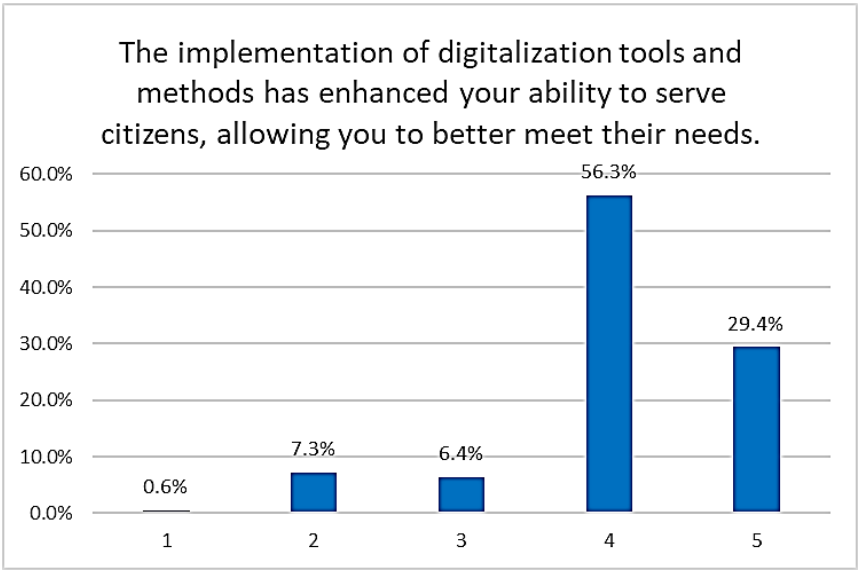

Figure 4. Impact of digitalisation tools and working methods in response to residents' needs.

The given statement that digitalisation makes it possible to better identify the needs of citizens was supported by 85.7% of respondents. The majority of these opinions are those that express uncertainty about the issue under study (56.3%). There is a percentage of 7.9% of respondents think that citizens' needs will be not better identified following the introduction of digitalisation tools and working methods (7.3% "rather not" and 0.6% "definitely not"). 6.4% of respondents have no opinion on this statement (fig. 4).

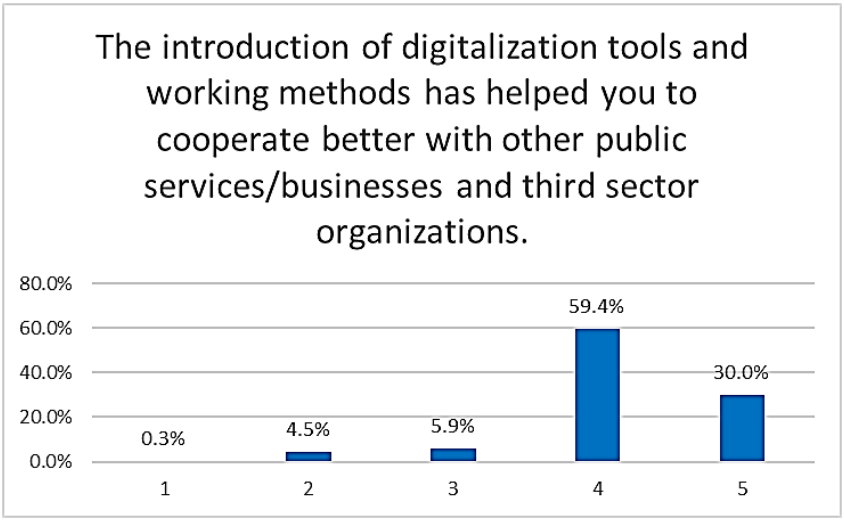

Figure 5. Impact of digitalisation tools and working methods on cooperation with other entities.

The data in Figure 5 show that respondents believe that digitalisation tools and working methods improve collaboration between organisations. However, among the positive opinions, most are expressed with uncertainty (59.4% 'rather yes' and 30% 'definitely yes'). There were also negative responses, with a total of 4.8%, as well as responses indicating a lack of opinion in the area surveyed (5.9% "I have no opinion").

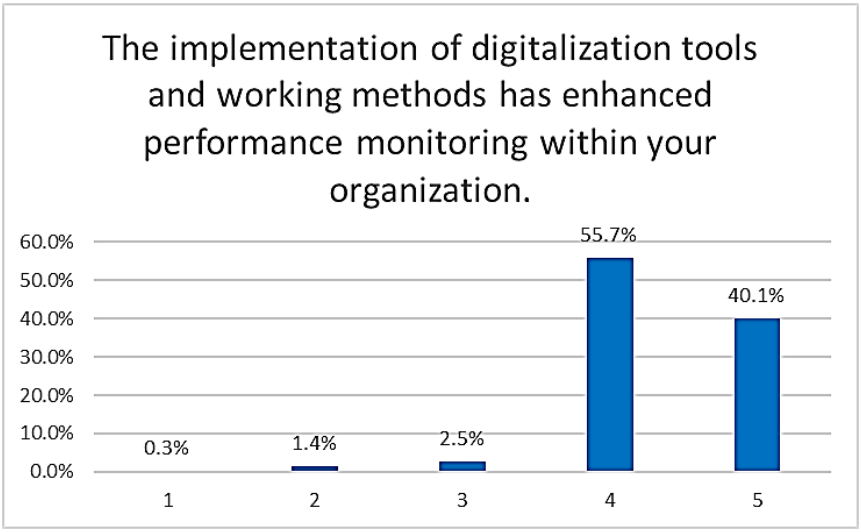

Figure 6. Impact of digitalisation tools and working methods on performance monitoring in the office.

It appears that digitalisation tools and working methods have increased the scope of performance monitoring in the public sector The majority of respondents (55.7%) agreed with this statement with some uncertainty, while 40.1% strongly agreed that work monitoring had increased. A small percentage of respondents had not noticed any change in the level of monitoring following the introduction of digitalisation tools (fig. 6).

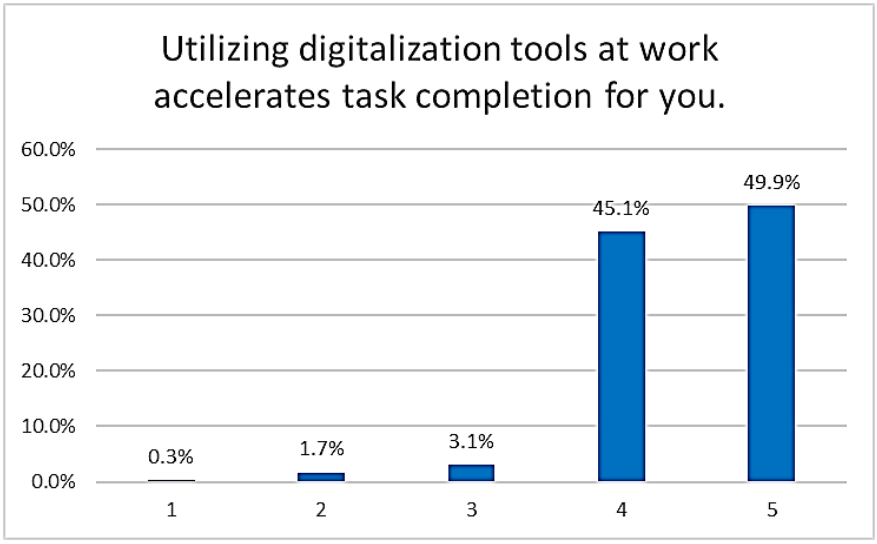

Figure 7. Impact of digitalisation tools on task completion times.

The majority of respondents (95%) agree that digitalisation tools make it possible to complete tasks faster. Half of respondents strongly agreed and 45.1% were uncertain. Two per cent of respondents did not see any impact of digitalisation on the speed of their tasks and 3.1% did not know how to respond to the statement (fig. 7).

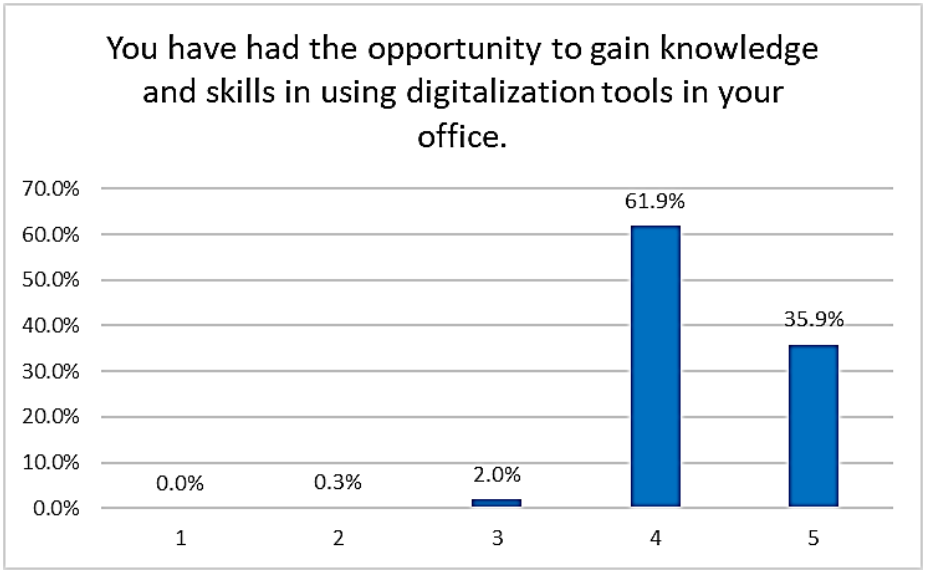

Figure 8. Opportunities to acquire knowledge and skills in the use of digitalisation tools.

The data in Figure 8 show that local government units representatives are not fully convinced that they have been enabled to acquire knowledge and skills in the use of digitalisation tools in they work. The majority of respondents (61.9%) were uncertain about this. It is worth noting that there are hardly any negative opinions in this area (0.3% "rather not").

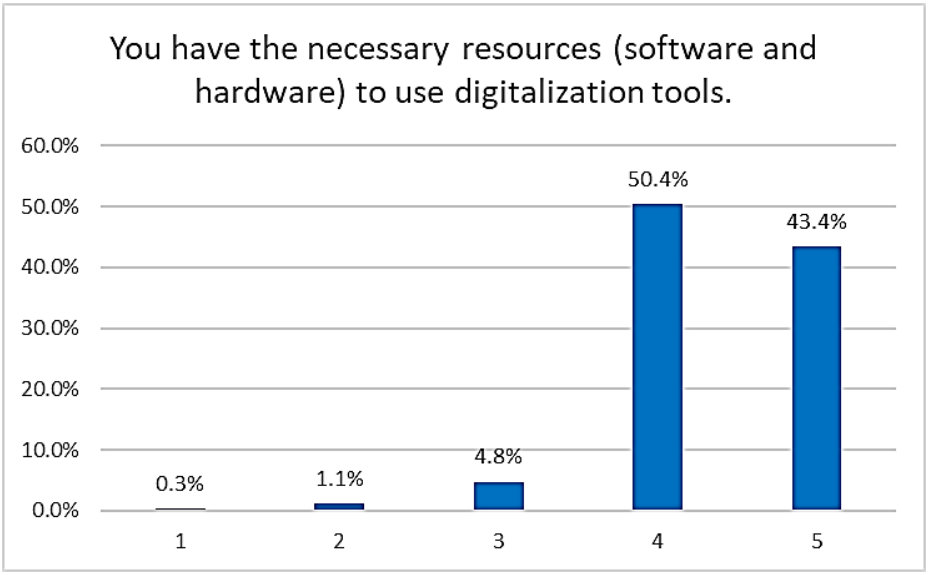

Figure 9. Equipping an employee with the necessary resources to use digitalisation tools.

In the context of having the necessary resources for using digitalisation tools, half of the respondents answered affirmatively, albeit without conviction, indicating that these resources (software and hardware) have been provided, but not entirely recognized by the employees. Although 43.4% of the local government units surveyed strongly agreed with this statement. One in twenty respondents had no opinion in this area and 1.4% felt that they had not been provided with the necessary resources to use digital facilities (fig. 9).

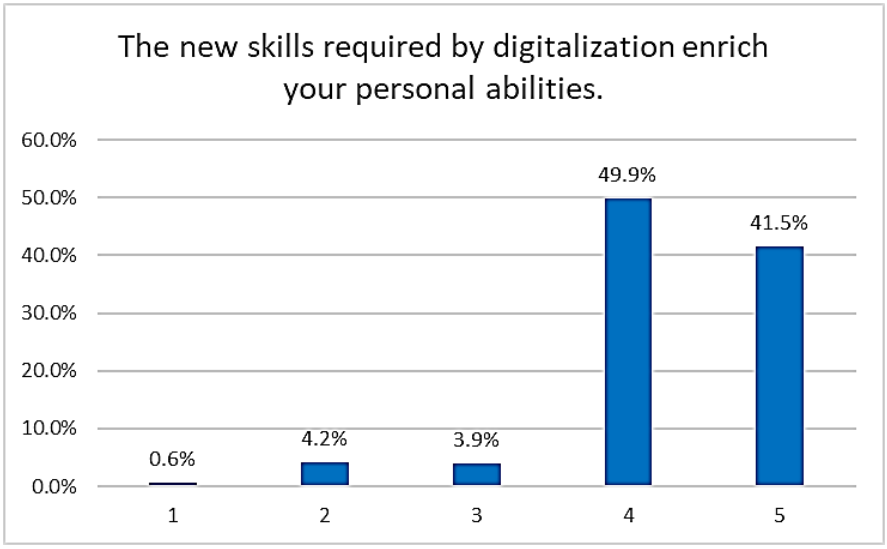

Figure 10. The impact of digitalisation on employee competence development.

The data in Figure 10 show that respondents believe that the new skills required by digitalisation enrich their personal competences. Although half of those who support this view are unsure, a similar proportion strongly support it (41.5%). Almost one in twenty respondents felt that the digitalisation of work had no impact on the development of their competences, and 3.9% were unable to answer this question.

6. Conclusions

The survey concludes that representatives of local government units generally perceive digitalisation tools as having a positive impact on their work outcomes and the quality of provided public services. Across all surveyed areas, opinions are divided between those seeing the positive effects of digitalisation tools and those who hold a more tentative positive stance. For the undecided respondents, it is plausible to posit that they may require additional time to acquaint themselves with the potential of digitalisation, or they might be hesitant to adopt new approaches. Investigating the barriers to digitalisation within public administrations could be a direction for future research.

The research also confirms that the adoption of digitalisation tools improves the scope of collaboration with public services, private companies and NGOs. The majority of respondents were uncertain about this, but almost one in three strongly agreed, indicating an increase in the level of cooperation. Collaboration in emergency management is the interaction of independent organisations and the search for common solutions to achieve the goal of saving lives and health of people in crisis situations. Kożuch and Sienkiewicz-Małyjurek (2015, p. 245) draw attention to the need for inter-organisational collaboration in crisis management, pointing out the importance of collaboration between the state administration and executive units, the civil sphere and NGOs. Many available studies focus precisely on improving the level of collaboration in crisis management (Witkowski, Marcinkowski, 2022; Frykmer, Tehler, Uhr, Wester, 2021; Supreme Audit Office, 2017; Sienkiewicz-Małyjurek, 2012; Silvia, McGuire, 2010; Blecken, Heidelberg, 2009).

Research demonstrates that digitalisation enables administrative employees to accomplish their tasks faster. This is particularly important in crisis management. When a disaster strikes, it is necessary to react immediately, as time is a key determinant of the effectiveness of actions during crisis situations (Marjanski, 2015). Research has shown that the new skills required by digitalisation enrich the personal competences of representatives of public administration. This is relevant in the context of public crisis management activities. The reports of the Supreme Audit Office (2017 and 2019) raise concerns about the organisational preparation for the implementation of tasks at the two main levels of crisis management, i.e. the county and the municipality, including the substantive qualifications of employees. In the opinion of the Supreme Audit Office (2017 and 2019), the scale of irregularities identified at the county and municipality levels poses a serious risk of inadequate implementation of crisis management tasks. Against this background, the tools of digitalisation can have a positive impact on increasing the competence of representatives of TSUs, including officials in crisis management structures.

The representatives of local government units are not entirely convinced that they have been provided with the opportunity to acquire knowledge and skills in using digitalisation tools. Although the majority believe that such conditions have been created, the highest percentage among them are those who are unsure of their opinion.

In summary, the digitalisation of public administration is viewed positively by respondents. Digitalisation tools have an impact on the speed with which tasks are carried out, and the respondents themselves believe that they are better able to identify and respond to the needs of citizens. In the field of public crisis management, as well as in public administration management as a whole, digitalisation tools, together with an increase in awareness and the development of staff's ability to use such digital means, can help to meet the needs of the citizens more effectively and ensure their safety to a greater extent. The level of security of the state and its citizens is increased through automation and improved access to information, as well as increased transparency of operations. Digitalisation tools also increase the responsiveness of crisis management, for example through the RCB's emergency alert system. Modern times are characterised by high dynamics and volatility, and the progress of civilisation is associated with an increased risk of disasters, both man-made and natural. In general, the increasing number and cost of crisis situations highlights the need for state-of-the-art technological tools, including digitalisation tools.

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RESILIENCE OF HOUSEHOLDS ON THE HOUSING REAL ESTATE MARKET TO ECONOMIC SHOCKS IN THE 2019-2022

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Purpose: Since 2019, we have been observing economic shock events in Poland - the COVID-19 pandemic and its effects, the outbreak of the war in Ukraine and ongoing inflation. In the face of these unexpected events, the real estate market has undergone many changes with negative consequences for households. A research gap was found in terms of the resilience of households in the market in question. The aim of the article is to examine whether households have demonstrated financial resilience to the above-mentioned events.
Methodology: First, a critical analysis of the literature on the subject was carried out, thanks to which two dominant definitions of the concept of household resilience in the housing real estate market were identified. Then, based on previously conducted research, monthly repayment of loan instalments was simulated to determine whether households showed resistance to economic shocks.
Findings: As a result of the research, it was found that households were not resistant to economic shocks, including the effects of the pandemic, the outbreak of the war in Ukraine and rising inflation. Moreover, it was shown that, assuming average earnings in the economy, average households do not have the ability to repay increasing loan instalments in accordance with the proposed indicator below 15% of the monthly salary. The amount of the loan instalment throughout the simulation period significantly exceeds this value. Therefore, taking into account the presented definitions of immunity, its absence was found in both cases.
Research implications: The study's results provide a valuable source of information about resilience of households in real estate market and partially fills the research gap in this area. Also indicates further possible research directions.
Originality: The considerations presented show households on the real estate market from a new perspective - in terms of their resistance to unexpected events. The article is addressed primarily to people interested in researching the real estate market, as well as to households struggling with problems related to financing their housing needs.

Keywords: financial resilience, real estate market, households, COVID-19, inflation.

Category of the paper: research paper, viewpoint**.**

1. Introduction

Economic changes which are occurring so quickly under the influence of unexpected events with negative consequences, called shocks and upheavals in the literature, have not been observed for a long time. The end of 2019 brought the so-called black swan (Antipova, 2020; Goodell, 2020; Mazzoleni et al., 2020). The outbreak of the COVID-19 pandemic and its effects significantly changed the operation of many economic sectors not only in Poland but also around the world and had a significant impact on households. On the one hand, the coronavirus has accelerated the development of many enterprises, e.g. the e-commerce industry and all transport and postal services, but on the other hand, the deepening lockdown, the need to switch to remote work and personal tragedies in households have forced many economic changes. Both positive and negative.

From the point of view of the Polish economy, and especially the real estate market, two more important events have been observed since then - the outbreak of the war in Ukraine in February 2022 and rising inflation. When the war in Ukraine began, a huge wave of refugees arrived in Poland, which slightly destabilized the market in several aspects. Soon, there was a shortage of apartments for rent on the market, and rental prices began to increase significantly. In addition, rising inflation and constantly rising interest rates have meant that housing, which has long been considered a luxury good in Poland, has now become even less affordable for the average Pole (Lubasiński, Kukołowicz, 2022). On the one hand, the availability of apartments for rent has decreased significantly and prices have increased, on the other hand, purchasing an apartment to own has also been made more difficult by rising loan prices and rising space prices. The situation was unfavourable also for developers. They initially refrained from making new investments in order to observe the direction in which the Covid situation would develop (Martyniak, 2021a), and then, in relation to the prevailing market conditions - i.e. the outbreak of the war in Ukraine and inflation in Poland, they increased the offer prices of apartments, which affected on the ability of households to meet their housing needs.

Shocks or upheavals in the economy are characterized by the fact that they cannot be predicted and must be reacted to. Due to the fact that the above-mentioned events occurred in a relatively short period of time (end of 2019 to 2022), the concept of resilience of market entities to this type of situations seems to be crucial. The real estate market is characterized by certain individualities, including: it is a market that requires a large financial contribution and has a specific subject of trade - real estate permanently attached to land (Kucharska-Stasiak, 2016). This means that it is not a product that is easy to sell or can be transferred to another market. Basically, the most important role in this market is played by households and enterprises renting space for business activities (on the demand side) and developers and real estate agents (on the supply side) (Martyniak, 2017). This article focuses on the resilience of households to the shocks and upheavals observed in recent years.

Therefore, the question arises whether households are resilient to unexpected events - economic shocks and upheavals? If so, what makes them resistant? How can this phenomenon be measured? Research questions formulated in this way will help achieve the assumed research goal, i.e. demonstrating whether households are resistant to the occurrence of unexpected events with a negative impact on the economy, as well as analysing and assessing the situation of these market participants in relation to the definitions of the concept of resilience adopted in subsequent chapters. A research hypothesis was also formulated: households on the real estate market are characterized by low resilience to economic shocks due to the excessive capital intensity of real estate.

2. Concept of resilience in relation to households in the housing market

The latest literature on the subject shows a wave of discussions and observations on post-pandemic changes in the real estate market. This research can be divided into several areas, e.g. in terms of market and prices - transactional (Bełej, 2021; Martyniak, 2021b; Palicki, Kostov, 2022) rental prices of residential real estate (Gajowniczek, 2021; Tomal, Marona, 2021), in terms of sectors - housing market, commercial market (Pindral, 2022). There are also studies on the impact of the pandemic on real estate market entities, but they are mainly aimed at the supply side of the market, i.e. developers and real estate agents (Hyży, 2023; Martyniak, 2021c; Najbar, 2021; Tomal, Marona, 2023; Zaniewska, Kobylińska, 2023).

Numerous studies of the real estate market in recent years have focused primarily on the impact of the pandemic on transaction prices and the behaviour of its participants, ignoring the context of their resistance to shocks and economic upheavals. Therefore, there is a research gap in this area and it seems important from the point of view of science to fill it. Moreover, households are a key participant in the real estate market and it is worth analysing their behaviour. Considerations on the discussed topic should begin with a discussion of the concept of immunity developed over the years by subsequent scientists.

The critical analysis of the literature on the subject shows that there is no single coherent concept of the category of "resilience", and the concept itself is highly interdisciplinary. Resilience in the literal sense can be understood as resistance, flexibility, endurance, and the ability to regenerate (Majchrzak, 2020). The multitude of definitions created, on the one hand, allows the author to adapt them more appropriately to the research being conducted, but on the other hand, it causes information chaos. Due to the above, for the needs of further research, it was decided to adopt two dominant ways of defining this concept in the literature:

- Resilience as the ability to cope with occurring disorders without loss of functionality, in other words the ability to withstand market or environmental shocks without losing the ability to function effectively (Perrings, 2006), and in relation to households, resilience as the ability to minimize life losses in the event of extraordinary events. threats (Hallegatte, 2014).
- Resilience as the ability of a company or an individual to return to the state before the shock occurred (Majchrzak, 2020).

The last definition is particularly applicable to enterprises. For example, from the point of view of financial results, it seems reasonable that a resilient enterprise will return to the original minimum or achieve even better financial results, while a non-resistant enterprise will achieve worse results. However, to the same extent it can also be applied to households, making appropriate assumptions.

O'Neil (2011) indicates that resilience can be considered at the level of economic and financial analysis both in relation to enterprises and households. This confirms that the concept of resilience can be transferred to real estate market participants struggling with unexpected economic shocks, such as the pandemic, the war in Ukraine and rising inflation and, consequently, an increase in interest rates in recent years. In terms of households, he recommended the use of simple techniques to increase financial resilience, including: maintaining the income debt ratio at a safe level (max. 15%), monthly repayments of consumer debt should be 15% or less of the monthly salary, households should maintain a "fund "emergency fund" as funds to cover at least three months' expenses or the purchase of life insurance, protecting against the risk of loss of income by the "breadwinner" of the household. In turn, in relation to enterprises, resilience can be identified with managing an enterprise in crisis, i.e. the ability to get out of the crisis with as little losses as possible, and even use it as a development opportunity (Romanowska, 2012).

Solarz (2016) presents an interesting perspective on the financial resilience of households. It is divided into the ability to survive sudden financial shocks, e.g. accidents, theft (financial resilience of households) and medium- or long-term resilience, e.g. as a result of job loss or disability (resilience as financial security). In the second case, the resilience of this entity is identified with the financial independence of households. In relation to the real estate market, we should therefore consider the resilience of households as their ability to secure their housing needs as a result of sudden economic shocks and upheavals and to respond to current negative financial changes.

The literature on the subject also indicates that, in addition to resilience, scientists also include two other, similar concepts in their research, i.e. vulnerability and sustainable development (Masik, 2022). Both have similar assumptions regarding the concept of resilience, however, a critical analysis of the literature on the subject did not bring the desired results. Also in this respect, households on the housing market were not included in the research. The topic of vulnerability refers more to social categories (Adger, 2006), while sustainability

is more about the supply side rather than the demand side of the market. Moreover, the category of vulnerability refers more to expected changes and is most often studied in the context of political economy (Eakin, Luers, 2006). In turn, the concept of sustainable development in the housing market refers mainly to the development of cities and housing construction technologies, not to households (Bartkowiak et al., 2023).

3. Research methodology

In order to answer the research question and verify the hypothesis, first of all, a critical analysis of the literature on the subject of research on real estate market entities and resilience was performed. The concept of resilience was defined and households in the housing market were selected as the research object. They constitute the largest group that is the first and most affected by the negative effects of unexpected shocks and economic upheavals. To verify the hypothesis, the two most dominant definitions of resilience in the literature on the subject were adopted, on the basis of which the actual study was then carried out. In short, the financial resilience of households in the housing market is considered as:

- ability to survive a crisis without major difficulties,
- as skills to return to the state before its occurrence.

The starting point of the analysis was the end of 2019 due to the first reports of the COVID-19 pandemic until the end of 2022. During this period, three events occurred that had a significantly negative impact on the Polish economy in general - i.e. the pandemic, the war in Ukraine and ongoing inflation. Some of the data obtained for analysis refer to the year 2022 due to the fact that newer statistics have not been published yet. Then, changes in WIBOR 3M and interest rates were presented, which have a direct impact on the amount of loan instalments - both for households wanting to enter the real estate market and for those currently repaying loans. At this point, the analysis has been extended to April 2023 to include the latest data and reflect the most up-to-date market situation. Then, based on previous own research (Martyniak, 2021b), a simulation of the monthly loan repayment instalments was carried out and the recommendations proposed by O'Neil (2011) for increasing the financial resilience of households were assessed.

4. Research results

From the point of view of households, their resistance to shocks should be considered in two categories: households entering the market, i.e. seeking to purchase or rent a property, and households having their own apartment (in particular those repaying a mortgage loan).

Entering the real estate market is mainly associated with a financial barrier. In recent years, prices on the real estate market have been increasing at a surprising pace, both on the primary, secondary and rental markets. Initially, the pandemic caused a standstill on the real estate market - uncertainty about its course and concerns about one's health postponed many housing decisions. This situation would probably last longer if it were not for the influx of refugees from Ukraine massively seeking refuge in Poland from February 2022. The rental market revived and prices started to rise. An additional difficulty for households, apart from rising transaction and rental prices, was inflation and high interest rate increases (see Figure 1). For households entering the real estate market, this meant more expensive loans or even a complete barrier to meeting their housing needs due to lack of creditworthiness, while for people already owning apartments, especially those with loans - a high increase in the repayment of monthly loan instalments.

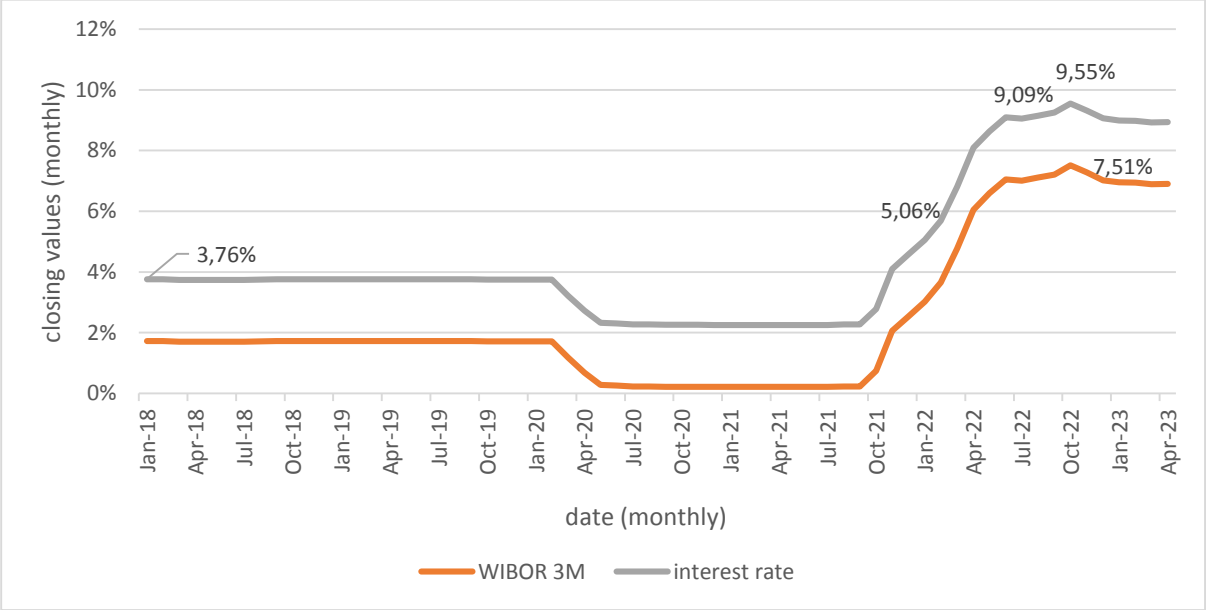

Figure 1. Changes in WIBOR 3M and interest rate.

Source: own study based on data from the www.stooq.pl portal.

After the initial period of the pandemic and reductions in WIBOR 3M and the interest rate, there was an higher increase in both indicators up to the maximum levels of 9.55% and 7.51%, which is more than twice their value from the beginning of the period under review. Assuming that the household took out a mortgage loan for a medium-sized apartment in 2018, given the economic conditions prevailing at that time, a simulation of the repayment of monthly loan instalments was created (see table 1).

Table 1.
Simulation of repayment of monthly loan instalments

date	WIBOR 3M	interest rate	instalment primary market	instalment secondary market
Jan 18 - Mar 20	1.71%	3.75%	1,807.91 PLN	1,667.77 PLN
Apr 20 - Jun 20	0.68%	2.72%	1,616.77 PLN	1,491.37 PLN
Jul 20 - Sep 20	0.23%	2.27%	1,537.11 PLN	1,417.89 PLN
Oct 20 - Dec 20	0.22%	2.26%	1,535.36 PLN	1,416.28 PLN
Jan 21 - Mar 21	0.21%	2.25%	1,533.63 PLN	1,414.67 PLN
Apr 21 - Jun 21	0.21%	2.25%	1,533.63 PLN	1,414.67 PLN
Jul 21 - Sep 21	0.21%	2.25%	1,533.63 PLN	1,414.67 PLN
Oct 21 - Dec 21	0.74%	2.78%	1,627.57 PLN	1,501.34 PLN
Jan 22 - Mar 22	3.02%	5.06%	2,067.98 PLN	1,907.58 PLN
Apr 22 - Jun 22	6.05%	8.05%	2,735.03 PLN	2,522.90 PLN
Jul 22 - Sep 22	7.01%	9.05%	2,963.02 PLN	2,733.21 PLN
Oct 22 - Dec 22	7.51%	9.55%	3,084.52 PLN	2,845.28 PLN
Jan 23 - Mar 23	6.95%	8.99%	2,948.57 PLN	2,719.87 PLN
Apr 23	6.90%	8.94%	2,936.54 PLN	2,708.78 PLN
difference (max - min)			1,550.89 PLN	1,430.61 PLN
difference (max - beginning)			1,276.61 PLN	1,177.51 PLN

Source: own study.

The base year is marked in grey, the lowest value of the loan instalment in the examined period is marked in orange, and the highest value is marked in green. Taking into account the previously adopted definitions of resilience, it can be noted that the monthly loan repayment amount did not return to the value from before the base year - i.e. the end of 2019 - by the end of the analysed period. Therefore, the resilience of households to economic shocks has not been confirmed.

However, when considering the second definition of resilience, namely the ability of households to minimize life losses, it is much more difficult to draw clear conclusions in the event of extraordinary threats. This ability is a highly individual matter for each household and depends, among others, on: on the state of one's assets, psychological aspects (e.g. tendency to risk and gambling), or random events (e.g. loss of job, winning a significant sum of money) (OECD, 2023). However, referring to the recommendations proposed by O'Neil (2021) to increase the financial resilience of households, it is possible to verify the effectiveness of the preventive actions he proposes (see chapter 2).

The average salary in the enterprise sector in April 2023 was PLN 7,430.65 gross (GUS, 2023). Assuming, for example, that the monthly debt repayment amount should be less than 15% of the monthly salary, this means that the loan instalment should be less than PLN 1,114.60. According to the simulation, at the end of the analysed period, the loan instalment is more than twice this value. Moreover, it also exceeds the repayment value of the monthly loan instalment in the base year and over the entire loan repayment period. It is also worth emphasizing that the April remuneration, which is the basis for calculations, is much higher than at the time of concluding the simulated loan agreement. In turn, purchasing insurance is an additional cost for households, which is also not a good solution. Therefore, also in this case, the author tends to negatively assess the resilience of households to economic shocks and upheavals.

5. Conclusion

The negative phenomena affecting the economy observed since 2019 affect all real estate market entities, especially households. The effects of the pandemic, the outbreak of the war in Ukraine and rising inflation also affected the residential real estate market through a significant increase in transaction prices. The previously difficult barrier to entering the real estate market for the purpose of purchasing a flat has become even more impossible for average households to overcome.

Based on the two adopted definitions of resilience, i.e. understood as the ability to survive a crisis without losing functionality and the ability to return to the state before its occurrence, it was shown that households are not immune to economic shocks and upheavals. The credit simulation showed that inflation and rising interest rates further deepen the lack of financial resilience of households to economic shocks. The proposals for increasing immunity proposed in the literature on the subject were not applicable in this case. The only way for a household to become resistant to unexpected negative events seems to be financial independence identified with high earnings and a high level of savings.

Both households and the real estate market itself are the subject of numerous studies and scientific studies, but so far the financial resilience of households to economic shocks has not been examined. This publication does not exhaust the topic, but is only an introduction to the development of research in this direction. It would also be worth extending this research and examining other real estate market entities, including: representatives of the supply side - developers or real estate agents.

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FINTECH SECTOR: A REVIEW OF RESEARCH TRENDS FOR THE PERIOD OF 2015-2022

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Purpose: The aim of this paper is to present a bibliometric study of the FinTech sector on the basis of the existing scientific data that has been collected and reviewed. Different aspects and matters within this area are discussed, and its development is critically analyzed.
Design/methodology/approach: Research data, namely 900 publications published between January 2015 and July 2022, was sourced from the Scopus database. Based on these, a bibliometric study was carried out using R software with Bibliometrix and Biblioshina codes.
Findings: The analysis of publications indicates that blockchain (and, first and foremost, cryptocurrencies), artificial intelligence and financial exclusion were topics most frequently examined by scholars in 2020-2021. Research findings also point to certain future trends in the FinTech area; these are mainly sustainable development, and economic and social effects.
Research limitations/implications: The main limitations of the conducted analysis are related to the study being based on the Scopus database and focused on specific disciplines, namely Business, Management and Accounting, Economics, Econometrics and Finance.
Originality/value: The paper analyzes FinTech trends in selected disciplines. The paper also provides information about the identified growth trends that are likely to grow and which of them will becoming less relevant. It identifies how various new technologies and sustainability development can change organizations and management.

Keywords: bibliometric study, financial inclusion, sustainability finance, financial education, blockchain.

Category of the paper: testing of data.

1. Introduction

FinTech has been one of the buzzwords of the past several years. Nevertheless, no consistent definition has been formulated thus far. The etymology of the word FinTech is "Financial Technology". We can define FinTech as a group of companies that employ new business models and new technologies with a view to providing new products and services that have a significant impact on the financial market and the supply of financial services.

This article aims to provide an analysis of the FinTech sector based on the available data on its current developments. Data has been collected and reviewed by the author in order to present the theoretical and conceptual framework of FinTech. In 2019, the results of a bibliometric study were published in the Electronic Commerce Research and Applications journal; it summarized academic publications related to the FinTech sector. The number of articles found in the two most famous, international scientific databases (Web of Science and Scopus) totaled no more than 221 of publications. A more detailed analysis showed that more than half (54%) of articles concerned this sector in general, while the rest focused on its specific aspects (Milian et al., 2019). The study revealed an important research gap in this area; existing studies tend to be of terminological nature, or focus solely on certain aspects of this sector.

In 2020, the outbreak of the COVID-19 epidemic pressured the world into an accelerated process of digitization and forced it to adopt new technologies within a short space of time. Rapidly advancing digitization of the financial sector may have been one of the reasons for record amounts of financing received by FinTech companies (CB Insights, 2022), which proved a strong driver of an even faster technological development. As customers begin to use these innovations, their expectations and demands when it comes to the usability, digitization and democratization of financial services increase. Therefore, we can assume that this area will continue to develop and become more interesting, also in terms of academic research.

The main research questions posed in this paper are as follows:

Q1: What are the global trends in scientific publications relating to FinTech? What research areas can be identified?

Q2: In the light of the existing research trend, which areas of this sector remain unexplored?

Q3: What are the potential research development directions?

In order to answer these questions, a bibliometric study shall be carried out. Bibliometry is a set of research techniques used for the quantitative analysis of publications, including academic publications and patent documentation (Klincewicz et al., 2012). The main contribution of this paper is the bibliometric analysis of the FinTech sector on 900 publications and the presentation of its findings and conclusions.

In the second part of the paper is presented definition and classification of FinTech companies, and aims to provide a perspective on the scale of this phenomenon and the trends both within and around it. The database and the method of analysis employed in order to answer research questions are discussed in the third part. Results of the bibliometric study are presented in the forth part. In the fifth part, findings are discussed and conclusions are drawn; a FinTech terminology framework, based on the literature review and the results of the analysis, is also proposed. The article ends with a discussion of research conclusions.

2. FinTech – definition and classification

The word FinTech only became widely known a few years ago. Technological novelties in the financial sector emerged much later, and entrepreneurs remained reticent about revolutionizing this sector of the economy, which can be accounted for by strict limitations imposed on the financial market. It is a thoroughly regulated area of the economy, and financial data is highly sensitive. At the same time, the development of such services may contribute to the development of society itself. Throughout the world, millions remain deprived of access to financial services, such as bank accounts and digital payments. They still rely on cash payments (Demirgüç-Kunt et al., 2020), while new financial technologies could greatly facilitate access to such services.

In his 2018 study, Bernardo Nicoletti analyzed the FinTech sector in terms of its subject and form. He emphasized that the word must not be associated only with startups, but rather with technologies that may be supplied also by mature enterprises (Nicoletti, 2017). Therefore, FinTechs are companies that use technology to operate outside of the traditional business model of financial services, striving to change the way financial products and services are provided (Fortnum et al., 2017; Milian et al., 2019).

The Financial Stability Board, which is a body that monitors the stability of the global financial system, defines FinTech as a technological and financial innovation related to new business models, as well as applications, processes or products that have a significant impact on financial markets and institutions, as well as the provision of services on this market (Dudley, 2017). Interestingly, the above definition emphasizes that it is related to new business models; the same was concluded by Bernardo Nicoletti. To sum up, the term describes a variety of innovative business models and new technologies that have the potential of transforming the sector of financial services (Al-Ajlouni, Al-Hakim, 2018), or provide solutions to improve it. Leong and Sung argue that FinTech is an interdisciplinary sector that combines finance, technology management and innovation management, and believe that it can be extended to cover "any innovative ideas that improve financial service processes by proposing technology solutions according to different business situations, while the ideas could also lead to new business models or even new businesses" (Leong, Sung, 2018).

Various classifications of this sector can be found in literature. According to Thakor, FinTech covers the following broad areas:

- credit, deposit and capital raising services,
- payment, clearing and settlement services including digital currencies,
- investment management services (including trading) and insurance,
- technological solutions, with blockchain as one of the main technologies (Thakor, 2020).

According to another interesting classification, the sector can be divided into two categories:

- Sustainable FinTechs - established financial service providers, striving to create new technologies in the financial sector to secure their position on the market through the use of information technology.
- Disruptive FinTechs - companies and start-ups that challenge established financial service providers by offering new products and services within this sector. These enterprises have new business models characterized by a greater flexibility, security, efficiency, and more opportunities compared to traditional financial services (Gomber et al., 2017; Milian et al., 2019).

This market is developing very quickly, and the challenges that arise are only accelerating this revolution. The COVID-19 pandemic constrained users of the financial sector to adopt digital solutions faster, and many processes had to be automated. Russia's aggression against Ukraine also triggered the adoption of new technology solutions that contribute to the security of this sector. It should also be emphasized that the use of these technologies, along with other innovations, is aimed, inter alia, at lowering the costs of searching for the interested parties to the transaction, achieving economies of scale in collecting and using large amounts of data, and benefitting from cheaper and safer information transmission, or reduced verification costs (Thakor, 2020). Another important aspect of FinTech development is a greater access to the financial sector of those who have thus far been excluded from it, which means that its development contributes to the fulfilment of one of the goals of sustainable development adopted by the United Nations[1].

3. Database and Research Method

The paper presents a bibliometric study of the FinTech sector based on the existing studies, collected and reviewed, with a view to creating a theoretical framework within which FinTech can be defined. Key trends and potential research gaps shall also be indicated.

Q1: What are the global trends in terms of scientific publications relating to FinTech? What research areas can be identified?

Q2: Which areas of this sector remain unexplored given the existing research trends in this domain?

Q3: What are the potential research development directions?

[1] Refers to the goals of sustainable development and sustainable finance.

In order to answer these questions, a study shall be carried out in four stages: (1) core data selection, (2) data analysis, (3) visualization and, finally, (4) interpretation, which are presented with details on Figure 1.

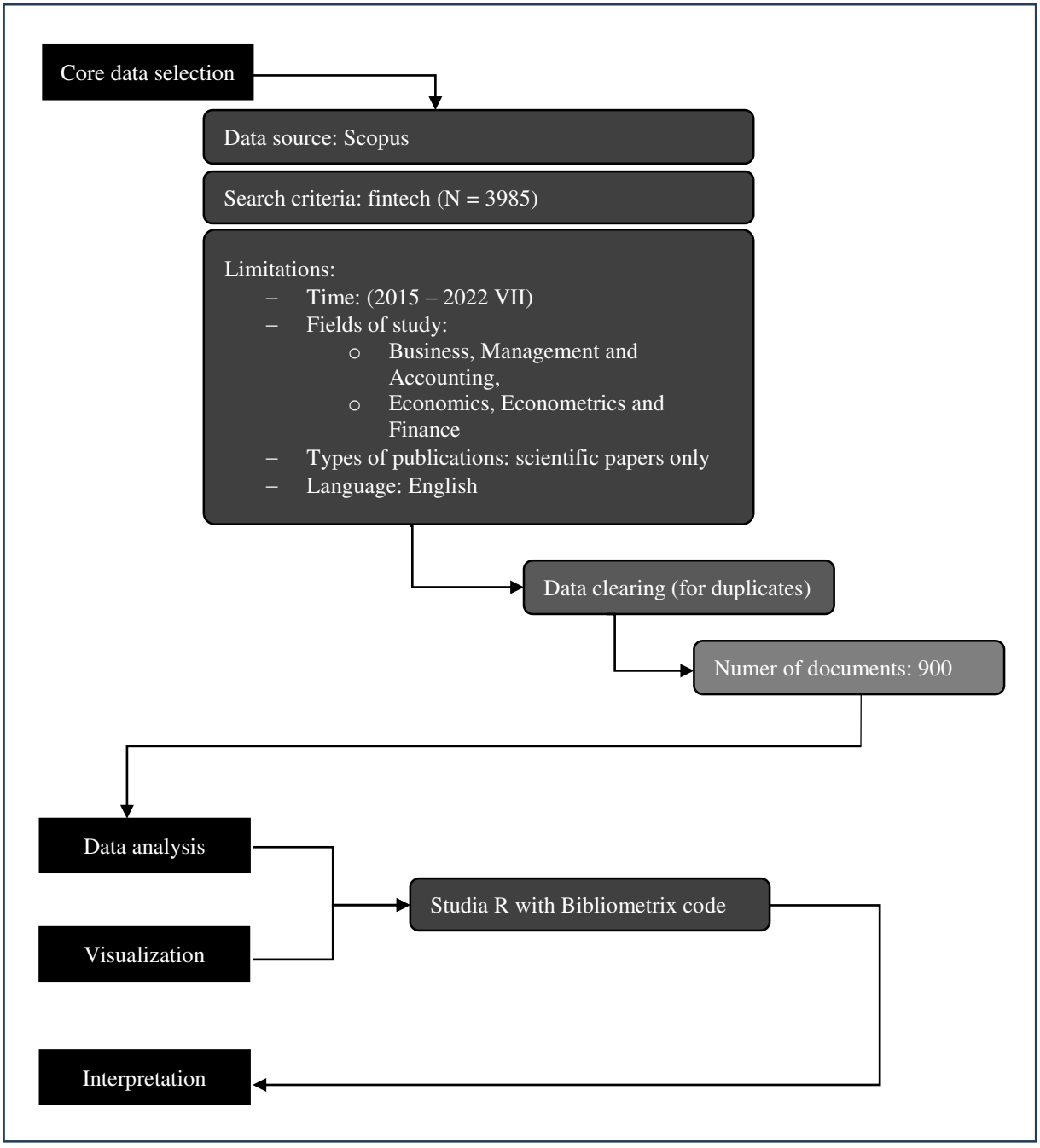

Figure 1. General scheme of the study.

Source: author's own.

The first stage consists in sourcing a database of scientific publications from the Elsevier SCOPUS global database available online. SCOPUS is considered the largest abstract indexing database; it provides advanced search options. It is a useful tool for researchers who wish to draw a list of relevant literature sources (Abbas et al., 2022).

Within it, a thematic query was carried out; it resulted in a list of 900 publications with the term "FinTech" in the title, in the summary and in keywords. The following limitations were applied:

- Time: between January 2015 and July 2022.
- Fields of study: Business, Management and Accounting, Economics, Econometrics and Finance.
- Types of publications: scientific papers only.
- Language: English only[2].

The result of the data collection stage was the creation of a ".bib" file, which was used in the following stage, which consisted in using R software with Bibliometrix and Biblioshina codes. Prior to creating a general summary of the bibliometric study, tables and matrices, the database was checked for repetitions and errors. The number of articles remained unchanged. In the third phase, classifications were made and all the documents examined are sorted out. "Biblioshins", or the bibliometrix web interface, were also used to build a network and a co-citation map (Abbas et al., 2022; Campra et al., 2020).

4. Results

4.1. General information on the analyzed literature

Table 1.

Main database statistics summarizes information sourced from the database downloaded from Elsevier SCOPUS. The total number of publications is 900, and the study covers the period between 2015 and 2022 (18 July 2022). The year-on-year increase in the number of publications is very high: 76.68%. As indicated in figure 2, in 2015 the number of publications related to FinTech was 4 per year. A sudden increase in this number took place in 2020, which may be accounted for by the impact of the Covid-19 pandemic that sparked interest in this area of research. The pandemic accelerated considerably the digitization of various areas, including the financial sector. It is worth noting that the FinTech sector delivers its solutions directly or indirectly, by selling its services/products to large institutions; by doing so, it has accelerated the automatization and digitalisation of the entire financial sector. In figure 3 a downward trend can be observed, starting in 2020. This proves that authors of new articles referred to a very small number of existing studies, while new publications had yet to be cited. The analyzed articles were written by a total of 2024 authors. The average number of authors

[2] Limitations entered in the Elsevier SCOPUS database on 18 July 18 2022 – "TITLE-ABS-KEY (fintech) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA, "ECON")) AND (LIMIT-TO (LANGUAGE, "English"))".

per publication is 2.7. As many as 27.33% of publications are the result of international cooperation. Interestingly, the average age of the analyzed articles is less than 1.67, which confirms that it is a very new field of research. The total number of publications cited in the bibliographies of the analyzed articles is 46,401.

Table 1.
Main database statistics

Main information about the data	
Timespan	2015:2022
Sources (journals, books, etc.)	398
Documents	900
Annual growth rate (%)	76.68
Average age of documents	1.67
Average number of citations per document	10.73
References	46,401
Document contents	
Keywords plus (ID)	1,116
Author's keywords (DE)	2,381
Authors	
Authors	2,024
Authors of single-authored docs	154
Authors collaboration	
Single-authored docs	181
Number of co-authors per document	2.7
International co-authorship (%)	27.33
Document types	
Article	900

Source: author's own.

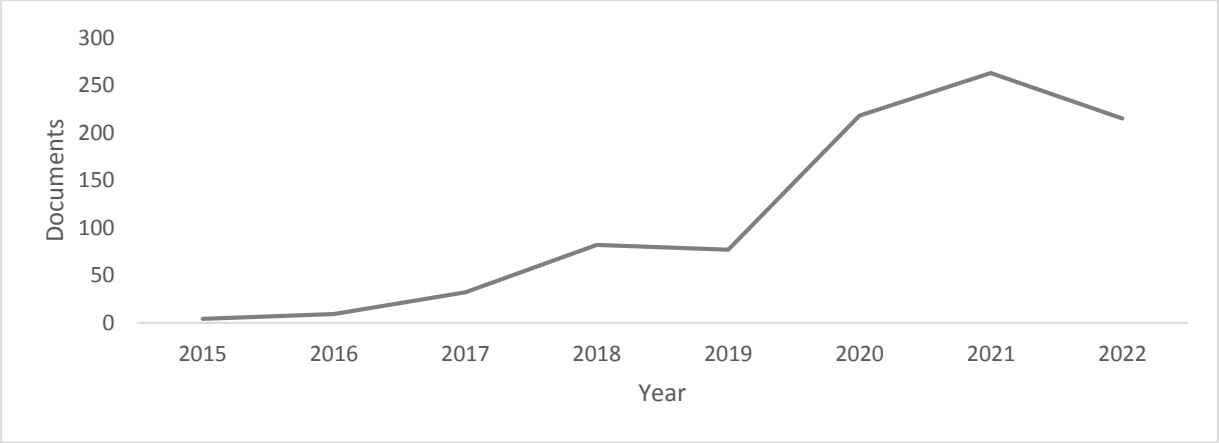

Figure 2. The number of analyzed articles published in 2015-2022 (VII).

Source: author's own.

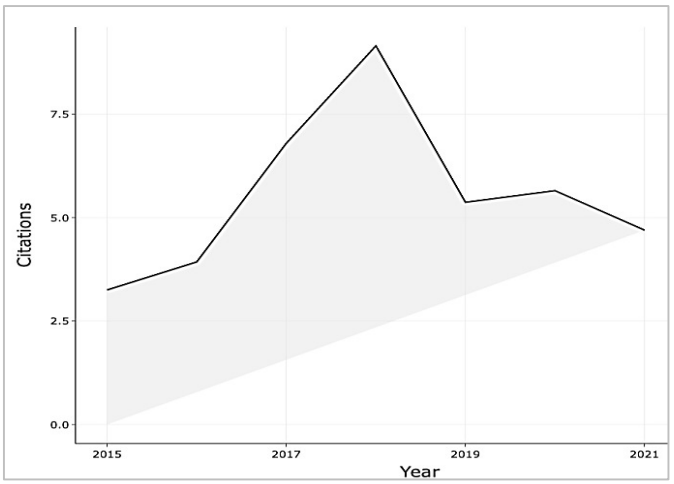

Figure 3. Average annual number of citations of the analyzed articles in 2015-2022 (VII).

Source: author's own.

4.2. Country-specific bibliometric research

The bibliometric analysis covered the countries of origin of researchers who authored the analyzed articles. The results show their geographic origin, as well as the total number of citations and the cooperation network.

Figure 4 presents countries in which articles about FinTech were published. As many as 43% of them were published in the US, China and the UK. The United States top the list of countries with the greatest number of articles relating to the subject (140), with China following as a close second with only one publication fewer (139).

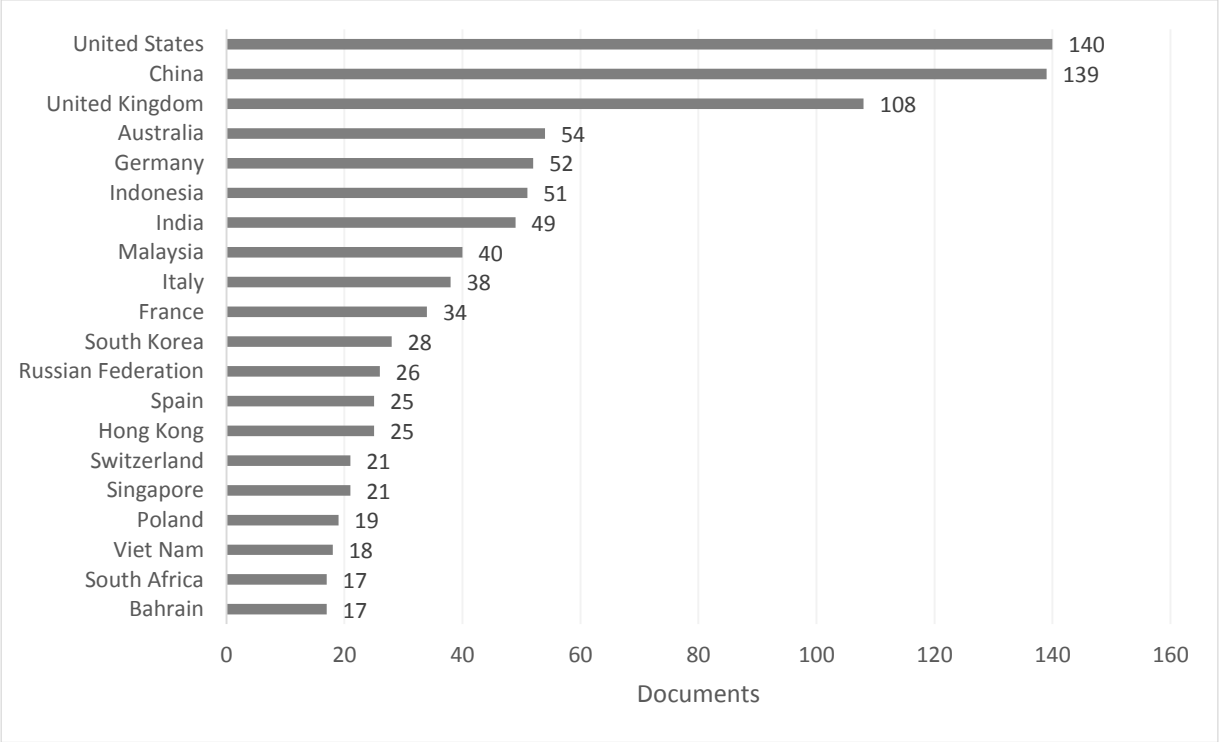

Figure 4. Country of publication of the analyzed articles, 2015-2022 (VII).

Source: author's own.

The first analysis focused on cooperation between countries (figure 5). The network has two central nodes (China and the US), and a minor one in the UK. These three countries are at the forefront of the research carried out in this area and link three continents. The number of articles published in the remaining countries represents fewer than 50% of those published in the US, China and the UK. These three leaders are followed by Australia, Germany, Indonesia and India.

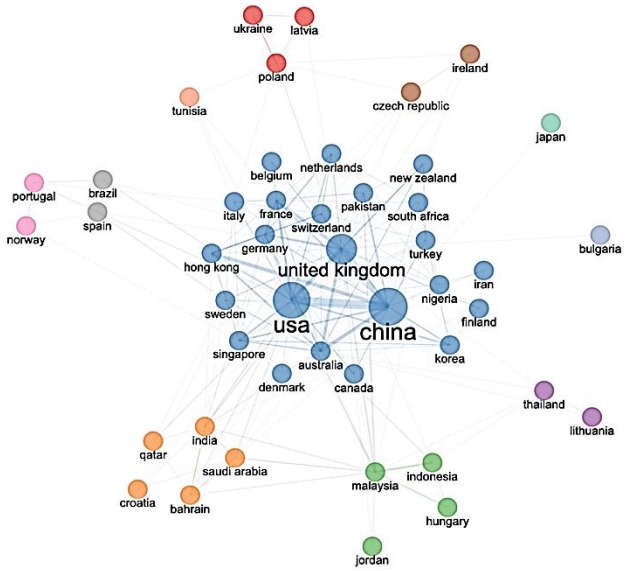

Figure 5. Cooperation between countries in FinTech research.

Source: author's own.

4.3. Bibliometric research pertaining to authors

This section presents the authors of articles from the analyzed database. Those most prolific in terms of the number of publications, and those who are most cited are analyzed, along with the authors' keywords. The graph below (figure 6) presents researchers who have authored the greatest number of publications from the analyzed database.

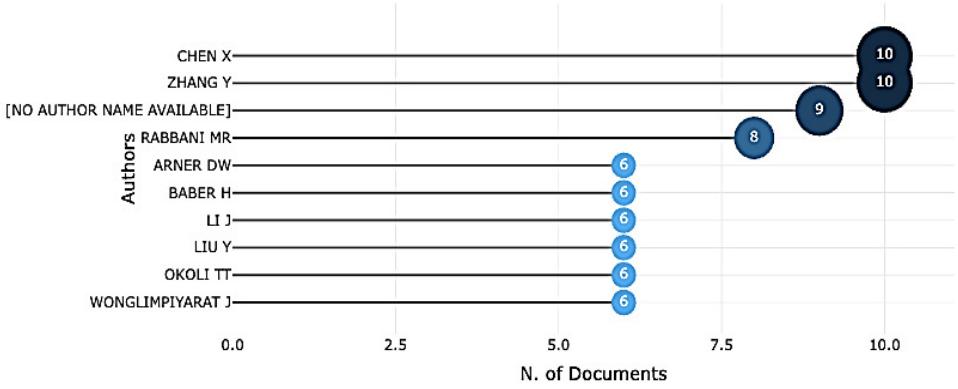

Figure 6. Ten authors with the greatest number of articles relating to FinTech.

Source: author's own.

According to the Graph 5, Chen and Zhang have the greatest number of publications (10); they account for 2.2% of the analyzed base. They are followed by Rabbani, who has authored 8, and Arner, Baber, Li, Liu, Okoli and Anglompiyarat (6 publications each). The next graph (figure 7) allows us to assess the productivity of the best authors over time, as it does not only show the number of their articles and dates of publication, but also the number of citations (detailed data is provided in the Appendix, in Table 2). The size of the circle in a given year reflects the number of publications, while the saturation of blue – the frequency of citation in a given year (it is easier to compare publications year on year from 2015 to 2021). In 2020, Rabbani published 5 articles, with the average number of citations totaling 32.67 per year. Arner published 3 articles in 2020; the annual number of citations was 26.

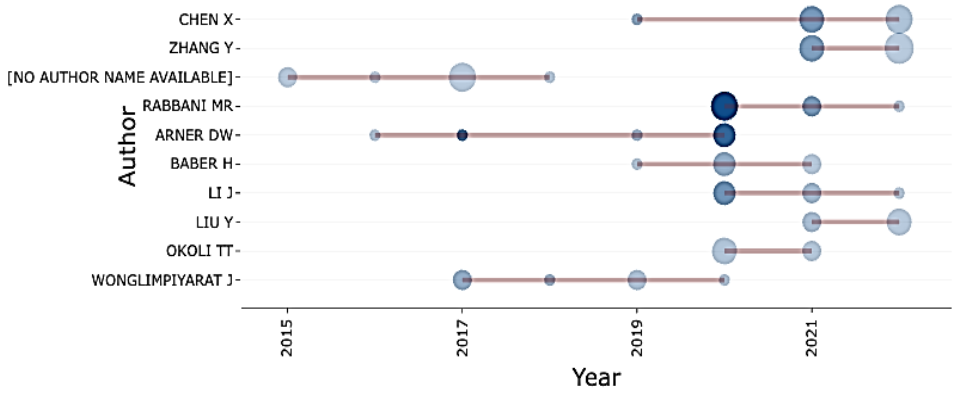

Figure 7. Ten authors with the greatest output over time.

Source: author's own.

Figure 8 presents the most cited authors. It is clearly noticeable that none of the above authors is present. The most cited authors are: Ab- Rahim, Jing, and Zheng (90 citations each), Polinesi and Recchioni (69), Mariani (68), and Deng (67).

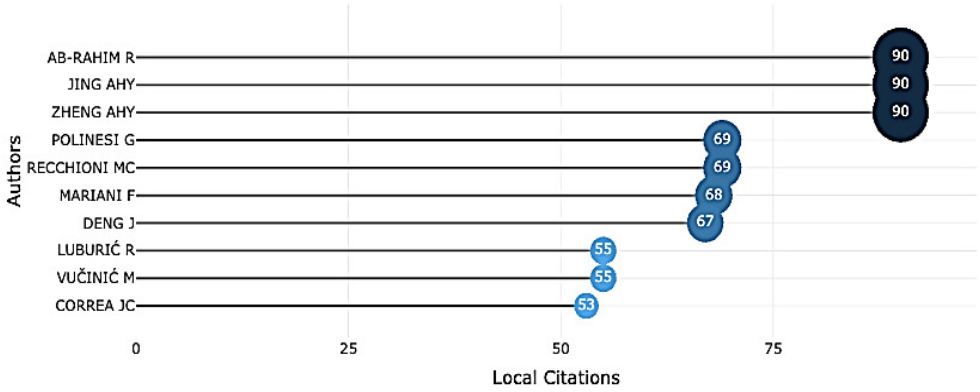

Figure 8. Ten most cited authors of articles on FinTech.

Source: author's own.

Figure 9 presents the distribution of Lotka's law, where the abscissa shows the number of articles, while the ordinate – the percentage of authors. In the figure 9, Lotka's law is illustrated with a dashed line. Over 87% of the authors included in the figure 9 have written at least one

article (detailed data is provided in the Appendix, in Table 3). The percentage of authors of several articles is less than the accepted quarter of the total. The number of articles on FinTech and the number of authors only approaches the dashed line in the graph (figure 9), which is consistent with Lotka's law. This proves that many authors have published a single article (Abbas et al., 2022; Ahmad et al., 2019).

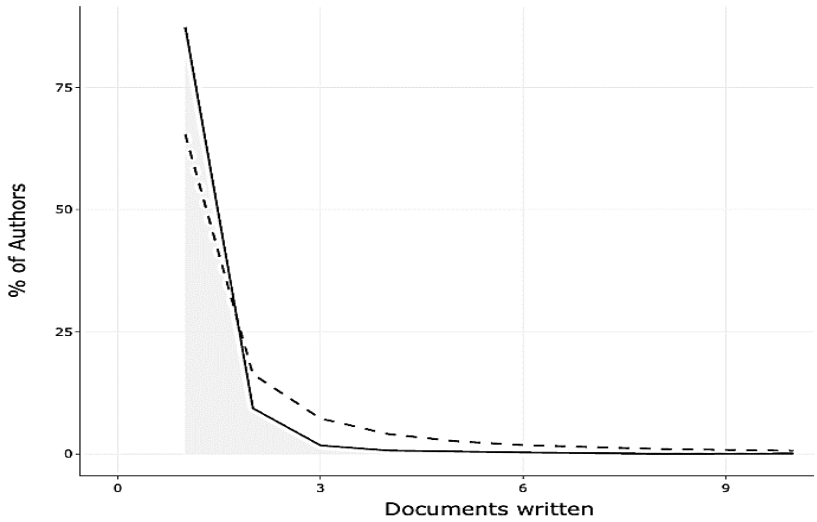

Figure 9. Distribution of Lotka's law.

Source: author's own.

4.4. Trends based on Keywords Plus, authors' keywords and titles

In this part, an analysis of the authors' keywords, Keywords Plus and titles contained in the selected documents shall be presented. It is necessary in order to assess the current research trends and to select areas that are most often analyzed. Additionally, an attempt will be made to identify gaps in FinTech research. On the basis of these results, we shall also try to define potential future directions of research. The analysis is mostly based on Keywords Plus, as they provide a very effective form of document indexing. The authors' keywords and titles are defined by authors based on their intuition and judgment. Keywords Plus are derived from a study by Irving Sher, who investigated the possibility of improving title word indexing by using title information in cited sources. As a result of these experiments, combined with experience in using procedures similar to algorithmic naming, he identified a system called Keywords Plus (Garfield, Sher, 1993). It was described in detail by Garfield in 1990 (Garfield, 1990). Currently, Keywords Plus are identified by Thomson Reuters editors; using a semi-automatic algorithm, they scroll through the titles of all references and highlight any other relevant, yet overlooked keywords that have not been mentioned by authors. As opposed to authors' keywords, the Keywords Plus field is standardized. Keywords Plus terms capture the content of an article with more depth and variety (della Corte et al., 2019).

Words and phrases from titles are summed up, and various algorithms are used to select and classify the best three-word, two-word, and one-word candidate terms. The system ascribes these terms to KeyWords Plus for each source element (Garfield, Sher, 1993).

The Figure 10 shows the difference between the title, the authors' keyword and the Keywords Plus. A search based on keywords resulted in 100 articles. In comparison, Keywords Plus searches yield a different set of roughly the same size (102 articles). Among these, approximately 44 articles overlap, while 58 additional and articles are found. Let us compare them with respect to authors' keywords.

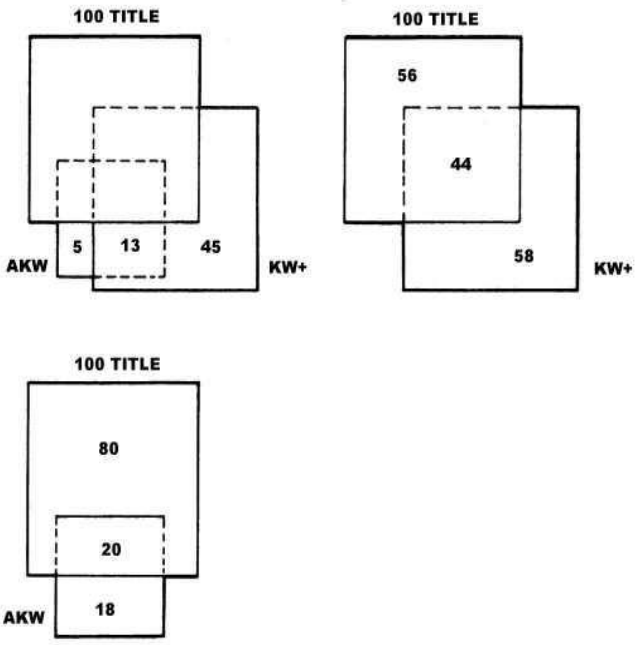

Figure 10. Percentage overlap in retrieval between title words, authors' keyword or Keywords Plus. Source: (Garfield, Sher, 1993).

First, we shall present 15 most common words based on the titles of the analyzed documents, authors' keywords, and Keywords Plus. The three graphs below (figure 11-13) present the results of the analysis. In the case of the 15 most common words/phrases found in the titles, "evidence" and "impact" seem most frequent. They are typical of the titles of academic articles and could appear in works from any research discipline. Therefore, we shall focus primarily on the analysis of Keywords Plus and on authors' keywords. On the basis of figure 13, we can determine areas of the FinTech sector on which research was focused. "FinTech", "finance" or "technology" are obvious terms for the base being analyzed, and therefore we shall, therefore, omit them at a later stage when discussing the results.

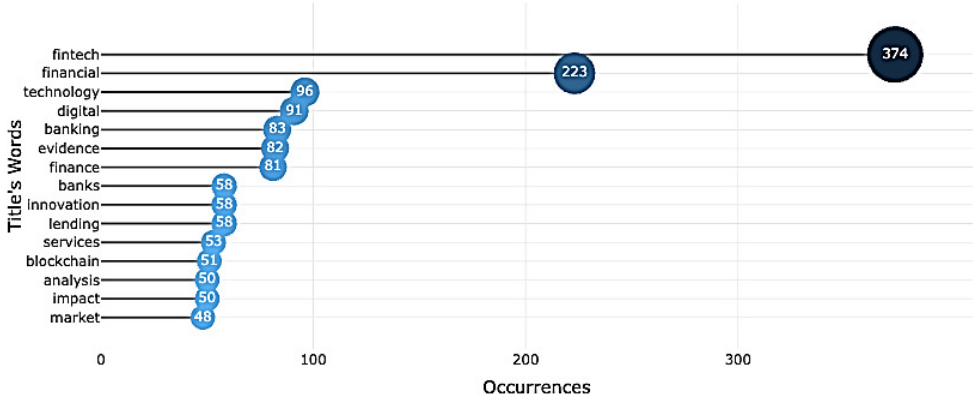

Figure 11. Fifteen most frequent words based on the titles of the analyzed documents.
Source: author's own.

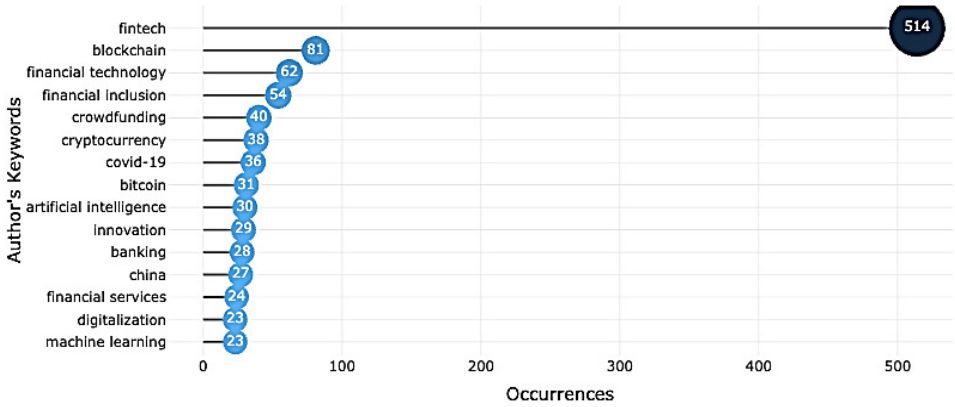

Figure 12. Fifteen most frequent authors' keywords in the analyzed documents.
Source: author's own.

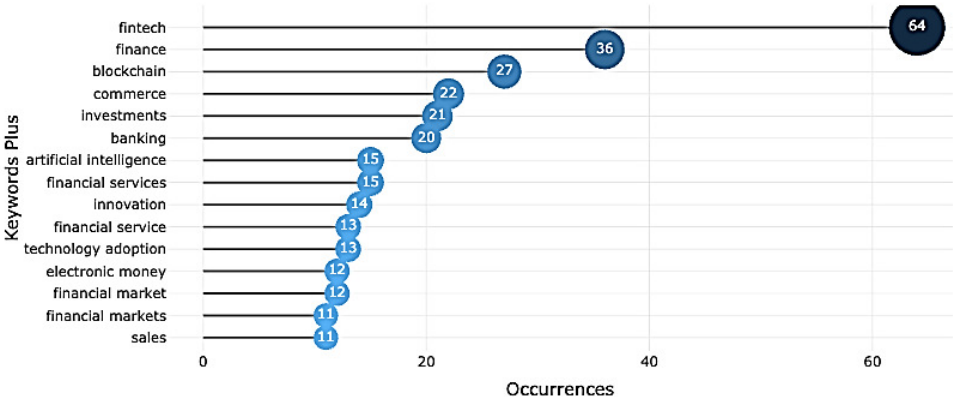

Figure 13. Fifteen most frequent Keywords Plus in the analyzed documents.
Source: author's own.

The analysis of the above graphs (figure 11-13) points to the following: blockchain (second among authors' keywords, and third among Keywords Plus), bitcoin and cryptocurrency. One of Keywords Plus is electronic money, which confirms that certain researchers focus in their work on the topic of electronic money, cryptocurrencies as an alternative to cash, or non-cash money. Banking, artificial intelligence, innovation, financial service are other common phrases. Financial inclusion ranks very high among authors' keywords, as it is a crucial

aspect of the FinTech concept. The issue of financial exclusion has been relevant since 2011, when the Global Findex Database published by the World Bank became a source of data on how people throughout the world use financial services (including payments, savings and loans, expenses, loss of income, etc.) (Demirgüç-Kunt et al., 2020). Research on this subject is regularly published by the World Bank and reflects changes in terms of the financial exclusion. The available data provides evidence for gaps in the access and use of financial services by women and the poverty-stricken, yet access to innovations in the financial sector seem to improve the situation. The Findex global database has become the backbone of global efforts to promote financial integration. It is used extensively by policymakers, researchers and development practitioners. Global Findex data is used to track progress in attaining the United Nations' Sustainable Development Goals (Demirgüç-Kunt et al., 2020).

Figure 14 presents thirty Keywords Plus that are most frequently used in the analyzed FinTech documents. Fifteen most frequently used terms coincide with those presented in figure 13. At the same time, it is worth noting that “financial markets” should rank much higher in figure 13, because this term appears in two forms, i.e. in singular and in plural. With a total of 23 occurrences, it would rank 4th in terms of frequency.

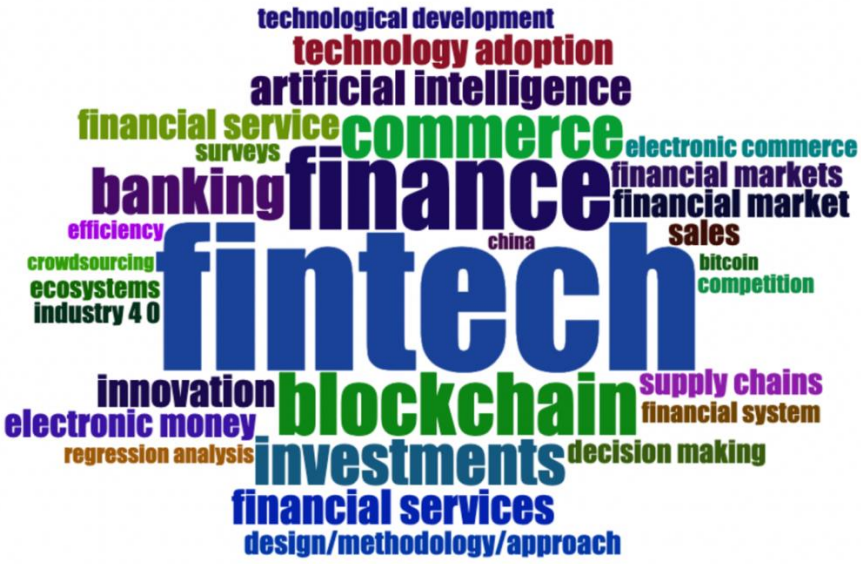

Figure 14. Thirty most frequent Keywords Plus in the analyzed FinTech articles.
Source: author’s own.

The next step in the authors’ keywords and Keywords Plus analysis is the trend analysis based on the phrases used in the FinTech database. In the bibliometric study, two assumptions were made: in order to show the trends regarding a given phrase in the graph, its minimum frequency was 4 in general and 3 per year. Figure 15 presents the results of this study for Keywords Plus, while figure 16 – for authors' keywords. The results for Keywords Plus show that "sustainable development" and "economic and social effects” are among the most frequently used new phrases, which indicates the growing interest of academics in financial inclusion. The analysis of trends suggests that the topic of blackchain and artificial intelligence

was of the most interesting to academics in 2020 and 2021. In the first half of 2022, these phrases did not appear with a sufficient frequency in FinTech-related articles. As for authors' keywords, they indicate that lately, researchers have shifted their attention to the topics of financial literacy, financial inclusion, mobile payments and, still, COVID-19. Interestingly, technology adoption and innovation were very popular topics in 2019. COVID-19 has greatly accelerated the process of adopting new technologies, which may be the reason why this phrase appeared less frequently in scientific research. In an article from 2020, the sudden increase in the number of downloads of FinTech applications during the Covid-19 pandemic was discussed (Fu, Mishra, 2020). This increased interest can clearly be attributed to the lockdown and minimal direct contacts among people. It is worth pointing out once again that those who do not switch to new technologies will, eventually, become socially excluded. Hence the importance of education in this field. The challenge lies in the fact that although part of society is very advanced technologically, a great number of people still do not have their own bank account.

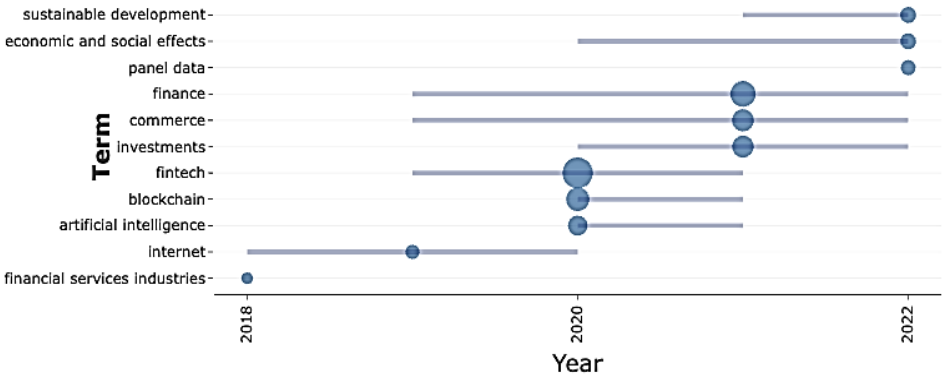

Figure 15. Trend Topics at: Word Minimum Frequency – 4, Number of Words per Year – 3 (Keywords Plus).

Source: author's own.

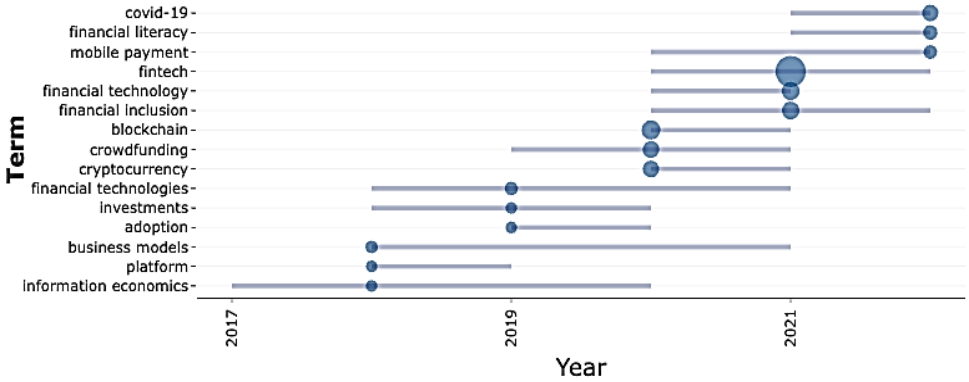

Figure 16. Trend Topics at: Word Minimum Frequency – 4, Number of Words per Year – 3 (authors' keywords).

Source: author's own.

A thematic map, also known as a strategic diagram, is presented below. Topics are classified into four groups (see figure 17), depending on the quadrant in which they are mapped:

- upper right quadrant: motor themes – the map indicates "hot topics", those that are developing and important for defining the conceptual framework of the studied issue,
- lower right quadrant: core themes – topics relevant for the field and cross-cutting topics that encompass different areas within it,
- upper left quadrant: very specialized/niche topics - highly developed, but marginal for the analyzed field,
- lower left quadrant: emerging or disappearing themes, often referred to as peripheral themes, not fully developed or marginally interesting for the field being studied (Aria et al., 2022; Cobo et al., 2011).

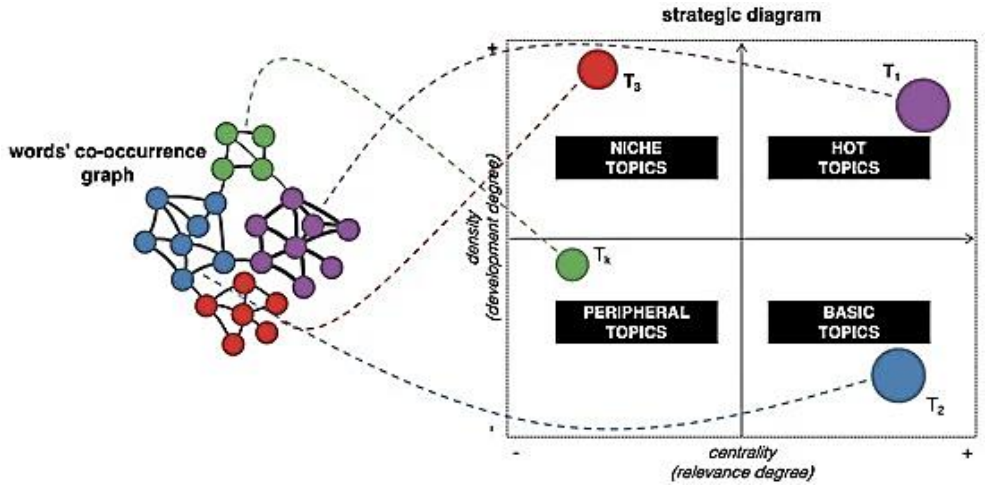

Figure 17. Theoretical framework of the strategic diagram (thematic map).
Source: Arner et al., 2020.

A strategic diagram of the FinTech field is presented below (figure 18). It was created on the basis of 100 Keywords Plus phrases, with the indication that it is to suggest a minimum of five clusters for this field. Then, a bubble chart (figure 19) was drawn up, where topics that can be classified within the discussed thematic clusters are already defined in detail and the relationships between them are clearly visible.

The FinTech thematic map indicates the following phrases in the part that contains topics that expand the discipline: efficiency, regression analysis, economy and social effects (red cluster, see figure 18). "Efficiency" can be interpreted as the result of any actions undertaken, described as the ratio of the effects obtained to the expenditure incurred. Efficiency is the subject of numerous studies, as confirmed by the results presented in the diagram. The second phrase in this cluster is "regression analysis"; it is a simple statistical test method of measuring relationships between two or more variables. It may be the most popular method of analysis in publications related to the FinTech sector. "Economy and social effects" is what scientists strive to determine in relation to the FinTech sector and potential changes that may occur together with the development of new technologies in the financial sector (Ajide, 2021; Malakhova

et al., 2018; Phuthong, 2022). A closer examination of the bubble chart allows us to see that there are other methods of verifying the hypotheses in the analyzed documents (panel data, empirical analysis, forecasting, generalized method of moments, machine learning). In addition, sustainable development, technological change and economy development appear. These keywords are important for research on the FinTech ecosystem in the context of the digitization of the financial sector and socio-economic results of digital transformation(Costa-Climent, Martínez-Climent, 2018; Vovchenko et al., 2019), technology development and environmental protection (Campanella et al., 2022; Costa-Climent, Martínez-Climent, 2018); this is related to the perception of FinTech as a key driver of financial integration which, in turn, is the basis of sustainable development (Arner et al., 2020).

FinTech, finance and blockchain are keywords on the verge of main and developing topics (purple cluster, see figure 18). This only confirms that these are basic concepts, and that they remain crucial for this field. The bubble chart also contains such terms as financial services, technology adoptions, investments, financial market, and industry 4.0.

Emerging and disappearing topics (orange cluster, see figure 18) include such terms as the internet (no longer perceived as a new technology, but rather as a service used by all new technologies). after nearly two years of restrictions related to the COVID-19 pandemic, it has now little impact on the FinTech area. Nevertheless, it ought to be emphasized that the influence of COVID-19 on the adoption of new technologies was immense (Akpan et al., 2022; Daqar et al., 2021; Miethlich et al., 2021).

The cluster on niche topics, which often means very specialized subjects, includes electronic money, ecosystem and financial service (green cluster, see figure 18). A closer examination indicates phrases such as data mining, peer-to-peer lending, crowdfunding and mobile payments (see figure 19).

There is one more cluster contiguous with the square that features basic themes, located between the square of emerging and disappearing themes. This cluster contains such keywords as supply chains, sales, design/methodology/approach (blue cluster, see figure 18). Other phrases in this area relate to basic economic or methodological concepts, namely costs, managers, big data, decision making and surveys (see figure 19).

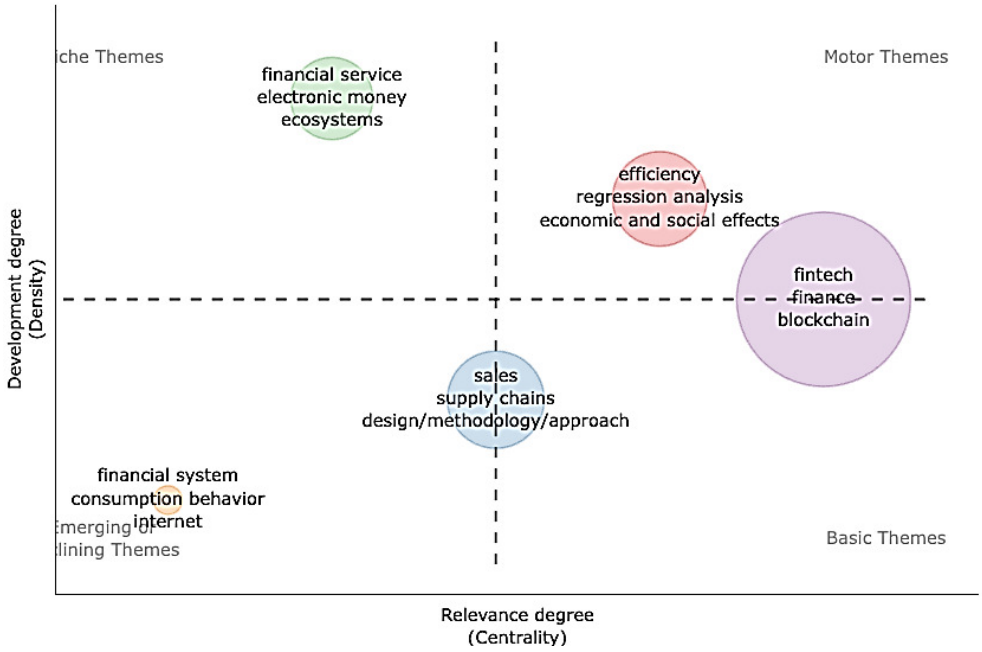

Figure 18. Strategic diagram of the FinTech field.

Source: author's own.

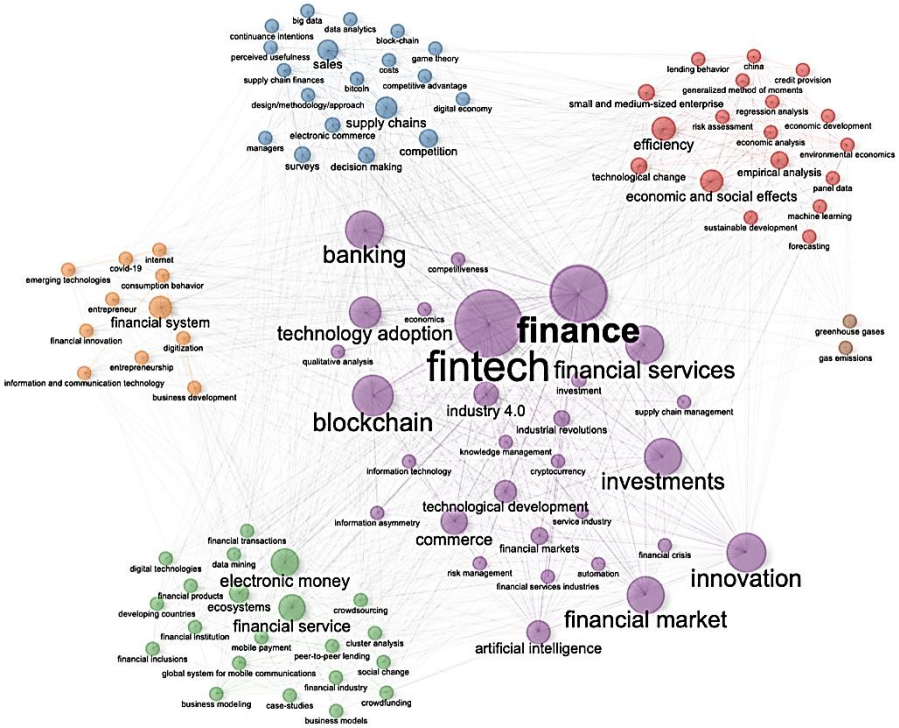

Figure 19. Co-word (Keyword Plus) network visualization; colors indicate word clusters.

Source: author's own.

Biblioshins for Bibliometrix allow the use of the "conceptual structure function" to perform multiple correspondence analysis (MCA) with a view to drawing a conceptual structure of the field and to classify together in order to identify groups with the same concepts (Huang et al., 2021). Results are interpreted on the basis of the relative positions of points and their

distribution along the dimensions; the more similar the arrangement of words, the closer they are represented on the map (Caparrós-Martínez et al., 2021). Parameters used in the analysis were groupings of a minimum of three areas; 50 was the maximum number of terms within them.

Figure 20 presents three areas of different conceptual groups. The blue group contains such terms as "bitcoin", "supply chain", "decision making", "supply chain finance" and "competition". This area relates to research on the possibilities offered by cryptocurrencies and ways in which blockchain can improve supply chains, as well as the way in which the quick settlement of cryptocurrencies can facilitate the decision-making process. Another area is green Industry 4.0, investment and industrial revolution. The type and scope of research into this area is easily imaginable: it will primarily concern investments in innovation, new technologies, as well as changes related to digitization and digital transformation of entities into companies using new technologies and becoming part of Industry 4.0. This area also includes research on the financing of companies producing innovations, i.e. start-ups providing this type of products and services. This is the last and the largest area related to FinTech and its concepts. Keywords generated by the R program include the major part of research and keywords contained in these publications.

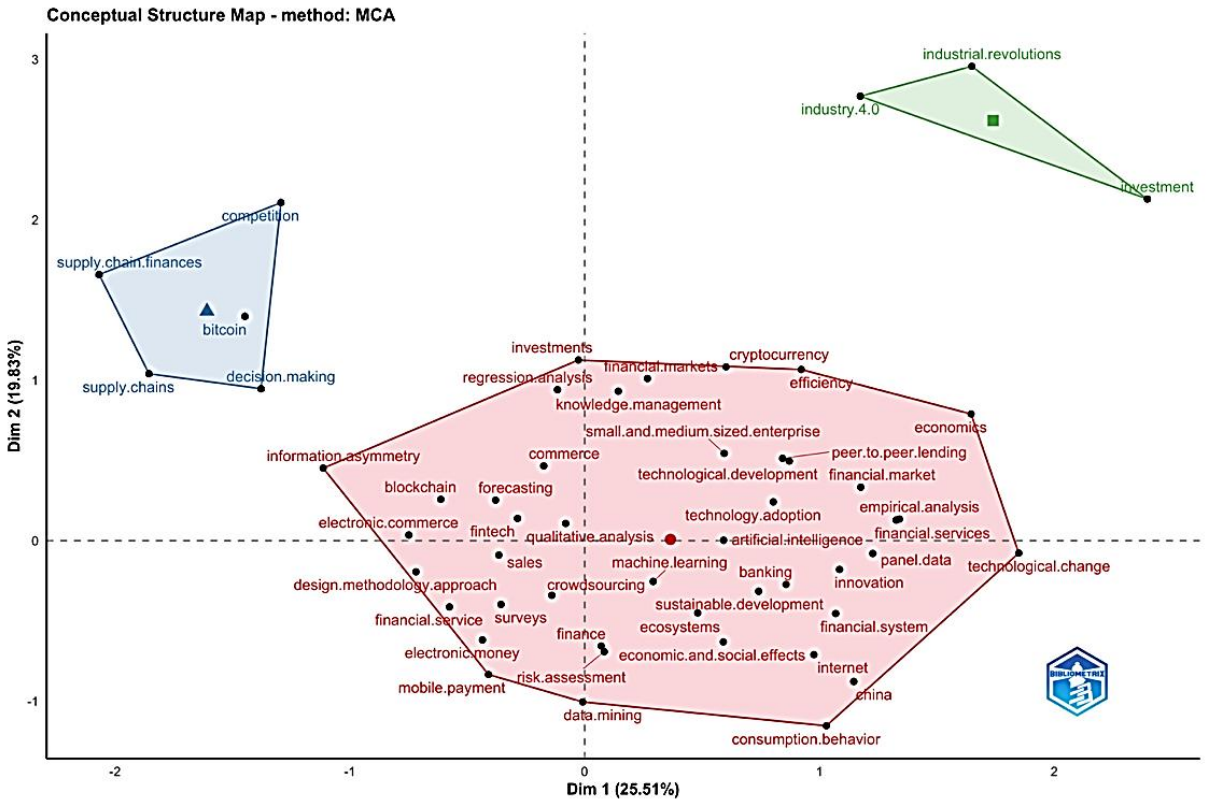

Figure 20. Conceptual structure map with correspondence analysis integrating and correlating knowledge about the current FinTech research.

Source: author's own.

5. Discussion

Summarizing the above-presented results obtained on the basis of the bibliometric analysis, let us refer to research problems formulated above:

Q1: What are the global trends in terms of scientific publications relating to FinTech? What research areas can be identified?

Q2: Which areas of this sector remain unexplored given the existing research trends in this domain?

Q3: What are the potential research development directions?

The study shows a clear trend in articles published in 2020 and 2021, namely focus on blockchain. It is one of the most common topics examined in FinTech publications. The bulk of blockchain research was carried out in 2020. In the Keywords Plus analysis, blockchain ranked third (second among authors' keywords).

In the analysis of authors' keywords, bitcoin and cryptocurrency are the phrases that appear most ofteh. Based on these results, it can be observed that, at the intersection of these two areas, namely FinTech and blockchain, research focused mainly on cryptocurrencies(Abdeldayem, Aldulaimi, 2020; Dupuis, Gleason, 2021; Saiedi et al., 2021; Wingreen et al., 2020) and less often on the distributed network and its application in finance (Drummer, Neumann, 2020).

Banking, artificial intelligence and innovation are also frequently referred to in FinTech publications. This trend is central to our analysis, and it is worth highlighting that generative artificial intelligence was extensively discussed in 2023, with the launch of the company Open AI (founded at the end of 2022), which created the Chat GPT app. At the beginning of 2023, the Chat GPT app became the most popular app, as it is estimated to have reached 100 million monthly active users in January 2023, just 2 months after the launch of Open AI. Compared to other apps, TickTock reached 100 million users after 10 months and Instagram after 1.5-2 years of operation (Hu, 2023). Generative AI is revolutionizing the way people search for information and use the results in their personal and professional lives. There are a growing number of solutions based on generative artificial intelligence to improve the performance of organizations and their managers (Korzynski et al., 2023).

"Financial inclusion" also ranks very high among the authors' keywords. This crucial topic is often associated with FinTech. On the basis of research carried out in 2018, Ozili proved that FinTech services have a positive impact on the "financial inclusion", i.e. the inclusion into the financial system of people with low and variable income, mainly in developing and emerging economies. This is achieved thanks to the simplicity of these solutions, as well as lower costs compared to the costs of conventional bank services (Ozili, 2018). Unfortunately, this often creates challenges in terms of the security of the financial sector and financial resources of individual customers.

The next stage of the bibliometric analysis based on the documents entered into the program involved the identification of future trends; these are: financial exclusion, democratization of finance, financial education and, in the area of FinTech, sustainable development and economic and social effects. This confirms that FinTech is a key driver of financial inclusion which, in turn, underlies sustainable development (Arner et al., 2020). It also poses a challenge related to problems with the use of new technologies that can be attributed to the lack of necessary skills of specific groups of customers. This may hinder their access to the financial sector, as well as innovations in this field and, consequently, translate into their social exclusion.

6. Conclusions

The article examines – using bibliometric analysis methods – FinTech-related papers published in business and economic journals between 2015 and 2022. Social networks and cooperation between institutions, countries and regions over this period were inquired into, and a thematic analysis of the FinTech sector was carried out with a view to discussing its current state, outlining trends and indicating potential further research directions. For the purpose of this study, a total of 900 documents were retrieved from the Scopus database.

FinTech research has been developing dynamically in recent years. The analysis of the available sources showed a 76-percent year-on-year increase in the number of publications, with the greatest surge in 2020. The number of articles (900) and authors (2,024) proves that this area of research is developing and that the above figures are likely to increase further in the coming years. This assumption is confirmed by the average age of the studied articles (1.67 years). Research findings suggest that FinTech is the future of business, economy and information technology (Nasir et al., 2021).

The analysis was subject to several limitations. First of all, only sources from the Scopus database were selected for the study; the search was carried out on 18 July 2022. It is worth noting that academic publications are often naturally "delayed" due to the lengthy review process. Other limitation can be attributed to the fact that the surveyed publications pertained to a specific number of disciplines – Business, Management and Accounting, Economics, Econometrics and Finance – and that only publications in English were analyzed.

Based on the bibliometric analysis of the FinTech sector, the future direction of research has been outlined. I intend to explore the impact of the development of FinTechs on the democratization of finance, as well as any related challenges (technology adoption, regulations, and the security of the financial sector). The study of trends also brings to the fore the importance and the involvement of FinTechs and of traditional financial in financial education.

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Appendix

Table 2.
Ten authors who have published the greatest number of articles related to FinTech with the total number of citations and the number of citations per year

Author	year	freq	TC	TCpY
ARNER DW	2016	1	4	0.571
ARNER DW	2017	1	123	20,500
ARNER DW	2019	1	19	4.750
ARNER DW	2020	3	78	26,000
BABER H	2019	1	1	0.250
BABER H	2020	3	21	7,000
BABER H	2021	2	0	0.000
CHEN X	2019	1	28	7,000
CHEN X	2021	4	25	12,500
CHEN X	2022	5	2	2,000
LI J	2020	3	41	13,667
LI J	2021	2	8	4,000
LI J	2022	1	0	0.000
LIU Y	2021	2	5	2,500
LIU Y	2022	4	0	0.000
AROUND TT	2020	4	4	1.333
AROUND TT	2021	2	1	0.500
RABBANI MR	2020	5	98	32,667
RABBANI MR	2021	2	23	11,500
RABBANI MR	2022	1	0	0.000
WONGLIMPIYARAT J	2017	2	40	6.667
WONGLIMPIYARAT J	2018	1	25	5,000
WONGLIMPIYARAT J	2019	2	7	1.750
WONGLIMPIYARAT J	2020	1	2	0.667
ZHANG Y	2021	4	22	11,000
ZHANG Y	2022	6	0	0.000
[NO AUTHOR NAME AVAILABLE]	2015	2	0	0.000
[NO AUTHOR NAME AVAILABLE]	2016	1	0	0.000
[NO AUTHOR NAME AVAILABLE]	2017	5	0	0.000
[NO AUTHOR NAME AVAILABLE]	2018	1	0	0.000

Source: author's own.

Table 3.
Lotka's law distribution for the tested sample

Documents written	No. of authors	Ratio of authors
1	1766	0.873
2	189	0.093
3	35	0.017
4	14	0.007
5	10	0.005
6	6	0.003
8	1	0.000
9	1	0.000
10	2	0.001

Source: author's own.

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USE OF ICTs IN FACILITATING ORGANIZATIONAL AGILITY BASED ON OWN RESEARCH

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Purpose: The purpose of the paper is to explore the use of ICTs (Information and Communication Technology) in the development of organizational agility and to identify the attributes of an agile organization and its employees. The paper aims to provide conclusions and recommendations on the role of ICT s in creating organizational agility and the attributes of employees that are conducive to this development. The main research issue wastools determining the impact of ICTs on the development of organizational agility. The hypothesis suggested a significant impact of ICTs usage on the development of organizational agility, characterized by employees who actively use these tools and exhibit traits that aid this development.

Design/methodology/approach: An empirical study was conducted, involving 930 randomly selected respondents from small, medium, and large enterprises. The questions were directed at both managers and operational employees. The survey was conducted in February/March 2022 using the CAWI (Computer Assisted Web Interviewing) technique.

Findings: Organizational agility is a crucial organizational competency that is becoming key to improving organizational effectiveness, gaining a competitive edge, and navigating a turbulent environment.

Organizational agility is the mechanism through which organizations can generate significant, sustainable value for their diverse stakeholders.

Organizational agility is achieved through the appropriate development and utilization of human capital. Employee agility is a fundamental pillar of organizational agility, so organizations should prioritize its development.

The development of organizational agility should be facilitated by ICTs. These tools aid in enhancing communication, collaborative work, remote work, decision-making, and project management.

Research limitations/implications: The research was limited to the 930 respondents from various enterprise sizes, and the time frame was February/March 2022. Further research could explore different time frames and expand the pool of respondents.

Practical implications: Organizations aiming for agility could focus on the development and utilization of ICTs and prioritize employee development programs that encourage traits conducive to organizational agility.

Social implications: The research shows that ICTs and employee agility contribute to organizational agility. This could influence educational programs to prioritize digital literacy and adaptability, potentially affecting workforce culture and public policy.
Originality/value: The study offers a fresh perspective by concurrently analyzing organizational agility from the standpoints of management science and information technology. A theoretical model for utilizing ICTs to foster organizational agility is also presented.

Keywords: ICTs, organizational agility, organization, agile employees, supporting organizational agility.

Category of the paper: research paper.

1. Introduction

The need for flexible and innovative management components in modern organizations has been evident for many years. However, it has recently gained particular significance. This has led to the issue of organizational agility receiving increasing attention, both among theorists and representatives of business practice (Homrozi, 2009; Yang, 2014; Liu, 2012; Trzcielinski, 2007; Sahota, 2012). Organizational agility is believed to be a means to survive and thrive in a competitive, turbulent, and unpredictable environment (Kidd, 1994; Andoh-Baidoo, 2016; Doz, Kosonen, 2008; Quereshi, 2016). It is emphasized that it helps to respond swiftly and efficiently to any market changes (Ravichandran, 2018), to quickly identify customer needs, and to offer them customized solutions for their highly personalized needs (Sanchez, Nagi, 2001; Teece, 2000; Rigby, 2000). In other words, organizational agility is becoming a way for organizations to function effectively (Narasimhan et al., 2006).

Recently, a key issue has become the search for various tools and technologies that could contribute to the support and development of organizational agility (Doz, Kosonen, 2008; Homrozi, 2009). The volume of information and events that need to be collected, analyzed, and explored for the management of today's organization prompts the use of ICT (Information and Communication Technology) tools. Unfortunately, there is limited theoretical and practical research devoted to the possibility of supporting organizational agility using ICT. So far, it has not been possible to determine, among other things, the strength of the impact of various ICTs on the development of organizational agility, as well as the areas of its support.

The purpose of this paper is to explore the use of ICTs in the development of organizational agility and to identify the attributes of an agile organization and its employees. The paper aims to provide conclusions and recommendations on the role of ICTs in creating organizational agility and the attributes of employees that are conducive to this development. The main research issue was determining the impact of ICTs on the development of organizational agility. It was hypothesized that the use of ICTs significantly impacts the development of organizational agility, with employees who actively use these tools exhibiting characteristics

that contribute to this development. In order to explore this issue in depth, the following research questions were formulated:

1. What ICTs are most commonly used in organizations?
2. What is the impact of ICTs on the development of organizational agility?
3. In which areas of the organization's operations do ICTs most strongly support and develop organizational agility?
4. What factors and attributes of employees influence the development of organizational agility using ICTs?

In order to realize the research objective formulated in this way and answer the questions posed above, a literature study was conducted, as well as empirical research. First, the essence of organizational agility was characterized, and the attributes of employees that contribute to its development were described. In addition, numerous arguments are given, demonstrating the key role of ICT in supporting organizational agility.

An important part of this study is the empirical research, which aimed to identify the relationship and determine the strength of the impact of ICT on the development of organizational agility. The research was conducted in February/March 2022 on a sample of 930 respondents using a survey questionnaire. The results of the questionnaires were compiled, following the standard CAWI technique.

The present research also identified key skills and attributes of employees, determining the development of organizational agility.

The novelty and originality of this study lie in the presentation of a research approach to determine the impact of ICTs on the development of organizational agility. Previous research presented in the literature has mainly focused on two unrelated approaches: the development of organizational agility and the use of ICT in organizations. In contrast, the present research integrates these two research streams, derived from management science and computer science, thus making it possible, among other things, to determine the level of impact of ICTs on the development of organizational agility. This provides a new insight that not only enriches the scientific literature on organizational agility but also offers valuable insights for organizations and their employees on the role of ICT in the development of organizational agility. The original culmination of this discussion is the proposal of a theoretical model for supporting organizational agility using ICTs.

2. Literature Review

2.1. The essence of organizational agility

The volatility of the environment, the accelerating pace of digitization, and dynamic technological development necessitate that modern organizations exhibit agility and flexibility. In the literature, the concept of organizational agility is interpreted in various ways (Table 1). Many authors (Kidd, 1994; Yang, Liu, 2013; Trzcielinski, 2007) argue that it is the ability of an organization to respond quickly to market changes, recognizing customer needs (Sanchez, Nagi, 2001; Rigby, 2000) and identifying emerging opportunities and threats (Almahamid, Awwad, 2010; Goldman, Nagel, Preiss, 1995; Sahota, 2012).

Organizational agility is also equated with an organization's ability to provide quality products, innovate, and personalize products and services (Doz, Kosonen, 2008; Rigby, 2000).

Organizational agility is sometimes understood as the ability to act adaptively (Homrozi, 2009; Zarczyńska-Dobiesz, 2008), as well as proactively (Sanchez, Nagi, 2001; Rigby, 2000). The former refers to the process of rapid adaptation of an organization to market requirements. The latter, however, is the ability to intelligently anticipate changes and consciously and subconsciously modify various behavior patterns in order to solve business problems more effectively (Homrozi, 2009; Zarczyńska-Dobiesz, 2008).

Many authors (Kidd, 1994; Bray, 2019; Homrozi, 2007) believe that organizational agility is a way to survive and cope in a competitive, turbulent, and unpredictable environment. It is emphasized that it helps to respond instantly and effectively to any market changes (Goldman, Nagel, 1995; Sahota, 2012), to quickly identify customer needs, and to offer customized solutions to meet their highly personalized needs (Sanchez, Nagi, 2001; Teece, 2007; Rigby, 2000). In other words, organizational agility becomes a way for organizations to operate more efficiently (Goldman 1995; Narasimhan, 2006; Zhang, Sharifi, 2000; Meredith, Francis, 2000; Bessant et al., 1999; Leberecht, 2016; Gunasekaran, 1998; Cappelli, 2018).

According to some authors (Goldman, 1995; Heer, 2012), organizational agility is the ability to assimilate different production technologies and personnel to meet market changes. Organizational agility is sometimes also equated with shrewdness, understood as the ability to identify market opportunities, as well as resilience, which can be interpreted as effectively coping with broad adversity and functioning under stressful conditions (Sumukadas, Sawhney, 2012). Organizational agility is likened to intelligent reasoning, meaning the ability to deal with situations for which there are no clearly defined rules of conduct (Gunasekaran, 1999; Sajdak, 2014; Doz, Kosonen, 2008). In concluding the consideration of the essence of organizational agility, it's worth noting that the development of organizational agility is determined by many components. Undoubtedly, a flexible organizational structure that allows for a rapid response to a variety of changes plays an important role (Uhl-Bien, Arena, 2017). The importance of an organizational culture that promotes innovation and openness to change (O'Reilly, Tushman,

2013), which are key to the development of organizational agility, is also emphasized. In addition, it is argued that flexible management processes that enable rapid adaptation and agile decision-making (Sull, Homkes, Sull, 2015) promote the development of organizational agility. Having agile human capital, i.e., employees who are open to collaboration and communication, is also an important element for the development of organizational agility (Gallup, 2016).

A review of the literature on the interpretation of the term "organizational agility" allows us to conclude that organizational agility is a multidimensional category, referring to the various skills and capabilities of an organization that enable it to operate efficiently in an unpredictable environment, respond quickly to changes occurring in the market, recognize opportunities and threats, and assimilate various technologies.

2.2. Attributes of agile employees

Closely related to the concept of organizational agility is the term ‘employee agility' (Sambamurthy, Bharadwaj, Grover, 2003). This concept is interpreted through the prism of various attributes, such as resilience, responsiveness, adaptability, proactivity, generativity, and intelligence (Doz, Kosonen, 2008).

It is believed that an agile employee is a resilient one. 'Resilience' is important in grappling with various problems that may occur, for example, during the execution of work. A resilient employee is oriented toward learning and self-development. They are also willing to solve problems quickly, eager to take on new responsibilities, and able to cope with change. It is argued that a resilient employee is a person who has the ability to apply new technologies, as well as the ability to create innovative ideas and accept new responsibilities (Krull, Mackinnon, 2016; Thalassinos, 2020; Doz, Kosonen, 2008; Breu, 2002; Nath, Agrawal, 2020).

An agile employee is also characterized by the ability to respond quickly to changes in the market (Gunasekaran, 1999; Sharifi, Zhang, 1999; El-Wakeel, 2019). Such a capability can be achieved by systematically conducting strategic analysis, creating early warning systems, and, most importantly, developing in-house effective methods of searching for market opportunities (Sambamurthy, Bharadwaj, Grover, 2003; Yin, 2020).

An attribute of an agile worker is adaptability, i.e., the ability to adjust to new situations, tasks, and roles, as well as the ability to work in teams, use new technologies, and implement new work procedures (Felipe, Leander, 2020, pp. 575-619; Galvin, 2019, pp. 1-13).

Another attribute of an agile worker is proactivity, which is related to the ability to initiate and implement new creative activities, as well as to anticipate unexpected situations (Sanchez, Nagi, 2001; Rigby, 2000).

An attribute of an agile employee is also generativity, which means activity, initiative, and continuous learning of employees through experiences acquired in the course of work (Sahota, 2012; Shahin, Nikjoot, Nilipour, 2011). In turn, intelligence helps to respond quickly to customer needs and changing market conditions (Dyer, Shafer, 2003; Heer, 2012; Rigby, Elk,

Berez, 2020). In conclusion, it is worth emphasizing once again that organizational agility is a multidimensional construct, referring to both human characteristics and the organization as a whole. These spheres are closely interrelated. This is because organizational agility is achieved through the development and use of human resources endowed with agile attributes. Employees, possessing certain qualities and skills, are able to adapt to changing conditions and respond quickly to new challenges. Their savvy, adaptability, resilience, and proactivity allow the organization to operate effectively in a dynamic business environment (Figure 1).

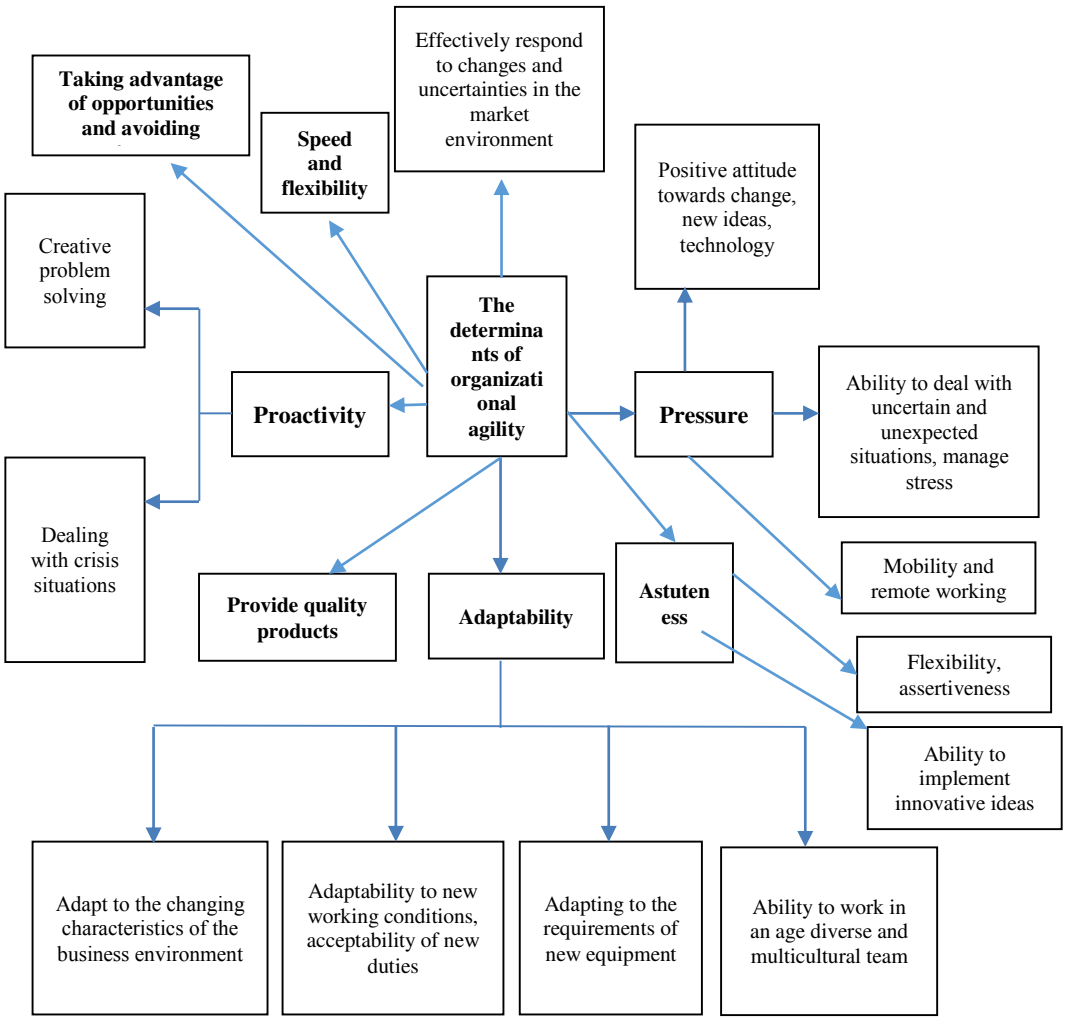

Figure 1. The determinants of organizational agility.

Source: own.

2.3. Use of ICTs in agile organizations

One of the essential features of an agile organization is the assimilation of various technologies, including the ability to effectively use modern ICTs (Bray, Reeves, Levin, Harnoss, Ueda, Kane, Johnson, Billespie, 2019, pp. 1-23; Cappelli, Tavis, 2018, pp. 46-52; Zhen, Xie, Dong, 2021, pp. 100-501). These tools are a broad concept, encompassing, on one hand, a variety of applications and complex integrated systems that allow for the efficient acquisition, collection, processing, analysis, transmission, and visualization of a variety of data

to support decision-making at various levels of management, as well as to support various business processes, such as customer and supplier relationship management (Chen, Chiang, Storey, 2012). On the other hand, ICTs, unlike traditional IT tools, cover the entire spectrum of media focused on communication, cooperation, and collaboration. These include, but are not limited to, the Internet, intranets, extranets, collaborative work systems, emails, chat rooms, social media platforms, video conferencing tools, and mobile and wireless networks (Turban et al., 2018). ICTs can also include computer hardware such as servers, workstations, smartphones, tablets, routers, and other devices (Tanenbaum, Wetherall, 2011).

The era of ICT development, which began in the 1960s, was mainly based on the principles of simple automation and supporting simple, operational activities of organizations. Today, the role of ICT has changed dramatically. ICT is used for, among other things: (1) developing modern strategies and business models; (2) creating sources of competitive advantage; (3) making fundamental transformations in organizations; and (4) integrating and developing the entire ecosystem. It is even claimed that they have become a strategic tool for economic growth, determining the competitiveness of many organizations and their innovative development (Drucker, 2014; Nonaka, Takeuchi, 1995; Tan, Steinbach, Kumar, 2005; Steiger, 2010). They can be used in virtually every sector of the economy and industry (Olszak, 2020; Olszak, Zurada, 2020; Olszak, Kisiołek 2020).

However, the use of ICTs in organizations requires competent, highly skilled, and agile employees (Martucci, de Felice, Schitone, 2012). Agility in the ICT area is particularly important, as it provides an opportunity to, among other things, introduce innovative solutions (in the form of new products and services), as well as improve communication, increase organizational agility, improve management processes, and improve customer service and optimize logistics chains (Nieves, Osorio, 2013; Mithas, Ramasubbu, Sambamurthy, 2011).

3. Materials and methods

The primary aim of this study is to ascertain the influence of ICT on the enhancement of organizational agility. An empirical study was conducted involving 930 randomly selected respondents representing small, medium, and large enterprises. Both managers and operational employees were surveyed. The research was carried out between February and March 2022 using a survey questionnaire. The CAWI (Computer-Assisted Web Interviewing) technique was employed, allowing for easy and widespread access to respondents via the Internet. The survey resulted in 930 completed questionnaires.

The study collected information on various sociodemographic aspects of the respondents. The data referred to the gender of the respondents. In the study group, women accounted for 61.7% and men for 38.3%. The largest age group was under 25 (66.1%), followed by 26-35

(18.1%), 36-45 (11.2%) and over 45 (4.6%). As for positions, top management was held by 5.8% of respondents, middle management by 10.9%, low management by 14.1%, and operational employees accounted for 69.2%. The size of the companies where the respondents worked was distributed among micro-enterprises (21.3%), small enterprises (21.6%), medium-sized enterprises (18.1%) and large enterprises (39.0%).

The respondents represented various industries. The largest group was represented by those associated with the transportation, communications, utilities, housing and trade sectors, which accounted for 33.7% of respondents. Another significant group was represented by employees in the financial, insurance, marketing, advertising and real estate sectors, who accounted for 31.9% of the survey sample. Health care, social welfare, education, research, tourism, recreation, government, justice, police and military represented another segment of respondents, accounting for 23.2% of the total number of respondents.

4. Research results

The research conducted, first of all, made it possible to identify the perception of the term "organizational agility" by the surveyed respondents. Analyzing the answers to the open-ended questions addressed to the respondents, two conclusions emerge. First, from an organizational perspective, organizational agility is identified primarily with:

- the organization's ability to respond quickly to change,
- rapid identification of opportunities and threats,
- identification of customer needs,
- ability to adapt to new situations,
- innovation and creativity of the organization,
- building the organization's culture and efficient management of human resources,
- ensuring quality products,
- ability to operate the organization in a changing environment,
- the ability to respond to crisis situations,
- ability to use modern ICT technologies.

In turn, from the perspective of employee attributes, the term "organizational agility is associated primarily with: commitment, dedication, reliability and open-mindedness, competence and creativity. At the same time, no definite importance was indicated for innovation and risk management skills (Table 1).

Table 1.
Interpretation of organizational agility, N = 930

	Definitely NO	Rather NO	I have no opinion	Rather YES	Definitely YES
Competence	2.15%	5.81%	4.62%	48.39%	39.03%
Innovation	3.33%	13.55%	15.38%	46.24%	21.50%
Creativity	3.23%	12.15%	11.72%	41.08%	31.82%
Open-mindedness	2.90%	8.82%	10.64%	40.75%	36.88%
Commitment	1.18%	2.90%	4.62%	33.33%	57.96%
Dedication	2.69%	6.56%	11.72%	37.10%	41.94%
Ability to manage risks	6.02%	15.48%	20.54%	33.87%	24.09%
Credibility	2.15%	4.94%	11.29%	39.35%	42.26%
Ingenuity	3.55%	9.14%	12.37%	46.45%	28.49%

Source: own.

The assessment of the surveys has identified the most important ICTs that support organizational agility. The results of the survey are presented in Table 2.

Table 2.
Most commonly used ICTs to support organizational agility, N = 930

Databases	650	18.60%
Spreadsheets	593	16.90%
Mobile technologies	408	11.70%
Social networking	362	10.30%
Corporate portals	297	8.50%
Data visualization tools	266	7.60%
Data warehouses	208	5.90%
Business intelligence and Big Data	204	5.80%
Cloud computing	171	4.90%
Internet of Things	128	3.70%
Artificial intelligence	116	3.30%
Other	97	2.80%
Total	**3500**	**100.%**

Source: own.

In this question, respondents had the option to answer more than one question, hence 3500 responses were obtained. It turned out that the most frequently used technologies are: databases, spreadsheets, mobile technologies and corporate and social networks. A certain surprise is the poor result of the very fashionable solutions of today: Business Intelligence and Big Data, Cloud Computing, Internet of Things and Artificial Intelligence.

An important part of the quantitative survey was an attempt to determine the degree of influence of ICTs on creating organizational agility, using a Likkert scale of 1-5. The results of the responses are presented in Figure 2.

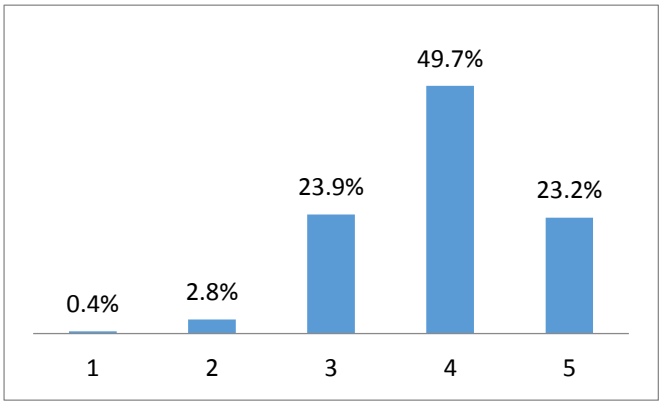

Figure 2. Assessment of the impact of ICT on organizational agility, N = 930.
Source: own.

The above survey confirmed the significant impact of ICT on organizational agility at an average level of 3.92 for the 1-5 scale used, resulting in 462 responses for a score of 4 and 216 responses for a score of 5, respectively.

In conducting the research, an effort was made to identify areas of the organization's operations where ICTs most strongly support and develop organizational agility (the third research question). Table 3 presents the research results.

Table 3.
ICT application areas supporting organizational agility, N = 930

Communication	614	12.1%
Group work	602	11.8%
Remote work	530	10.4%
Decision making	496	9.7%
Project management	459	9.0%
EDI - electronic document workflow	381	7.5%
CRM - customer relationship management	357	7.0%
E-commerce	333	6.5%
E-business	330	6.5%
Virtualization of business processes	260	5.1%
SCM - supply chain management	244	4.8%
Networking	238	4.7%
B2B or B2C	198	3.9%
Other	50	1.0%
Total	**5092**	**100%**

Source: own.

5092 responses were obtained, which is the result of the ability of a group of 930 respondents to provide any number of answers. In interpreting the results of the survey, it should be noted that the most common areas of ICT applications supporting organizational agility include: communication, group work, remote work, decision-making and project management. Only in the next place were indicated: EDI, CRM, or E-commerce.

Based on the review of the results shown in Table 4, it can be concluded that agile workers will contribute to organizational agility. Communication, teamwork, remote working, decision-making and project management are often identified as key areas where ICTs support organizational agility. Agile employees who use these tools have a greater ability to

communicate effectively, make decisions flexibly, work in teams and manage projects. Tools such as electronic workflows, customer relationship management, e-commerce and business process virtualization also help improve organizational agility by streamlining operations and customer interactions. Thus, it can be concluded that agile employees, through the use of ICTs, tend to develop organizational agility.

In seeking answers to the fourth research question, regarding factors and employee attributes affecting the development of organizational agility using ICTs, it is important to note the results shown in Table 4.

Table 4.
Factors and attributes that develop organizational agility, N = 930

	Yes	No	Don't know
Flexibility	86.77%	4.73%	8.49%
Assertiveness	63.55%	19.03%	17.42%
Mobility and remote working	79.68%	12.47%	7.85%
Ability to solve problems	89.57%	3.12%	7.31%
Adaptability to new working conditions	88.06%	4.41%	7.53%
Ability to implement innovative ideas	65.48%	12.26%	22.26%
Acceptability of new responsibilities	83.01%	6.67%	10.32%
Ability to work in an age diverse team	86.02%	6.67%	7.31%
Ability to work in a multicultural environment	74.41%	9.46%	16.02%

Source: own.

In this survey, respondents could confirm, deny or give an answer of "I don't know" in the context of personality traits that affect organizational agility. The majority of responses indicated positively, with problem-solving skills, adaptability, flexibility and the ability to work in an age-diverse team being the most common, while assertiveness received the least attention.

In this study, cross-correlations were also determined between such variables as management effectiveness using ICT, innovation, creativity, open-mindedness, commitment, dedication, risk management skills, and reliability and resourcefulness. For this purpose, the Pearson correlation coefficient was used, which is one measure of the linear relationship between the following variables. The obtained correlation coefficients are shown in Table 5.

Table 5.
Correlation between variables

Variables		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Management efficiency using ICTs	**1**	**1**								
Innovation	**2**	0.876	**1**							
Creativity	**3**	0.984	0.927	**1**						
Open-mindedness	**4**	0.991	0.865	0.988	**1**					
Commitment	**5**	0.873	0.562	0.828	0.901	**1**				
Dedication	**6**	0.959	0.766	0.945	0.983	0.959	**1**			
Ability to manage risks	**7**	0.859	0.951	0.932	0.890	0.652	0.834	**1**		
Credibility	**8**	0.968	0.787	0.953	0.988	0,948	0.999	0.844	**1**	
Ingenuity	**9**	0.965	0.969	0.983	0.956	0.738	0.892	0.940	0.908	**1**

Source: own.

The value of the correlation coefficient should have been determined in the range from -1 to 1. Table 6 shows the strength of the correlation between variables 1,2,3,4,5,6,7,8,9. The value of the correlation coefficient can take a value from -1 to 0 (which means a negative linear correlation between the two variables), 0 (which means no linear correlation between the two variables) or 0 to1 (which means a strong positive linear correlation between the selected variables). The further the correlation coefficient deviates from zero, the stronger the relationship between the two variables.

In the above study, most of the correlation coefficients are between 0.8 and 1, which indicates an extremely strong positive relationship between the variables under study. Analyzing the results of the study, it can be seen that management effectiveness using ICTs had a strong positive correlation with innovation, creativity, open-mindedness, commitment, dedication, ability to manage risk, trustworthiness and ingenuity. All of these employee characteristics showed a high correlation with each other, suggesting that organizations that effectively use ICTs in management are more innovative, creative, open-minded to new ideas and committed. These results therefore confirm that organizational agility is closely related to effective management using ICTs and employee characteristics. The better an organization uses ICT, the greater the tendency to develop traits related to organizational agility.

Additionally, based on data from Table 5, a remarkably strong correlation can be observed between "Credibility" and "Commitment" (correlation coefficient of 0.999). This indicates that employees who are perceived as credible also exhibit a high level of commitment in their work. Such a high correlation may imply that these two attributes are inseparable and can be key factors of success for the organization. Also, the correlation value between "Creativity" and "Inventiveness" (0.983) indicates a very strong relationship between these two variables. This hints that creative employees are often also inventive, which is essential for creating innovative solutions within an organization.

Moreover, it is worth highlighting the correlation between "Innovation" and "Risk Management Ability" (0.951), suggesting that more innovative companies also exhibit better effects in risk management. This is particularly relevant in a turbulent market environment where risk management is a key element in maintaining competitiveness.

Finally, it should be noted that the "Efficiency of Management Using ICTs" shows a strong correlation with all other variables. This suggests that effective use of Information and Communication Technology (ICT) is fundamental in supporting innovation, creativity, open-mindedness, commitment, risk management skills, credibility, and inventiveness within an organization. This underlines the role that ICT plays in modern management and the development of organizations.

The analysis of the survey results allows for a positive verification of the research hypothesis presented. Above all, as the results from Table 1 suggest, a significant majority of respondents perceive organizational agility as a vital concept, with features such as innovation, creativity, and open-mindedness being emphasized.

An important finding is that ICTs, such as databases, spreadsheets, or mobile technologies, are commonly used by respondents (Table 2). This indicates that these tools can play a significant role in facilitating and supporting organizational agility.

ICT application areas, such as communication, teamwork, or remote work, which were most frequently indicated by respondents (Table 3), are areas that can directly influence the agility of the organization, enabling efficient responses to changes.

Results presented in Table 4 confirm that flexibility, problem-solving ability, adaptability to new working conditions, and the ability to work effectively in age-diverse teams are assessed as crucial for organizational agility. This demonstrates that ICTs can support the development of these features in organizations.

Lastly, Table 5 illustrates strong correlations between the efficiency of management using ICTs and the other characteristics studied. This points to the possibility that the use of ICT can not only contribute to organizational agility but also stimulate other features such as innovation or creativity.

In conclusion, the results of the analysis demonstrate that ICTs can play a key role in promoting organizational agility, thereby confirming the research hypothesis posed.

5. Discussion

The research conducted confirms the significant impact of ICTs on the development of organizational agility. Organizations that effectively use ICTs are better able to respond to change, identify opportunities and threats, create innovative solutions, communicate effectively, and manage projects effectively. It is worth noting that employee qualities such as commitment, creativity, and flexibility, and problem-solving skills play an important role in creating organizational agility. Organizations should, therefore, strive to recruit, train, and encourage employees to develop these qualities in order to make full use of them in the development of organizational agility.

It is also worth noting that modern ICTs such as Business Intelligence, Big Data, Cloud Computing, and the Internet of Things have been used to a very limited extent for the development of organizational agility. This may be due to various factors, such as a lack of awareness among users of their potential, difficulties in implementing them, or financial constraints.

It should also be noted that there is a strong correlation between the use of ICTs and organizational traits such as innovation, creativity, open-mindedness, and the ability to manage risk. Effective use of ICTs can help improve these traits and strengthen organizational agility. The theoretical considerations and the empirical research carried out lead us to propose the author's model for supporting organizational agility using ICTs (Figure 2). This model was

developed based on the analysis of the conducted research results (Table 2, 3, 4, 5, 6). The model requires further validation and implementation in selected organizations.

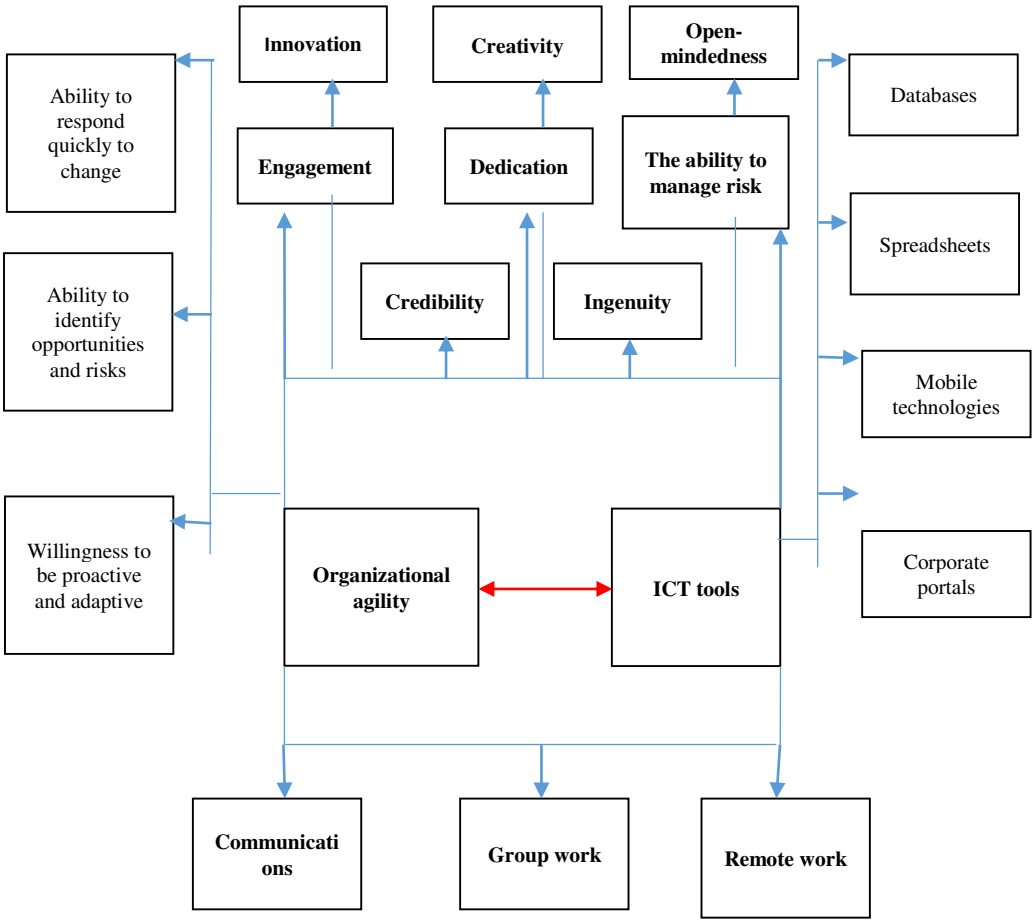

Figure 3. Model of supporting organizational agility with the use of ICTs.
Source: own.

The analysis of Figure 3 allows us to conclude that organizational agility refers to a company's ability to proactively and adaptively respond to changing circumstances. It is complemented by the ability to identify opportunities and threats, allowing the company to quickly react to changes. Such traits are essential for organizations that aim to succeed in an uncertain and dynamically changing business environment.

Agile attributes, such as innovativeness, creativity, open-mindedness, risk management skills, engagement, commitment, ingenuity, and credibility, play a crucial role in enhancing organizational agility. For instance, organizations that are innovative and open to new ideas are typically better prepared to adapt to changes. Similarly, engagement and commitment can lead to higher performance and better risk management, which also enhances agility.

ICTs, such as databases, spreadsheets, mobile technologies, and corporate portals, can enhance an organization's agility by facilitating access to information, increasing communication efficiency, and enabling better resource management. For example, databases can help organizations in identifying opportunities and threats, while mobile technologies can allow for faster response to changes.

ICT application areas that support organizational agility include communication, teamwork, and remote work. Communication is crucial for effective management and decision-making, and ICTs can enhance its efficiency. Teamwork and remote work are also facilitated by ICT, allowing for greater flexibility and adaptability to changes.

In summary, organizational agility is strongly linked with agile attributes, ICTs, and their applications. The effective use of ICT can increase organizational agility by facilitating access to information, increasing communication efficiency, and enabling better resource management. Agile attributes, such as innovativeness, creativity, open-mindedness, and risk management skills, are also key to enhancing agility. Therefore, organizations should focus on developing these attributes and effectively using ICT to boost their agility.

It could also be insightful to contrast some of the outcomes from this investigation with the results achieved by other scholars in the field. In a study conducted by Lu & Ramamurthy (2011) on organizational agility, respondents also identified agility as an organization's ability to respond to change, adapt to new situations and be creative. These findings are in line with those of the authors of this study. A study by Sherehiy & Karwowski (2014) on employee characteristics that support organizational agility indicated that commitment, creativity and flexibility are key characteristics that foster organizational agility. These findings are consistent with those of the authors.

6. Conclusions

The analysis of the literature on the essence of organizational agility and its determinants, as well as the empirical research conducted in selected organizations with a sample of 930 respondents, leads to the following conclusions and recommendations:

Firstly, respondents perceive organizational agility primarily as the ability to respond quickly to change, the ability to identify opportunities and threats, and a willingness to take proactive and adaptive actions.

Secondly, the research conducted indicates a strong relationship between the use of ICT and the development of organizational agility. Respondents mainly pointed to the important role of ICTs such as databases, spreadsheets, mobile technologies, and corporate portals.

Thirdly, organizational agility supported by ICTs is developing especially in areas such as communication, teamwork, and remote working.

Fourthly, organizational agility is strongly correlated with employee characteristics, especially problem-solving skills, flexibility, and adaptability. In other words, the development of agile organizations largely depends on innovative, creative, and open-minded people with competence in the use of ICTs.

Fifthly, a survey of various industries found that organizational agility is mainly associated with employee characteristics such as commitment, dedication, trustworthiness, open-mindedness, competence, and creativity. The most commonly used ICTs to support organizational agility are databases, spreadsheets, mobile technologies, social networks, and corporate networks. Taking innovation and risk management skills into account proved less important. Different industries are using different ICTs to improve processes and management methods. For example, the transportation and trade sector uses monitoring, trading platforms, and mobile applications, while the financial sector uses databases and spreadsheets to analyze financial data and manage customers. The size of the organization can make a difference in this aspect, with larger organizations having more financial and technological resources. Thus, organizational agility and the use of ICTs depend on the characteristics of the employees, the type of tools used in the industry, and the size of the organization.

The analysis and research conducted authorize the following recommendations and implications for business and organizational management:

1. Organizational agility is a crucial organizational competency that is becoming key to improving organizational effectiveness, gaining a competitive edge, and navigating a turbulent environment.
2. Organizational agility is the mechanism through which organizations can generate significant, sustainable value for their diverse stakeholders.
3. Organizational agility is achieved through the appropriate development and utilization of human capital. Employee agility is a fundamental pillar of organizational agility, so organizations should prioritize its development.
4. The development of organizational agility should be facilitated by ICTs. These tools aid in enhancing communication, collaborative work, remote work, decision-making, and project management.

This study presents a novel perspective on the issue of organizational agility development, analyzing it in parallel from the perspective of two major research streams, namely: management science and information technology. Previous works have not sufficiently exposed the impact of ICTs on the development of organizational agility. Thus, this study is an innovative approach to this issue, taking into account the role of ICT and employee characteristics. A unique aspect is the theoretical model of using ICTs to promote organizational agility.

Finally, it is worth addressing the limitations of the proposed research tool. First of all, it should be noted that the research took place during the coronavirus pandemic. The authors did not have the opportunity to meet the respondents in person and conduct in-depth interviews, which can be considered a significant limitation of the present study. Besides, mainly Polish companies were invited to participate in the study.

It is therefore important to continue the research in order to expand the knowledge of organizational agility and its impact on organizational performance. Future research should take into account different sectors and types of organizations in order to gain a more comprehensive understanding of this issue. Further research on the topic undertaken would also require identifying critical factors determining the development of organizational agility, as well as identifying key barriers to it.

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Appendix

Survey: Organizational agility as a determinant of effective use of ICT in the implementation of social innovation

Dear All!
I kindly request you to fill out a questionnaire, the purpose of which is to study the readiness of organizations to effectively use ICT in the implementation of innovations. The collected material will be used to develop a scientific article.

Thank you in advance for your time
Dr. Artur Kwasek

Metrics questions

1. Gender:
Female
Male

2. Age:
Under 25 years old
26-35 years old
36-45 years old
Over 45 years old

3. Position held:
top management
middle management
low-level management
employee

4. Seniority:
up to 5 years
6 - 10 years
11 - 15 years
16 - 20 years
over 20 years

Questions about your company

5. Size of your company:
Micro enterprise (less than 10 employees)
Small enterprise (10-50 employees)
Medium enterprise (50-250 employees)
Large enterprise (more than 250 employees)

6. What sector of the economy does your company operate in:
Sector 1 - agriculture, forestry, fishing.
Sector 2 - mining, quarrying and processing, and construction.
Sector 3 - transportation, communications, utilities, housing and commerce.
Sector 4 - finance, insurance, marketing and advertising, and real estate.
Sector 5 - health care, social welfare, education, scientific research, tourism and recreation, government, justice, police and military.

7. The company is in business:
less than 1 year
1 to 3 years
from 4 to 7 years
more than 8 years

8. Type of business conducted (multiple choice question):
Production
Trade
Services

9. Geographic scope of the company's operation:
Local
Regional
National
International

10. Financial situation of the company:
Very good
Good
Bad
Very bad
Hard to say

11. How would you rate your competence in using information and communication technologies (ICT)? (scale of 1-10)

12. How do you rate your ability to adapt to rapid changes? (scale of 1-10)

13. In your ongoing projects, are you able to: (Likert cafeteria)

	Definitely NO	**Rather NO**	**I have no opinion**	**Rather YES**	**Definitely YES**
Manage the project					
Be a leader (leadership)					
Achieve the set goals within the set time frame					
Achieve the set goals within the set budget					
Execute several projects simultaneously					
Manage a project team					

14. Is your consideration in the workplace: (Likert cafeteria)

	Definitely NO	Rather NO	I have no opinion	Rather YES	Definitely YES
Competence					
Innovation					
Creativity					
Open-mindedness					
Commitment					
Dedication					
Ability to manage risks					
Credibility					
Ingenuity					

15. Your personality traits are:

Flexibility	Yes	No	Don't know
Assertiveness			
Mobility and remote working			
Ability to solve problems			
Adaptability to new working conditions			
Ability to implement innovative ideas			
Acceptability of new responsibilities			
Ability to work in an age diverse team			
Ability to work in a multicultural environment			

Questions about ICT

16. Indicate areas where applied ICT supports/develops organizational agility (ability to respond to change and unpredictable situations) (multiple choice question)
Teamwork
Decision-making
Project management
EDI - electronic document flow
B2B or B2C
SCM - supply chain management
CRM - customer relationship management
Communication
Networking
Virtualization of business processes
E-commerce
E-business
Remote working
Other

17. Indicate which ICTs are most commonly used in your company? (multiple choice question)
Spreadsheets
Databases
Data visualization tools
Corporate portals
Social networking sites
Data warehouses
Business intelligence and Big data

Cloud computing
Internet of Things
Mobile technologies
Artificial intelligence
Other

18. rate the degree of influence of the above-mentioned ICT technologies on organizational agility: (scale of 1-5)
Innovation

19. In your enterprise:

	Yes	No	Don't know
A research and development (R&D) department is in operation			
Systematic training is provided			
Some changes are constantly introduced			
An external company is used in the IT area (IT outsourcing)			
Analysis of large amounts of data (big data) is performed			
Data analysis and visualization systems are used			
Customer suggestions via ICT are used			
New knowledge is constantly being acquired			

20. Has your company introduced innovations that have a significant impact on business process efficiency?
Yes
No
Don't know
(if yes go to 20, if no go to the end)

21. Was the innovation:
Product-based
Process
Marketing
Organizational

22. Was the innovation the result of: (max 3 answers)
The activity of your own R&D department
The work of the project team
Expectations and suggestions of customers
The initiative of employees or managers
Continuously implemented changes
Built relationships with business partners
Cooperation with an external company
International cooperation
Big data analysis
Analysis of social media activity
Implementation of sustainable development principles
Changes in strategy towards corporate social responsibility
Other

23. How did your company's employees react to the introduction of the innovation?
Full acceptance
Neutrality
Control of the situation
Lack of acceptance
Resistance to change
Willingness to escape
Other

Thank you for completing the survey.

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MOTIVATING EMPLOYEES OF COMPANY X

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Purpose: The aim of the article is to determine the importance of motivating employees in the examined company X, in contemporary human resources management. The aim of the study was achieved on the basis of a case study in a branch of a telecommunications company in Krakow. The obtained results indicate that the surveyed employees are rather satisfied with their work in the surveyed organization.
Design/methodology/approach: The primary data were collected with a survey questionnaire. An original and anonymous questionnaire was e-mailed to employees of the Kraków branch of the company.
Findings: The article attempts to determine the importance of motivating employees in an organization.The needs of each employee are different. It is difficult to find one appropriate way to motivate employees. their needs depend on age, gender, position or social affiliation. the direct superior's management style also plays an important role in the motivation process.
Originality/value: Workplace motivation is both important and relevant because satisfied employees are more engaged in their duties. It is useful when building motivation systems.

Keywords: motivation, human resource management, leadership styles.

Category of the paper: Research paper.

1. Introduction

The importance of human resource management in business grows because people and their knowledge are critical for business performance. Employee satisfaction measurement is among the key aspects of human resource management. Organizations should strive to ensure high satisfaction levels among their employees, which is a prerequisite for improved productivity, response time, or service quality (Bayad, Govand, 2021). Motivating is a particularly important element of people management in modern organizations, hence on the one hand - the needs and expectations of employees, and on the other - the capabilities of the organization, including the motivational competences of managers, should be the starting point for constructing effective motivational solutions. The art of motivating employees is, above all, the ability to recognize

the potential and abilities of others and to influence employees in such a way as to effectively direct people's knowledge and abilities to achieve common goals (Knap-Stefaniuk, Karna et al., 2018).

Human resources are one of the critical assets in organizations. Employees' work and commitment are necessary to reach the organization's goal. Human resources are a capital that has to be stewarded every step of the growth path. They include every employee who can pursue tasks individually or in a team. It is every person linked to the organization. Proper motivating efforts improve enthusiasm for work and employees' readiness to realize the goals of their organization. Employee motivating efforts should be set to put their strengths into practice or take advantage of rising opportunities.

The aim of the study was to determine the importance of motivating employees in the examined enterprise X, in contemporary human resources management. An attempt was made to determine the effectiveness of the motivation system in the examined enterprise. The specific goal was to determine whether the management style of the direct superior influences the process of motivating employees. For the purpose of the article, the obtained results were divided into four separate groups of manager behaviors depending on the management style.

Research questions:

1. What factors of material and non-material motivation are more important for the surveyed employees?
2. Does the amount of remuneration influence employee satisfaction with their work?

2. Nature and significance of motivating

Motivation is an important aspect of effective work as it drives human efforts and actions. It requires a purposefully built system that combines economic and psychological instruments to incentivize employees, which is necessary for commercial success. Employee motivation is founded on monetary and non-monetary factors. Good employee motivation is key to the organization's success. Motivation is to find the need budding in employees and help them satisfy it. Employee motivating efforts expand their skills to meet the requirements of the organization. Every manager should be responsible for collaborating with employees to learn about their individual needs and combine them with the needs of the organization (Omollo, 2015). Motivation is what drives human activities and behaviour. It is an indispensable and critical factor for boosting work effectiveness. Recognizing employee motivation (the job of the manager) is very difficult because motives are internal. One can recognise their effects by carefully observing human behaviour. Nevertheless, it is necessary to identify both motivation and its determinants because it drives conscious and effective effort, leading to an even greater importance of motivation and an increase in work performance (Borkowska, 1985).

Remuneration remains the strongest motivator in Poland. Still, considering international trends, one can expect a gradual change in the motivational structure. The role of non-monetary bonuses will increase, also in Poland (Ciekanowski, Szymański, 2017).

3. Employee motivation theory

Motivation significantly affects employee's commitment to their job duties and the use of their abilities, knowledge, and skills to pursue their goal (Korońska, Krzywonos, 2017). The word 'motivation' originates from the Latin *movere*, meaning 'to move' or more precisely from *moveo*, *movi*, *motum*, which mean 'to move, set in motion' and *semovere*, meaning 'get ready for something', 'start something', 'embark', 'cause', etc. Simply put, 'to motivate' can be seen as 'to move' and 'to encourage to act'. Motivation is also associated with such phrases as work commitment, work attitude, industry, readiness, devotion, dedication, and willingness to work, which are related to staffing, training, and performance evaluation. Motivation is an internal need or desire, which affects the human will and drives specific action. To motivate a team means to direct them towards specific activities they should do to complete the tasks they were assigned (Kazuś, Fierek, 2019). Motivating is a process of affecting people in such a way that they proceed as expected by the organization. Motivating is set to achieve a goal. When it happens, a need is satisfied. Motivating should serve the purposes of both parties, the motivator and the motivated (Różańska-Bińczyk, 2014). Motivating and inspiring employees to work effectively, constructively and efficiently has always played an important role in the human resources management process, regardless of the type and size of the organization (Domagalski, 2019). Employee motivation reflects the level of energy, commitment and creativity that employees of a given organization bring to their work. Motivated employees help the organization survive and develop, making it more dynamic and productive. The starting point for every manager is to learn the factors that motivate employees to work in the context of their roles in the organization. of all the functions that a manager performs, employee motivation is certainly the most complex, given the fact that the factors that motivate employees are constantly changing (Glišović, Jerotijević et al., 2019).

4. Tangible and intangible employee motivation

Tangible motivation has always been a key employee motivator regardless of their age. Financial safety is very important to people.

Financial reward is a central part of the job for all employees and potential employees. Many people believe that remuneration mostly defines an attractive job offer. Selection of the right motivation tools is critical for employee motivation. The tools come in two categories: tangible and intangible.

Remuneration is the leading factor when selecting an employer. With time, it becomes a factor that fosters workplace attachment (Armstrong, 2005).

Work motivation results from a psychological process. Its structure is shown in Table 1.

Table 1.
Employee motivation tools

Tangible		Intangible
Monetary	**Non-monetary**	
Base salary	Corporate bonds	Promotion and career
Pay rise	Training paid by the employer	Independence at work
Bonuses	Company car	Power to make decisions
Financial rewards	Additional paid leave	Successes
Functional allowance	Healthcare services paid by the employer	Recognition by the superior
Bonuses for overtime work	Public transport fee reimbursement for rides to work	Employee-friendly organization of work
Seniority allowances	Extra old-age and health insurance for employees	Flexible working time
Service anniversary awards	Team-building trips/events	Friendly workplace atmosphere

Source: original work based on Pietryka, 2015.

Selection of the right motivators is important for the employee motivating process and for their job satisfaction. For years, intangible means have been underestimated and not considered motivation tools at all. Motivating has changed significantly over the recent years. Organizations started to abandon negative reinforcement and appreciated the potential of non-monetary incentives (Głuch, 2013, p. 305). Note, however, that remuneration is undoubtedly still very important and non-monetary means make no sense for an employee dissatisfied with their salary. On the other hand, when the employee is satisfied financially and the right intangible incentives are applied, there is a considerable chance of synergy and enhancement of their effects. Every enterprise should make full use of this group of motivating techniques because they can yield surprising outcomes at a relatively low cost (Doleciński, 2018).

5. Motivation system

Human resource motivating effort is among the primary components of human resource management. Therefore, it is vital to build an appropriate motivation system. To this end, one has to define the motivational factors the employees in a particular organization are likely to respond to. It is crucial because the efficient operation of the motivation system contributes to improved employee performance, job satisfaction, and corporate profits (Doleciński, 2018).

Motivation systems should provide a broad palette of solutions matching the employee's or team's needs. The modern employee increasingly often performs well driven by a sense of belonging to the organization, the urge to identify with it, and thanks to their impact on decisions (Amstrong, 2011). Enterprise motivation systems for more efficient work should be founded also on the above observations. According to Kopertyńska, motivating others to work is one of the most challenging managerial functions. It involves affecting employee behaviour through such stimuli that they will translate into actions in line with the objectives of the organization (Kopertyńska, 2008). An effective motivation system is of paramount importance for the organization because it boosts the organization's performance through more efficient work. Moreover, it enables the organization to:

- improve work quality in the short- and long-term,
- achieve full identification of the employee with the goals of their job and organization,
- build the right organizational culture,
- improve internal communications,
- improve employee business awareness and encourage them towards professional development, which will affect the results,
- limit fluctuations among the most valuable employees,
- improve the effectiveness of line managers,
- speed up corporate strategy implementation and amendments,
- optimize personnel costs (Mikołajczewska, 2011).

The motivation system is a set of logically coherent and complementary motivation tools. It covers an array of various motivators: monetary (tangible), and non-monetary (intangible). When building it, one should follow the principle of comprehensiveness and regularity and found the effort on a well-recognized hierarchy of values and expectations of employees combined with the organization's capabilities. It should also consider links between personnel and employment policies (Korońska, Krzywonos, 2017 quoted from Sedlak, 1997).

She believes that corporate motivation systems should take into account the widest possible array of factors, tangible and intangible both, that will support a continuous high level of employee motivation.

6. Selected management team leadership styles

A good team management style can be defined as the one that works for a particular group. Managers who have learnt how to modify their natural style according to the needs of the team they lead at various growth phases have a better chance of success.

The coercive style refers to the general belief that managers are authoritarian. This style represents autocratic decision-making, where subordinates are merely informed about the decision and can in no way shape it (Korycka, Pluciński, 2019).

The autocratic style means that employees implement the manager's vision. Many managers who represent this approach exhibit good team leadership skills. Subordinates have very limited possibilities of affecting the events. This style is used in organizations with strict division of labour, clear guidelines for completing tasks, and not much room for modifications. This style fosters efficiency because it seldom focuses on people but rather on projects and tasks. In this context, the employee is in a way put aside. Their needs, strengths, or weaknesses are not as important as performance. A clear labour structure gives subordinates intelligible guidelines with which they are evaluated. Therefore, the autocratic style is attractive to those who prefer a predictable work environment. In the autocratic approach, the manager is expected to have a proper vision for corporate growth. This style should not be mistaken for the coercive style, which is more extreme (https://witalni.pl/pojecie/styl-autokratyczny/).

The democratic style is typical of managers who discuss all relevant matters with their subordinates. Staff's brains are picked and the manager tries to make the final decisions as a team. Personnel involvement in decision-making guarantees substantial commitment to the pursuit of jointly set goals. A democratic manager fosters an atmosphere of trust and mutual respect and needs to be open to feedback. They need to select employees that are competent so they can help make decisions. Note that the manager always has the last word (Miściukiewicz, 2007).

The coaching style focuses on improving employee competencies by boosting their strengths and reinforcing weaknesses. Self-esteem building and new challenges are also part of this approach. When applying this style, the manager becomes a kind of coach who supports the professional and personal growth of their employees. Staff competence building is a long-term effort and inherent to this style. A strong subordinate-manager relationship is a characteristic attribute of this style as a critical component for empowering the former. The manager focuses on worse-faring employees more. In this case, the needs of more able members of the team are neglected. The coaching style needs employees to be engaged and is based on their intrinsic motivation. This is why subordinates sensitive to extrinsic motivation (pay rises, benefits such as sports cards) may find it hard to operate under this style. Moreover, this style requires a substantial effort from the manager because the energy spent to support the team is considerable (https://witalni.pl/pojecie/styl-trenerski/).

The pros and cons of the styles are summarized in Table 2.

Table 2.
The pros and cons of the management styles

Style	cons	pros
autocratic	Blocks initiative and reflection in subordinates.	Efficient completion of tasks.
democratic	Participatory decision-making takes time.	Encouragement to discuss problems and find solutions together reinforces relationships and fosters commitment.
coercive	The manager makes decisions and communicates them to the team. The group's potential remains untapped. Subordinates realize the manager's will.	Effective especially in crises when quick action is needed.
coaching	Individuals who need resolute instructions and a rigid labour framework may operate poorly under this style.	Strong employee-leader relationship, which is necessary to improve the employee's abilities and skills.

Source: Own work based on Szczupaczyński, 2014 and https://witalni.pl/slowniczek/zarzadzanie-zasobami-ludzkimi/style-zarzadzania/.

The literature suggests that the manager should apply several styles, the more the better. The most effective managers shift styles depending on the situation. They are aware of their impact and modify their behaviour to achieve the best outcomes (Olechnowicz, 2014).

7. General profile of the study subject

The company was established in the 1990s. It is one of the largest telecommunications service providers in Poland. It offers its services to individuals, businesses, and institutions. Every functional company has branches to pursue its goals and tasks. The investigated company also has nearly 70 offices throughout Poland.

A survey was conducted to obtain the data. This is a method that involves obtaining data by asking questions based on a specially developed survey questionnaire. The survey was conducted among employees of a telecommunications company in the Krakow branch. The survey questionnaire was sent by e-mail. This form of research shortens the time to obtain the necessary data and allows for easy distribution. The respondent can fill out the survey just as easily. The answers obtained are recorded on an ongoing basis. Survey research is the easiest and most effective method of obtaining data in the context of market research. Such research allows to obtain structured answers from the respondents. The survey was sent to all employees of the branch and was correctly completed and returned by all respondents.

8. Results

The survey was conducted in a branch of the company among all 28 employees. The data were collected with an anonymous survey sent to employees of the Kraków branch. All the respondents returned correctly completed questionnaires. Online questionnaires are a modern and effective survey tool.

Eighty-six per cent of the respondents were men and 14% were women. Their age varied from 20 to over 50 years. People aged 20–31 years constituted the most numerous group (57%). It was composed in 13% of women and 87% of men. The age group 32-40 constituted 32% of the sample, 11% of whom were women and 89%, men. Employees aged 41-50 made 7% of the respondents. Fifty-seven per cent of them were men and 43%, women. Only 4% of the employees were aged above 50 (only men). The team members were young, energetic, inventive, and enthusiastic. It is consistent with their length of service. Those who worked there for up to two years constituted 54%. Three to six years of work experience in the branch was declared by 28% of the respondents, while 18% of them worked there for less than 12 months.

The employees were asked whether their remuneration was adequate. Half of them answered ‘definitely yes’. ‘Somewhat yes’ was selected by 36% of the respondents, while 14% of them declared the remuneration to be inadequate.

The employees were then asked whether their remuneration was the most important motivator for work. Their answers are summarized in figure 1.

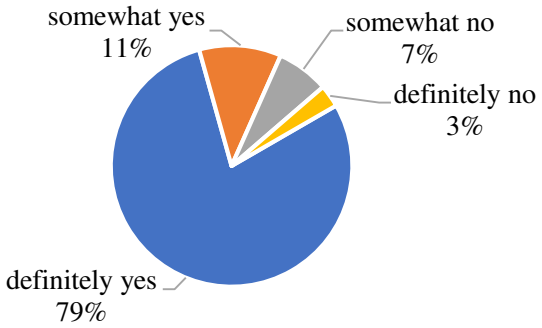

Figure 1. Answers to the question of whether remuneration was the primary motivator for work.
Source: original work.

The research confirms that remuneration was the primary motivator for work. The respondents were young, hence remuneration was obviously the most important motivator. Chart 1 shows that 79% of the respondents considered financial reward to be the most important factor motivating them to work in the organization. ‘Somewhat yes’ was selected by 11% of the respondents; ‘somewhat no’ and ‘no’ by 10% in total.

Work appreciation by the superior may be important for the mental health and subjective state of employees. As is the case with other emotions, appreciation can be conceptualized both as an emotion or disposition. The current emotional state of an employee may mean they feel grateful. Someone else can be happy. These statements describe emotions felt at the moment.

Appreciation is defined as ‘acknowledging the value and meaning of something—an event, a person, a behaviour, an object—and feeling a positive emotional connection to it’ (Adler, Fagley, 2005). The employees were asked whether their managers appreciated their work, see figure 2.

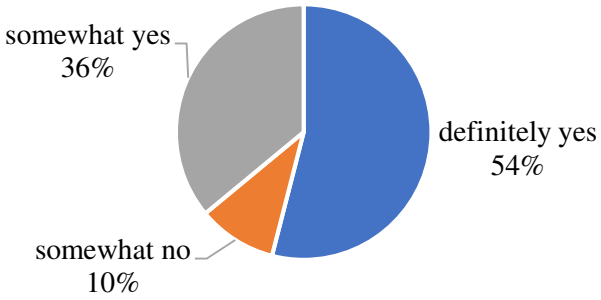

Figure 2. Answers to the question of whether the respondents believed their managers appreciated their work.

Source: original work.

Figure 2 shows that the employees believed their managers appreciated their work. Managers affect future behaviour with praise. ‘Definitely yes’ was selected by 54% of the respondents and ‘somewhat yes’ by 36%. The remaining portion believed they were ‘somewhat’ not appreciated. Note there is a difference between how managers appreciate employees and how employees feel appreciated. It is due to the effect of the illusion of transparency: people tend to overestimate the degree to which their emotions are evident to others.

The investigated organization has a motivation system. The employees were asked to assess its effectiveness. The results are shown in figure 3.

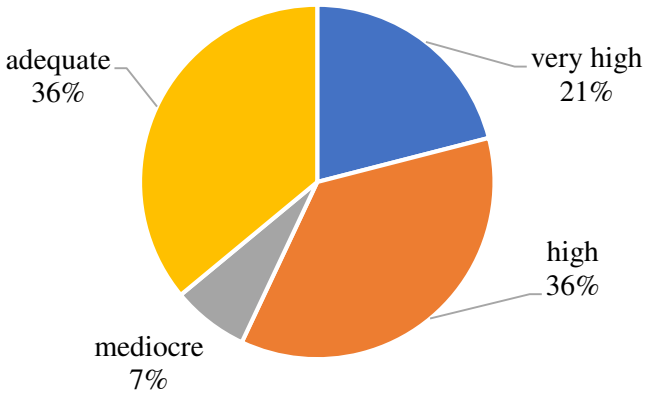

Figure 3. Answers concerning the motivation system in the organization.

Source: own work.

The respondents believed the effectiveness of the motivation system to be high and adequate (36%). Only 21% selected ‘very high’. Mere 7% believed the effectiveness of the motivation system to be ‘mediocre’. This assessment of the motivation system by the respondents may

indicate that they are familiar with the motivation system in the company and know how it works. Identification of employee preferences regarding the factors that motivate them is crucial for motivation system analysis. The group was asked to select up to three such factors, see figure 4.

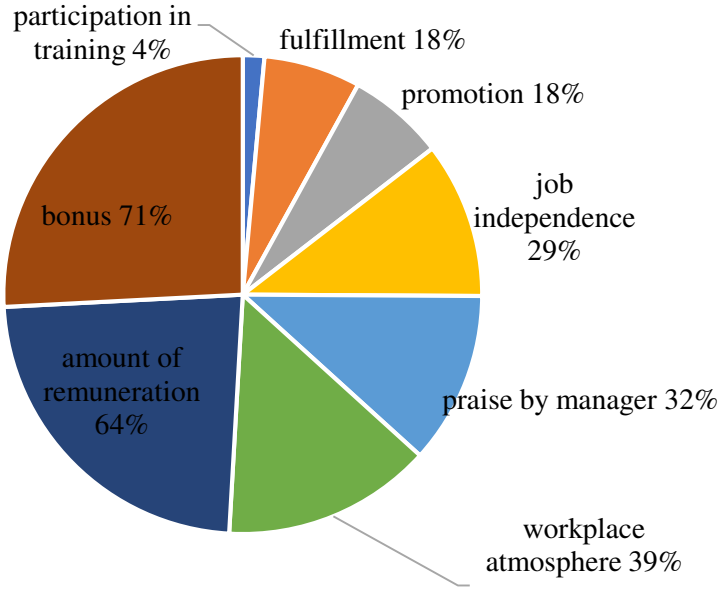

Figure 4. Respondents' opinions about selected factors that improve their motivation, in %.
Source: original work.

The study confirms that bonus payment is the primary motivator apart from base salary. Its importance lies in that it has a direct and strong relationship to the current employee's work performance. Bonuses are intended to incentivize employees to do more effective work, expand knowledge, or acquire new skills. Bonuses turned out to be the most important motivators for the respondents, with 71% selecting this answer. Regarding bonuses, the most motivating one was the monthly bonus (65%), quarterly bonus (18%), and annual bonus (17%). The value of remuneration as a tangible motivator was selected slightly less often (64%). Promotion is among the most important and effective motivators. However, it comes with a precondition that the employee accepts both a higher position and greater responsibility. If so, promotion satisfies the need for appreciation and positive self-assessment. Potential promotion was a positive motivator for 39% of the respondents. It is directly linked to the fact that with such appreciation, the employee believes in themself, considers themself valuable, has a higher sense of dignity, and strives for better professional results. Thirty-two per cent of the respondents found praise from the manager motivating. An appreciated employee feels more valuable and knows that their effort at work is recognized by the superior. An independent employee makes unaffected decisions, takes responsibility for their work, and can organize their work. Twenty-nine per cent of the respondents were motivated for better work by the possibility to exhibit independence. Fulfilment and a better atmosphere at work were motivating for 18% of the employees. Training opportunities affected motivation according to 4% of the respondents. The results are summarized in figure 4.

The group was then asked to indicate nonmonetary motivators employed in the branch. They could select multiple answers. The results are presented in figure 5.

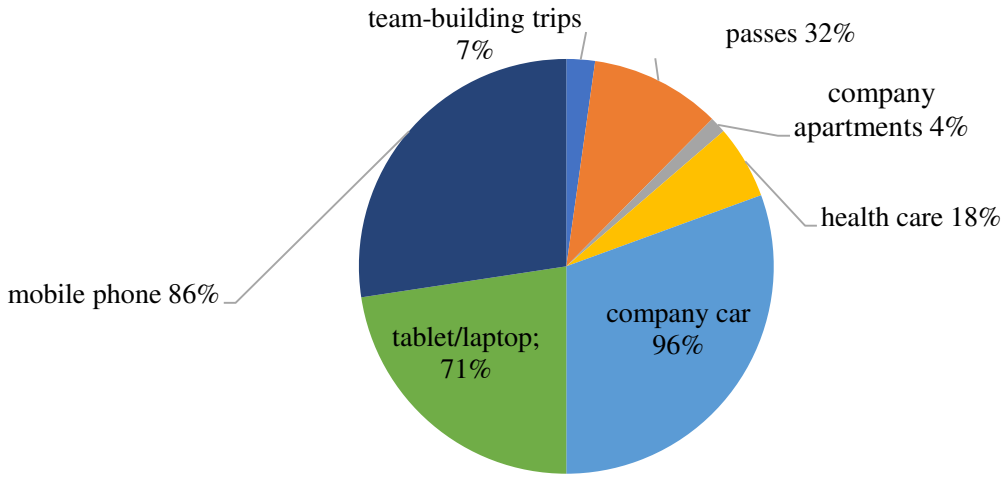

Figure 5. Answers regarding non-monetary motivators in the company.
Source: own work.

One of the most effective non-monetary motivators in the branch was access to a company car. It is a daunting and laborious task to hunt and retain a good employee, so companies increasingly often offer a company car as an added value. Data in figure 5 demonstrate that the company car was a non-monetary motivator for 96% of the respondents. In addition, a company laptop or tablet was an important non-monetary incentive for 71% of them. Thirty-two per cent were motivated by access to sports cards. Access to health services was selected by only 18% of the respondents, perhaps because most of the team were young (20-31 years) and not yet suffering from health conditions. Less than 7% indicated team-building trips as a non-monetary motivator.

Most probably, team-building events are reserved for employees with very high sales only.

Well-motivated personnel is one step towards the organization's success. To choose and employ the right incentives, the organisation has to map employee needs. One of the manager's tasks is to motivate employees towards specific results with the right management style, see figure 6.

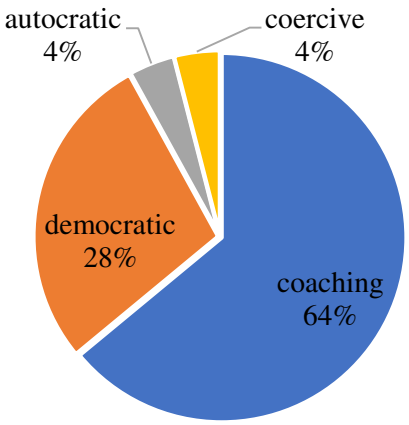

Figure 6. Answers regarding the management style of the direct superior.
Source: original work.

The employees were asked to assess the management style of their direct superior. According to 64% of the respondents, their manager employed the coaching style of management. It involves loyalty and support for every employee. When working with this style, the team leader focuses on the employee's strengths and weaknesses and fosters their individual development. The democratic style—where employees are not left to themselves—was selected by 28% of the respondents. Here, the employees are involved in decisions regarding activities and how work is done. The manager allows them to propose ideas, opinions, suggestions, and comments. Employees' needs are taken into consideration. The final decision is still taken by the manager. The coercive and autocratic styles were selected by a small portion of the employees (4%). The results are summarized in figure 6.

9. Conclusions

Employee motivating effort is the most challenging function in management. Employee's behavior and needs may be unpredictable. Each employee has different needs and getting to know and meet them is difficult, so an appropriate approach to the employee's needs is very important. Employees who are properly motivated and their hard work in pursuit of both personal and organizational goals can be a key competitive advantage for an organization. Employees can be motivated both with wage (material) and non-wage (intangible) means. Human resources management is about discovering what really motivates us to work more efficiently.

The study presented in the article has certain limitations resulting largely from the adopted methodology, based on the analysis of one case study. Its narrow scope of the study means that it does not exhaust the research problem, but only constitutes a contribution to further analyses.

Despite these limitations, it can be concluded that the study is important for practitioners and managers, as it contributes to the understanding of material and non-material motivation factors that may translate into increased employee involvement in more effective work and the willingness to identify with the organization.

- The study group consisted of young people aged 20-50 and more. The largest age group is those between 20 and 30 years old.
- As a result of the research, it turned out that the most important factor of material motivation for the studied group was remuneration.
- In the opinion of the surveyed employees, their superior appreciates their work in the organization.
- The surveyed employees believe that the motivation system in force in their organization is effective and clear.
- The surveyed employees indicated that among non-wage factors, the most motivating factor was the possibility of using a passenger car. According to the research, integration trips were not an important factor motivating work in the study group.
- The coaching style of management of the immediate superior, as indicated by the respondents, is characterized by constant motivation of subordinates. the manager tries to link their personal goals with the goals of the organization.

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SPECIFICATIONS OF THE SUSTAINABLE HUMAN RESOURCES GROWTH ON THE EXAMPLE OF COMPANIES IN THE TSL SECTOR

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Purpose: The purpose of this article is to present the specifications of the sustainable human resources growth on the example of companies in the TSL sector.
Design/methodology/approach: The paper presents the issues of the sustainable human resources growth as a significant element of sustainable human resources management. The paper is based on the literature review in this area and presents the results of secondary research referring to the sustainable human resources growth in the TSL sector (reports of examined companies).
Findings: The analysis presented in the article shows that the sustainable human resource growth affects the employee's work productivity in a positive way. The implemented ideas of sustainable human resources management and growth is the key factor for the correct human resources policy in the company.
Originality/value: The paper has a theoretical value. The issues of sustainable human resources management were discussed from the theoretical point of view as well as from the empirical one (the presentation of the sustainable human resources growth in the examined companies). The work is original due to the multi-aspect approach to the scientific issues and the obtained results may be useful both for management practitioners as well as be the inspiration for further research.

Keywords: sustainable human resources management, sustainable growth, organisation, company.

Category of the paper: general overview, point of view.

1. Introduction

Putting emphasis on taking actions and just taking actions concerning sustainable human resources growth comprise directions of strategic actions performed by various kinds of companies (also from the TSL sector). Thanks to the performance of the sustainable human

resources growth (the assumption is that human resources are the main factor guaranteeing the company its development), the organisations are able to develop effectively and obtain competitive advantage in the market. The result of initiating such a concept is shaping the sustainable human resources in a form of highly competent staff that also understands and is aware of the necessity to apply the sustainable growth rules in the work place. The purpose of this paper is to present what various actions concerning sustainable human resources growth are applied by selected companies from the TSL sector. It is based on the subject literature in this area and information obtained from the reports referring to the tasks from the area of the sustainable human resource growth in those companies.

2. Sustaianble human resources management – scope of the issue

The basis of the sustainable human resources management is the idea of sustainable growth (sustainable company) which causes the change how the purpose and success of each organisation is perceived and at the same time changes the responsibility towards the interested parties of the organisation (Jamka, 2010, pp. 17-32). Whereas according to Marin (Marin et al., 2012), the sustainable growth enables the interaction between the society, ecosystem and other live systems (without the impoverishment of key resources).

The sustainable human resources management, in accordance with one of the first definitions of this concept (according to R. Zaugg, A. Blum and N. Thorn) refers to three basic factors – abilities and willingness to be an attractive employee on the labour market, maintaining the work – life balance and increasing the employees' autonomy and using their competences (Zaugg, Blum, Thorn, 2001, pp. 3-4). Whereas Müller-Christ and Remer specify the sustainable human resources management as the thing which the organisations themselves should do in their surroundings in order to achieve access to highly-qualified staff in the future (Müller-Christ, Remer, 1999, p. 76). On the other hand, Gollan defines the sustainable human resources growth as the organisation ability to create value and at the same time the ability to regenerate the value and renewing the wealth by using policies and practices concerning human resources (Gollan, 2005, p. 26). Moreover, the social approach referring to the social corporate responsibility and to the relations of a given organisation with its interested parties is a key issue in designing sustainable human resources potential (Macke, Genari, 2019).

On the other hand, according to J. Pfeffer, sustainable human resources management should focus on the influence of human resources management on employee's health and life expectancy. Consequently, it is recommended to focus on such issues as (Pfeffer, 2012, pp. 34-45):

- Working hours and their influence on employee's health or reducing the barriers in joining professional and family obligations;
- Wage inequalities and their influence on the differentiation of health condition;
- Use of holidays by employees;
- Presenting the offers on the health insurance or healthcare programmes to the employees;
- Derecruitment and its consequences for the dismissed employees;
- Requirements at the workplace (contributing to the employee's health condition);
- Atmosphere in the workplace or the event of violence.

The ecological aspect, i.e. the use of the personal policy to support ecology, is a significant aspect of sustainable human resources management.

The ecological aspect, i.e. using the staff policy to support ecology by promoting the idea of 'green' organisations focusing on its results and individual, communal and environmentally friendly development, is a significant element of sustainable human resources management (Chams, Garcia-Blandon, 2019).

According to D. Rewick, T. Redman and S. Maguire, the performance of the ecological aspect in the human resources management should be applied as (Renwick, Redman, Maguire, 2013, pp. 3-4):

- Actions motivating employees in order to encourage them to act for the environment;
- Development of employees' 'green skills' (by recruitment, selection, training or development of managers and green leadership);
- Creating attitudes engaging employees in the scope concerning the issues referring to the environmental protection (by using their knowledge or shaping appropriate organisational culture).

Also a social aspect referring to keeping ethical rules in the employer – employee relations or respecting human rights and dignities is a component of the sustainable human resources management. It can be performed in the following areas of staff policy (Bombiak, 2019, p. 76):

- Employees motivation (fair remuneration, objective criteria of granting gratifications or employees' participation in the management of organisation);
- Selection (fair job offers, ethical interviews or friendly social and professional adaptation);
- Shaping working conditions (care for abiding the OHS provisions and the ergonomics of workplaces, keeping the work-life balance, mobbing counter-acting, various social benefits);
- Derecruitment (dismissing employees keeping the rule of respecting their rights and dignities, ethical and understandable disciplinary procedures, using the programme of monitored redundancies);

- Periodic assessment (transparency of the periodic assessment system, objectivity of the employees' assessment criteria, elimination of typical mistakes of periodic assessment or talking with assessed employees according to the rule of partnership);
- Professional development (investing in employees' professional development or providing them equal access to trainings).

The managing staff, which has a wide range of tools to affect employees, is also an important element of initiating the sustainable human resources management. It refers to three areas (Pabian, 2013, p. 8) and they are:

- Employee – company relations (giving bonuses and rewards for economical use of materials, economical exploitation of machines or initiation of sustainable growth innovations in the organisation);
- Employee – superior relations (positive reactions of managers to subordinates' suggestions concerning the sustainable growth, appreciating the achievements in this area or supporting ecofriendly or social initiatives);
- Employee and work place relations and its direct surroundings (equipping the workplaces in healthy, safe, economical and permanent products, proper adaptation of tasks from the sustainable growth to the qualifications and possibilities of employee).

3. Sustainable human resources growth in the TSL sector – case study

The case study covered the companies characteristics for the TSL sector. The information about the actions referring to the sustainable human resources growth taken by these companies was collected on the basis of the information from the reports published by these companies.

The first one of the tested companies occurring under two firms – Rohlig Suus Logistics and Suus Logistics – is a Polish global logistics operator[1]. It provides services of the complex logistics service within the road, sea, air, railway transport, warehouse services, Project Cargo and custom service. It also offers services connected with the supply chain management (VMI, Control Tower, 4PL, Logistics Solution Design) as well as counselling in the scope of supply chain strategies within the team Suus Advisory. This company has three basic values in the logistics activity. They are one step ahead, partnership, and permanent development (Rohlig Suus Logistics, 2023). One of the five strategic objectives of the company is creating the conditions of employees' engagement and satisfaction by creating stable working environment providing work comfort and letting the employees focus on their professional development. In particular, it is performed by (Rohlig Suus Logistics, 2023):

[1] It possesses branches in seven countries – Poland, the Czech Republic, Slovakia, Hungary, Russia, Slovenia and Romania. Its mission is *increasing the productivity of our customers' activity by delivering intelligent logistic solutions.*

- (hard) training programmes (CRM, Power BI, SQL classes, customers' service or issues referring to particular products offered by the company);
- (soft) training programmes (communication, dealing with stress, leading and organisation of efficient meetings, conflict management, assertiveness, emotion control ability, awareness building, prioritizing and work organisation, or ability to keep New Year's resolutions);
- Training programmes concerning managers' development the purpose of which is to shape appropriate organisational culture and creating pleasant atmosphere at the workplace[2];
- Programme Work&Care Academy – programme supporting employees both in the area of emotions as well as care for health and mental balance[3];
- Suus Active programme – the programme encouraging employees to take care of their health in various sport competitions (running, cycling, swimming, whole-body exercises or also marches and walks)[4];
- "Mum comes back to work" programme. In this programme young mum receives a folder with all necessary documents which she needs to submit in connection with the child's birth and maternity leave (as well as the timetable helping with all formalities)[5];
- Wide range of employees' benefits[6].

The next company – The Metropolitan Transport Authority – serves and manages the city communication systems working at the area of Silesia. It is the biggest transport organiser in Poland. It serves over 50 cities, towns and municipalities (connecting the most important centres of the Silesia Province)[7]. The company takes the following actions in the scope of the sustainable human resources growth (The Metropolitan Transport Authority, 2023):

[2] It means raising competences in the area of management – motivation, task delegating, appreciations and giving feedback as well as raising the awareness of the importance of the manager in an organisation and promoting management on the basis of the leadership model accepted in the company or unified management standards.

[3] Within the cooperation of Rohlig Suus Logistics with the online clinic HearMe the employees receive the psychologist's support.

[4] Each employee who opened an account in the free application WorkSmile can join the programme. Apart from that, company employees (and their families) may take advantage of financing the cards (enabling support within care for health) in three different packages: Zdrowie Plus [Health Plus], Zdrowie Premium [Health Premium] or Pakiet Senior [Senior Package]

[5] The women-employees have the possibility to take part in the training "Why is it not worth being a perfect mum and how to stop trying?" after the maternity leave (apart from the welcome present). Besides, each employee (who had a baby) receives a gift (women receive Misie Szumisie [Scumbag Teddy Bears] which help new-borns sleep and men receive baby carriers).

[6] They are among others: group life insurance, support of participation in sport competition, extra charge for 14-day long holidays, sport card Multisport and Medicover Sport, private Medicover care, subsidies, English courses, Christmas benefits, extra charges to sport equipment for children or fuel cards Lotos and Circle K).

[7] Within this company about 1,700 buses, trams and trolleybuses run at the area of Silesia every day (The Metropolitan Transport Authority, 2023).

- Introduction of solutions supporting professional development and creating the atmosphere contributing to the achievement of work satisfaction by an employee. Moreover, creating professional environment free from discrimination and prejudices as well as opening on the diversity (employment of the disabled);
- Each employee's access to key documents of the employees' field (Regulations of employees' remuneration, Work Regulations or Regulations of raising professional qualifications)8;
- Functioning of Ethical Code of the Metropolitan Transport Authority since 2019. Each employee may count on ethics commissioner whose role is to create the ethical culture of the Metropolitan Transport Authority (he provides the employees with the ability to consult cases when they have doubts what to do in a given professional matter in order to be in agreement with the organisation values). The commissioner guarantees the confidentiality which makes it possible to communicate the doubts openly or reporting abuses and offers mediations in disputes. There is also an online and physical box where it is possible to report issues to the Ethics Commissioner;
- Functioning of the periodical assessment system one of the objectives of which is the specification of employees' educational needs9 and raising the quality of work performed by them;
- Emphasising keeping the occupation health safety of the working conditions (both for administration employees as well as controllers working in the field).

The next examined company – VGL Solid Group – is one of the forwarding companies offering the full range of transport services – sea, air, railway and road forwarding (VGL Solid Group, 2023). Three basic values[10] - growth, responsibility, openness, work hard, team, honesty comprise its mission (VGL Solid Group, 2023). VGL Group leads its actions and projects towards the employees on the basis of dialogue and the set of basic company values connected with the selected tasks of sustainable growth objectives. They comprise (VGL Solid Group, 11.04.2023):

- 'Engagement Team' – it is the team consisting of the representatives of various company departments and branches and its objective is to make decisions in the matters important for the employees (organisation of trainings, integration meetings, initiation of company improvements or solving significant problems)[11];

[8] These documents specify among others the conditions of work remuneration, rules of granting additional benefits, qualifications required to work at particular positions, company policy concerning racism and mobbing counteracting at the workplace or rules of financing access to trainings.

[9] The company in its strategy includes the performance of sustainable growth objectives determined by the UN – towards the employees, local communities or customers (VGL, Solid Group, 2023).

[10] Whereas the area of directions of work are recognised on the basis of survey performed every year "What is important for you?"

[11] For example, giving employees fresh fruit every Tuesday or honey and fresh ginger in the autumn, "Healthy Breakfast" organised by the company once a year.

- Wide range of employees' benefits (health care, sport package co-financed by the company, Mybenefit café – the employee has the ability to choose any benefits within the café, extra charges to meals during the worktime)[12];
- Differentiated range of benefits within celebrating various events and recreation[13];
- 'VGL Adventure' – it is a set of trainings which let the employees get involved in the new company and new work place (its objective is to obtain useful information which enable to understand the organisation, its function and responsibility of particular departments in the first weeks of work);
- 'VGL Adventure – Leader's Academy' (trainings for the company leaders which enables to get knowledge in the areas: communication, personal awareness, building relations, task delegating, leadership, motivating, employees' development, change management and legal aspects of manager's work);
- 'Induction Day' – training programme for new employees (getting to know the organisation and its structure, familiarising with basic IT tools);
- Financing English classes by the company;
- 'VGL Leader Academy' – half-year long training programme the purpose of which is to develop personal and managerial competences (preceded by 360 degree assessment)[14];
- Coaching (help to achieve previously specified goals);
- Branch trainings in order to raise professional qualifications;
- Trainings concerning soft competences (time management, active interpersonal communication, assertiveness or dealing with stress);
- Development and integration meetings (the purpose of such trainings is to develop cooperation and trust in a team, raise awareness of controlling emotions or to get to know tools supporting physical and mental regeneration);
- Cyclical development talks between the employee and his superior.

The next company – Kuehne+Nagel – is a global logistics partner (sea, air, road and contract and integrated logistics offering highly-specialised solutions for the needs of main branches all over the world (Kuehne+Nagel, 2023)[15]. The company claims that the coherence of three key factors – economic growth, social inclusion and environmental protection – is necessary to

[12] E.g. Women's Day, Boy's Day, Forwarder's Day, Shove Tuesday, Christmas competitions of employees and their children, layettes for the child's birth or gifts for the wedding.

[13] It is the help in searching new solutions and possibilities, work on motivation, development of abilities and development of managerial competences for beginning managers.

[14] Its development strategy covers global programme of sustainable growth – among others initiation of global standards and frameworks, maintaining the highest level of ethical and consistency practices, care for health and employees' safety, minimalization of service influence of the environment, defining objectives of sustainable growth for corporate and regional management or contribution to the development of local societies (Kuehne+Nagel, 2023).

[15] A week of zero emission (the employees are encouraged to resign from using cars) or Vege Wednesdays (employees who declare are obliged to resign from eating meat every Wednesday).

perform the concept of sustainable growth. The company performs the following actions regarding sustainable human resources growth (Kuehne+Nagel, 2023):

- Performance of high ethical and legal standards (Kuehne+Nagel Ethics and Consistency Programme) as well as the ones towards the employees;
- Organising meetings for employees all over the world every quarter, during which the managerial staff informs the employees about important information concerning the company and the employees have the possibility to ask questions as well as presenting their opinions. Its element is the introduction of the initiative Future of Work (checking the employees' satisfaction and opinions);
- Trainings programmes for employees concerning the counteraction against briberies, corruption and monopoly practices;
- Putting emphasis on providing the employees with the highest level of health and safety;
- Trainings "NO HARM" for the managing staff concerning: behavioural safety, introduction of Safety Anchors KN (specifying the situations and behaviours which may lead to accidents and control and preventive measures which are to prevent them effectively);
- Promoting the development of organisational culture which will fully support and respect human rights;
- Promoting of ecological actions and behaviours among employees[16].

Whereas Raben Group is one of the biggest logistic companies and provides various services on the basis of the excellent fleet, developed chain of branches and modern warehousing area. Raben Group[17] performs actions connected with the sustainable human resources growth within the strategy Employer Branding which integral element is "People with Drive" (the purpose of this strategy is to become a first-choice employer and to attract, keep and guarantee the development possibilities to the employees). The actions performed in this area comprise (Raben Group, 2023):

- Complex research of employees' satisfaction and involvement[18];
- Introducing the programme "Manager of Choice" in a form of competition (during the programme almost 1,000 key managers from 13 countries of Raben Group performed 40 various tasks connected with human resources management). Its purpose was to change the managers' attitudes and education to teach them how to become an engaged leader and how to be more sensitive to the issues connected with team management;

[16] A week of zero emission (the employees are encouraged to resign from using cars) or Vege Wednesdays (employees who declare are obliged to resign from eating meat every Wednesday).

[17] At present it works in 15 European countries providing warehousing, national and international transport, sea and air shipping and intermodal transport services (Raben Group, 2023). One of significant elements of its mission covers running the activity based on sustainable growth which is reflected in the acceptance of the Sustainable Growth Strategy for years 2021-2025 in 2021 (Raben Group, 2023).

[18] Also the research COVID Plus Check was an important element. Its objective was to get to know the employees' opinion about the company activity during the pandemic.

- Trainings and workshops for company employees (connected with onboarding, managerial skills, OHS, project management and compliance with law);
- Regular reviews of employees' results and professional development;
- Efficient and transparent internal communication meaning the information for employees about any changes in the activity which may affect their functioning in the Raben Group;
- OHS training for all employees (performed by the internal and external specialists)[19];
- The performance of research in which the employees are asked about their feelings and perception of safety in the Raben Group (the research results are used to plan changes and improvements in the safety systems and culture in order to minimise the risk of accidents and improve ergonomics);
- Identification of threats connected with work and risk assessment (according to the SHE standards with the consideration of local labour law requirements) and reporting by the employees work accidents in accordance with the incident management procedure (in accordance with the SHE standard, if the situation seems dangerous, each employee has the right to inform the superior about this fact and leave the workplace immediately).

The last of the tested companies, DB Schenker is a leading provider of services in the scope of global logistics and serves industry and trade in the global goods exchange with the use of road, air transport and ocean freight, contract logistics and supply chain management[20]. Its strategy covers all aspects of sustainable growth and aims to achieve economic, social and environmental harmony in logistics and supply chain management (DB Schenker, 2023). DB Schenker takes the following actions regarding the sustainable human resources growth – on the basis of the DB Schenker Proceeding Code, DB Schenker's vision and values (DB Schenker, 2023):

- Regular analysis of professional career of all company employees;
- Respecting the diversity and equal treatment – regardless of the gender, skin colour, views or religion (workshops for managers in this scope);
- Various employees' benefits[21];
- Strengthening (by trainings) employees' well-being in the areas of mental and physical health, education about the healthy lifestyle (care for spine or keeping life – work balance);

[19] The company provides subsequent additional trainings to some employees. The programme depends on the type of employment and specific threats connected with work and reacts to the needs specified during the discussion identifying the areas of potential threats and problems.

[20] DB Schenker is the leader of logistics for the car and technological industry, consumption goods, market logistics, special transport and logistics of special events (DB Schenker, 2023).

[21] Such as e.g. financing medical package, financing sport and entertainment activities, group life insurance, participation in sport tournaments, flu vaccinations every year, workshops of health prevention, financing family holidays from the Social Benefits Fund, material and financing help for employees in difficult life situations, loans to decorate a flat, vouchers for Christmas or extra remuneration for work at night.

- Employees' training in the first aid (among others teaching to use defibrillator);
- Periodic assessment with the use of the method 360 degrees[22];
- Care for the safety of employees on the basis of the Integrated Management System included in the Plans to Improve Working Conditions and Environmental Protection[23];
- Monitoring of serious work-related injuries by the company;
- Functioning of the Worksmile Platform (it is used to promote physical activity or healthy lifestyle (it offers the motivating challenges and activity rankings as well as the possibility of individual result tracking);
- Active company participation in the programme safe transport[24];
- The performance of the Safe Drive Plan (specifies the way of recruitment and education of couriers employed by the shipping company cooperating with DB Schenker or includes monitoring accidents and possible actions after accidents);
- The performance of the Healthy Challenge programme thanks to which the company recognised the employees' needs concerning the healthy lifestyle.

4. Conclusion

At present, the actions concerning sustainable growth and in the same time concerning sustainable human resources growth are included in the development strategies of companies from the TSL sector more and more often. It is particularly important that the companies wanting to perform the assumptions of sustainable growth need so called sustainable employees. Such employees should feature with the attempt to perform the company development objectives by maintaining and performance of tasks entrusted to them in a way ecologically and socially responsible. In particular, they feature with: (Cohen, 2011, pp. 1-19, 132-156):

- Emphasising the balance in production, consumption, sale;
- Control the company influence on the person and the environment;
- Responsibility for the planet health;
- Actions for the benefit of future generations (so that they were able not only to survive but also to develop);

[22] This method allows to compare the employees' self-assessment with the assessments performed by others people, e.g. the superior, subordinates or co-workers). The results of such an assessment enable to identify the strengths and areas to develop as well as indicate the importance of particular competences for the taken position.

[23] Each employee has access to the system about reporting work accidents by using an applications "ACCIDENTS".

[24] The programme covers: the analysis of the situation on the roads, description of the road transport safety system, drive safety factors, costs of road accidents, education, description of connections between railway network, water routes and road network, transport of dangerous goods and spreading standards and actions supporting safety.

- Minimising the negative influence of the company in the environment;
- Emphasising the development of products, services or technology in accordance with the rules of sustainable growth;
- Concentration on future and the performance of economic, ecological or social objectives.

The basis to perform such a process comprise appropriate actions of the company concerning sustainable human resource growth (management) with the participation of managerial staff as a stimulator of such actions. These actions should cover among others employees' professional growth, providing work – life balance, health protection or liquidation of remuneration differences and initiating the practice of environmental protection by employees.

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HIGHER EDUCATION AND DIGITALIZATION IN PERSPECTIVE OF USE OF INTERNET, INTEGRATION OF DIGITAL TECHNOLOGY, DIGITAL PUBLIC SERVICES: PANEL STUDY OF EU NATIONS

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Purpose: Global discussion issues include managing innovation and incorporating digitalization into higher education. Combining and balancing these, digitalization may hold the key to enhancing higher education's capacity for innovation and expanding the use of cutting-edge learning technologies into their curricula, ultimately boosting student achievement. The distinctiveness of the research is on the need to improve higher education's administration, instruction, and practice via the process of innovation and digitalization of higher education. The primary goal research purpose of the study is to examine the relationships between higher education and different facets of digitalization in the context of European countries.

Design/methodology/approach: Methods used to carry out the empirical analysis were EViews 12.0, SPSS 28, and Tableau. Moreover to find out whether there is a connection between digitalization and higher education, panel regression and Granger causality were applied. Due to data accessibility, we utilized data from 31 European nations for the 2013 and 2020 empirical research relating the Digital Economy and Society Index (DESI) components and higher education.

Findings: The results suggest that every hypothesis was correct, and digitalization is crucial for higher education since it shows outstanding levels of dependability with Industry 4.0. The integration of digital technologies, internet usage, and digital public services all have a significant influence on higher education in EU nations. Additionally, studies have shown that throughout time, the higher education systems in various European nations have changed in diverse ways in terms of digitalization. As a result, the integration of higher education and innovation on a new digital foundation will support digital public services of research discoveries and creative operations of higher education institutions.

Originality/value: The challenges of the human capital required in the digital economy have received the bulk of attention in research on innovation and digitalization in higher education. In the case of European countries, there are no empirical research on the connections between elements related to digitalization and higher education. This document fills the gap in this situation. The novel of the study tackles digitalization in higher education and the need of

enhancing managers, educators, and practitioners' professional growth in higher education via the process of innovation.

Keywords: Digital University, Economy and Society Index, EViews 12.0, improvement, innovation, SPSS 28, strategic management, Tableau.

Category of the paper: research paper.

1. Introduction

Digitalization has altered the entire educational structure globally during the last decade, with practitioners, scholars, and policymakers paying close attention to educational progress (Bond et al., 2020; Pan et al., 2023; Rosak-Szyrocka, Zywiolek et al., 2022). Education is unaffected by the fast progress of technology's digitalization (Ciolacu and Svasta, 2021; Rosak-Szyrocka et al., 2024); other areas are also changing. The world's living and working standards are changing as a result of the Fourth Industrial Revolution, making many conventional educational models and teaching techniques outdated. Digital education penetrates and aids in the education of students from afar (E-learning…, 2015; Ronchi, 2019). Other areas of the industrial revolution are likewise reliant on educational structures to increase industry capabilities. The development of the educational sector was an important aspect of the industrial revolution (Jung, 2020). Regarding communication situations, accurate information, and understanding application, the educational sector has a chance to achieve a more significant aim (Information and Communication…, 2017; Measuring Teachers' Readiness…, 2020). Although knowledge will be freely accessible, comprehension and perspective on it will be required to establish innovative learning strategies. All methods and ways of life learning, distant learning, and practical learning will now have to be accommodated in traditional classroom education (Editor Academic Journals & Conferences, 2022; Tiwari et al., 2022; Wu et al., 2018). The challenges of the human capital required in the digital economy have received the bulk of attention in research on innovation and digitalization in higher education. In the case of European countries, there are no empirical research on the connections between elements related to digitalization and higher education. This document fills the gap in this situation. The novel of the study tackles digitalization in higher education and the need of enhancing managers, educators, and practitioners' professional growth in higher education via the process of innovation.

2. Literature review

The term "digitalization," often referred to as "digital transformation," refers to a business strategy that is supported by "trends related to the employment of digital technology in all sectors of human society (Stolterman, Fors, 2004). The concept of "digitalization" refers to the use of digital technology to many spheres of human existence and business across the globe. The growth of "smart cities" and "smart objects" has been linked to the rise of digitalization as one of the major themes in the development of contemporary nations (Analysis of the transformation…, 2021). The fourth industrial revolution emphasizes the use of high-speed Internet to facilitate the adoption of digital technology (Fahim et al., 2021; Feerick et al., 2022). The influence of digital technology on the learning process is enormous (Hariharasudan, Kot, 2018). Because the procedures for the expansion of the digital economy are moving more quickly, the higher education system is changing. Universities are forced to digitize their own educational, research, international, marketing, financial, and economic activities in order to maintain their competitiveness in the global market for educational services (Popelo, 2017). The use of technology in education is bringing up new avenues for learning and resource efficiency (Qureshi et al., 2021). Infrastructures on a large scale are being condensed into a single space and a single digital device. Higher education must incorporate the latest related technologies, and the Internet of Things must adapt to new methods of interacting with machines and data (Khan, Javaid, 2021). Digital technologies including artificial intelligence, cloud computing, additive manufacturing, data analytics, wireless sensor networks and social media (Lanzolla et al., 2021) are just a few examples that provide unmatched opportunities for creating and delivering distinctive products (Verganti et al., 2020). Digital product innovation is becoming a more important strategy for businesses (Nylén, Holmström, 2015). New goods or services that use or are made feasible by digital technology are known as "digital product innovations" (Lyytinen et al., 2016; Nambisan et al., 2017). The global socioeconomic issues force higher education in the twenty-first century to embrace digital technology and big data analytics in order to provide tailored learning skills via value-added intelligent educational models (Tiwari et al., 2022; Żywiołek et al., 2021). This allows for a collaborative learning environment in which academics determine the finest educational learning models. The COVID-19 virus serves as an example of how sophisticated educational technology have become one of the most important components in integrating institutions into the increasingly competitive global market (Rosak-Szyrocka, Zywiolek et al., 2022; Vargo et al., 2021; Verma et al., 2022). Digital technology is having a significant impact on education, skills, and employment. These changes highlight the growing importance of technology in education 4.0 (17th International Conference…, 2020; 2021 IEEE Global Engineering…, 2021; Effectiveness of Digital Technology, 2021; Rosak-Szyrocka, Apostu et al., 2022; Tri et al., 2021b). As a consequence of educational cooperation, digital technologies are advancing beyond cutting-edge and unconventional teaching and learning approaches. Digitalization should be incorporated into the educational institution's competitiveness strategy as well as the

state's educational policy (The shape…, 2015; Digital transformation…, 2018; Exploring digital transformation…, 2021; Popelo, 2017; Reyes Salazar et al., 2021; Rodrigues, 2017; Toader et al., 2021). The key dimensions of higher education's impact on the digital economy are shown in Table 1. In the modern world, students are used to using digital devices like smartphones, tablets, and laptops in everything from elementary school to higher education (Oztemel, Gursev, 2020; Qureshi et al., 2021). The majority of the time, people use these gadgets for communication and amusement. However, the changing world's need is for pupils to study and be educated through these technologies (Networked, Smart…, 2020; Lee et al., 2014). For trainers and instructors who have been working for a long time, understanding these gadgets is difficult. The findings of Zeehan's (Zeehan et al., 2020) study point to the difficulty of teachers' preparation for new technology. The study's conclusions also suggest that in order to enhance students' skills in digital technology education, instructors still have not properly included digital technologies into their teaching strategies. The outcomes of Zeehan research suggest that instructors' preparation for new technologies is difficult. The study's conclusions also suggest that teachers still need to do more to enhance the effectiveness of their teaching approaches by using digital technologies. The emphasis on education is shifting in the modern world to include technological learning and usability (Qureshi et al., 2021; Safiullin, Akhmetshin, 2019). When a person learns a new technology in a reasonable amount of time, they will be deemed skilled. The notion of education 4.0 (Khan, Qureshi, 2020) is a skill that is valuable now but may not be relevant tomorrow. Digital technologies that are simple, affordable, and effective will be widely used in education in the future (Rosak-Szyrocka, Blaskova, 2016; Rosak-Szyrocka et al., 2021). Therefore, education administration and learning practices must encourage vigorous improvement, exceptional service systems, resolve, particular aptitudes, access to top data and information resources, completion, alignment to excellence, continuous transformation and growth, and belief (Flexible forms…, 2018; Eglash et al., 2020). It's crucial to keep in mind that the modernization of institutions was sparked by the expansion of the digital economy. Higher education institutions need to use modern information and communication technologies into their instructional and research operations if they want to compete in the market for educational services. At this time, a lot of focus is being placed on equipping students and teachers with the digital skills they need, including providing them with gadgets and a good Internet connection. At the moment, a lot of attention is being paid to providing students and instructors with the necessary digital skills, including giving them access to devices and a reliable Internet connection. Distance and blended education are now an important aspect of every university's operations. Authors Batista et al. (2016), Bond et al. (2018), Cosmulese et al. (2019), Djakona et al. (2020, 2021), Filyppova et al. (2021), Skharlet et al. (2019), Tkalenko et al., (2017), Tømte et al. (2019), Ugur et al., (2020) have looked at the value and potential of contemporary information and communication technologies as a tactical tool to ensure that the higher education system is responsive to the demands of the digital economy (Tkalenko, 2017).

Table 1.
The key dimensions of higher education's impact on the digital economy

A characteristic of the digital economy	Impact directions on higher education's modernisation initiatives
Increasing significance of information in a nation's economic development	Increasing the demands on graduates of higher education institutions in terms of professional knowledge and abilities; encouraging lifelong learning
The role of information in a nation's economic development is becoming more important.	Intensification of knowledge and information generating processes, as well as advancements in knowledge and information transmission routes in the economy
Economic enterprises are actively incorporating information technology into their operations	Dissemination of distance education; development of future professionals' operational mastery and productive work abilities using current technologies for information and communication
The creation of an international information space	Extensive access to information technology for students, population information mobility and media literacy, the development of young people's preparation for interprofessional and interterritorial labor mobility
Increase in the proportion of information goods	Higher education institutions' focus on developing specialists for new professions, whose demand is generated by new types of economic activity
A focus on training specialists for new professions, the need for which is brought on by new sorts of economic activity, by higher education institutions	Higher education institutions should emphasize hiring IT professionals and concentrate on specialized training in information and communication technology (especially limited specialty)
Informatization, computerization	The integration of modern information and communication technology into academic procedures at universities, the development of global competencies among applicants to higher education, and the preparation of professionals to compete in a global labor market (in light of the increase in overseas work options due to the usage of Internet resources)

Source: own study base on (Popelo, 2017).

3. Data and methodology

Considering the extant literature, the subsequent hypothesis were formulated:

H1: Use of Internet significantly influences higher education.

H2: Integration of Digital Technology significantly influences higher education.

H3: Digital Public Services significantly influences higher education.

H4: The European countries evolved differently regarding digitalization and higher education across time.

The study explores the relations between higher education and digitalization components in case of European countries. Thus, higher education is represented by *tertiary education*, and digitalization is represented through three dimensions encountered also in DESI calculation: Internet using, Digital Administrative Services and Integration of Digital Technology. For Use of Internet dimension, it was used *Fixed broadband coverage*, for Integration of Digital Technology dimension it was used *E-commerce sales*, and for Digital Public Services dimension it was used *Individuals using internet in case of relationship with*

public authorities. The proportion of upper secondary, post-secondary non-tertiary, and tertiary education is reflected in the tertiary education. The E-commerce sales represents the number of enterprises registering e-commerce sales for more than 1% turnover reported to the total number of companies, except financial sector with more than 10 employees and self-employed persons. The Fixed broadband coverage represents the percentage of Fixed broadband coverage (DSL, incl. VDSL, FTTP, Cable modem DOCSIS 3.0/3.1, incl. DOCSIS 1.0/2.0, FWA) in case of householders. The proportion of people who used the internet in the last year to communicate with public authorities is shown by the Individuals utilizing the internet for engagement with public authorities. The study period was specified as 2013-2020 and all the variables were annual. All the variables are described in Table 2.

Table 2.
Dataset definition

Variables	Definition	Unit	Source
TE	Tertiary education	%	Eurostat Database
ECS	E-commerce sales	%	Eurostat Database
FBC	Fixed broadband coverage	%	Eurostat Database
IPA	Individuals using internet in case of relationship with public authorities	%	Eurostat Database

Source: own study.

The sample of the study consists of 31 European countries, according to the availability of the data. The programs SPSS 28, EViews 12.0 and Tableau were used for the empirical analysis.

In order to detect if there is a causality between digitalization and higher education it was used Granger causality and panel regression. In case of panel data, before running the panel ganger causality is necessary to verify cross-section dependence and test the stationarity using Unit root tests. To test the cross-section dependence, the most common tests are Lagrange Multiplier (LM), Pesaran's CD test, Friedman's test and Frees' test. Regarding stationarity, are used unit root tests, such as Pesaran test, Shin W-stat, Lin & Chu t test. The IPS and Levin tests imply cross-section independence in case of errors, but Pesaran (Pesaran, 2021) developed a cross-section IPS including cross-section dependence.

In case of static panel regression three different models can be used: common constant, fixed effects (FEs), and random effects (REs). There are no discrepancies between the matrices of the data in case of cross-sectional aspect when using the common constant approach (N). Differences between units may be handled by using a different intercept when FE models are employed. Interference variables may relate to time and units when the RE model is applied (Apostu et al., 2022). FE models are appropriate in case of specific set of entities and the RE model are appropriate in case inferences are based on entities randomly drawn from a large sample (Baltagi et al., 2012).

The regression equation for panel data analysis can be expressed as follows:

$$y_{it} = b_0 + b_1 x_{1it} + \cdots + b_k x_{kit} + e_{it} \quad (1)$$

where:

b_0 – cross section constant on time axis,

y_{it} – the endogenous variable,

x_{kit} – the exogenous variable, X_k, where:

$i = 1, \cdots, n$ – n represents cross sections,

$t = 1, \cdots, T$ – t represents time axis, in our case the years,

e_{it} – the error term.

In case of FEs, the model has the following form:

$$y_{it} = b_{0i} + b_1 x_1 + \cdots + b_k x_{kit} + e_{it} \quad (2)$$

The model for Res can be expressed as follows:

$$y_{it} = (b_0 + v_i) + b_1 x_{1it} + \cdots + b_k x_{kit} + e_{it} \quad (3)$$

$$y_{it} = b_0 + b_1 x_{1it} + \cdots + b_k x_{kit} + (v_i + e_{it}) \quad (4)$$

In order to select between REs and FEs it was used Hausman test and Redundant Fixed Effects test. Robustness checks imply errors heteroskedasticity, autocorrelation and dependence between the panels). For this were used the Wooldridge test (for autocorrelation). Wald test (for heteroskedasticity in case of errors), Pesaran test (for dependence among the panels in case of errors), Greene heteroscedasticity test and LM test (errors autocorrelation). In order to group the countries according to digitalization and higher education we used cluster analysis, respectively Hierarchical cluster. The homogenous groups were defined based on digitalization components and tertiary education. In cluster analysis, comparable data are grouped into uniform subsets to reveal distinctive patterns. Through remote function and grouping algorithms, the similarity between items is assessed. The similarity measures are calculated between observations and between clusters, after clusters are generated (Boccard, Rudaz, 2013). The clustering techniques assess the effectiveness of cluster configuration recovery techniques already present in the data, verifying the algorithms. Validating the algorithms reflects the methods capacity to regain cluster structures existing in the data. Statistical analyses of empirical datasets, mathematical derivations, and Monte Carlo simulation techniques are all examples of validation procedures (Milligan, Cooper, 1987). The correlation approach serves as the foundation for the hierarchical grouping algorithm (Sokal, 1958). The dendrogram, which groups all of the pieces into a single tree, illustrates the basic objective of the hierarchical grouping method. A node links two or more components, and the average of the integrated elements is used to compute the node expression profile (Eisen et al., 1998). Hierarchical Cluster Analysis identify the objects governing structure considering iterative process through objects association (agglomerative methods) or dissociation (divisive methods) (Steinbach et al., 2004).

For a certain collection of items, hierarchical cluster analysis seeks to create a hierarchically structured series of partitions; the resulting hierarchy is based on closeness measurements determined for each pair of objects (Köhn, Hubert, 2015).

Beginning with items in distinct clusters, the agglomeration process mixes the sequences until all the objects are a part of a single cluster (Almeida et al., 2007).

4. Empirical results

We employed the panel data equation model described below to address the study aim of the factors influencing high levels of education in European nations:

$$TEit = \beta it + \beta 1ECSit + \beta 2FBCit + \beta 3IPAit + \varepsilon it \quad (5)$$

The dependent variable is tertiary education The independent variables considered in the regression equations are E-commerce sales, Fixed broadband coverage, and Individuals using internet in case of relationship with public authorities. The statistics for the variables are presented in Table 3.

Table 3.
Summary statistics of dependent and explanatory variables

Variables	Mean	Std. Deviation	Min.	Max.	Skewness	Kurtosis
Tertiary education	28.950	7.242	13.800	42.800	-0.227	1.989
E-commerce sales	17.404	7.259	5.000	38.000	0.374	2.395
Fixed broadband coverage	95.732	5.120	79.100	100.000	-1.599	4.904
Individuals using the internet for interaction with public authorities	63.043	18.558	9.000	94.000	-0.513	3.098

Source: own study.

To determine the characteristics of the sampled nations, summary statistics of the data were carried out (Table 3). The average value for *tertiary education* for the European countries included in the sample is 28.95%, the minimum is 13.80%, the maximum is 42.80%, and the standard deviation is 7.24%. In the case of *E-commerce sales,* the values vary between 5% and 38%, the average is 17.40% and standard deviation of 7.26%. The average score for *fixed broadband coverage* is 95.73% with standard deviation of 5.12%, the smallest value being 79.10% and the biggest value 100%.

The percentage of people who contact with governmental authorities online ranges from 9% to 94%; the average is 63.04%, with a standard deviation of 18.56%. According to Skewness and Kurtosis values, all variables are normally distributed. Referring to the temporal axis, the variables trend are highlighted in Figure 1.

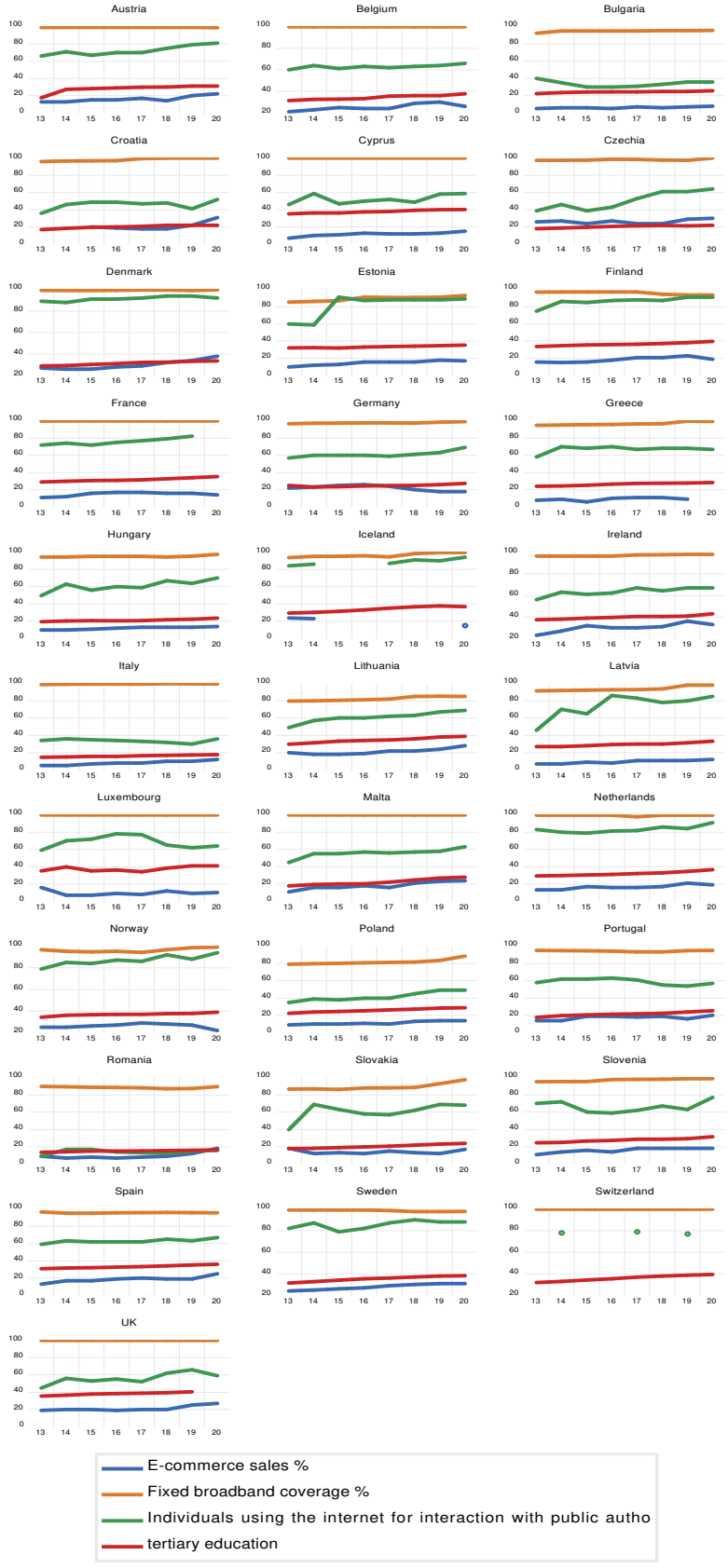


Figure 1. Variable trends.

Source: own study.

In addition, Tertiary education shows an average correlation with E-commerce sales, and Individuals using internet in case of relationship with public authorities, and a poor correlation with Fixed broadband coverage. The correlations between E-commerce sales and Fixed broadband coverage, and Individuals using internet in case of relationship with public authorities are poor (table 4). Fixed broadband coverage registers a poor correlation with Individuals using internet in case of relationship with public authorities.

Table 4.
Correlation matrix

Variables	Tertiary education	E-commerce sales	Fixed broadband coverage	Individuals using internet in case of relationship with public authorities
Tertiary education	1.000	0.417***	0.199***	0.615***
E-commerce sales	0.417***	1.000		
Fixed broadband coverage	0.199***	0.223***	1.000	
Individuals using internet in case of relationship with public authorities	0.615***	0.443***	0.275***	1.000

* 10% significance; ** 5% significance; *** 1% significance.

Source: own study.

To identify the cross-sectional dependence between variables we performed the Pesaran cross-sectional dependence test (Im et al., 2003) (Table 5). According to the results, we rejected the null hypothesis, thus there is no cross-sectional dependence, i.e., not being registered a correlation between the variables.

Table 5.
Results from testing the cross-sectional dependence

Test	Statistic	Prob.
Breusch–Pagan LM	1287.372	0.0000
Pesaran LM normal	29.967	0.0000
Pesaran CD normal	15.164	0.0000

Source: own study.

In order to test the relationship of cointegration we used the Pedroni and Kao tests for cointegration and the results confirmed the presence of a cointegration relationship among our variables (Table 6).

Table 6.
Cointegration test

Pedroni cointegration test		
Test	**Statistic**	**Prob.**
Panel v statistic	-1.178	0.881
Panel Rho statistic	3.357	0.999
Panel PP statistic	-5.753	0.000***
Panel ADF statistic	-5.049	0.000***
Group Rho statistic	5.462	1.000
Group PP statistic	-18.208	0.000***
Group ADF statistic	-8.989	0.000***
Kao cointegration test	**t-stat**	**Prob.**
ADF	-1.192	0.117 *

* 10% significance; ** 5% significance; *** 1% significance

Source: own study.

To test the variables stationarity was used unit-root tests, the results confirming all variables are stationary at level (Table 7).

Table 7.
Unit root tests

Variables	Levin, Lin & Chu		Im, Pesaran & Shin W-Stat		DF-Fisher Chi-Square		PP-Fisher Chi-Square	
	Statistic	**Prob.**	**Statistic**	**Prob.**	**Statistic**	**Prob.**	**Statistic**	**Prob.**
Tertiary education	-35.722	0.000***	-0.790	0.215	66.084	0.338	99.874	0.002***
E-commerce sales	-5.958	0.000***	0.713	0.762	57.344	0.499	105.605	0.000***
Fixed broadband coverage	-24.664	0.000***	0.317	0.624	50.732	0.797	63.475	0.455
Individuals using the internet for interaction with public authorities	-19.471	0.000***	-2.259	0.012**	123.557	0.000***	180.524	0.000***

* 10% significance; ** 5% significance; *** 1% significance

Source: own study

To test the causality the Granger causality test is employed, and the results indicate the role of Individuals using internet in case of interaction with public authorities on Tertiary education, but not vice versa. Thus, there is a unidirectional causality, flowing from Digital Public Services to high education, instead high education does not causes Digital Public Services (Table 8).

Table 8.
Granger causality results

Null hypothesis	F-statistic	Prob.
Individuals using internet in case of relationship with public authorities does not Granger Cause Tertiary education	2.301	**0.103**
Tertiary education does not Granger Cause Individuals using internet in case of relationship with public authorities	1.497	0.227
Fixed broadband coverage does not Granger Cause Tertiary education	0.831	0.437
Tertiary education does not Granger Cause Fixed broadband coverage	0.140	0.870
E-commerce sales does not Granger Cause Tertiary education	1.252	0.289
Tertiary education does not Granger Cause E-commerce sales	0.074	0.929
Fixed broadband coverage does not Granger Cause Individuals using internet in case of relationship	0.945	0.391
Individuals using internet in case of relationship with public authorities does not Granger Cause Fixed broadband coverage	0.679	0.509
E-commerce sales does not Granger Cause Individuals using internet in case of relationship with public authorities	0.632	0.533
Individuals using internet in case of relationship with public authorities does not Granger Cause E-commerce sales	0.607	0.546
E-commerce sales does not Granger Cause Fixed broadband coverage	0.022	0.978
Fixed broadband coverage does not Granger Cause E-commerce sales	0.020	0.980

Source: own study.

The panel analysis results are estimating the impact of the variables: Fixed broadband coverage, E-commerce sales, and Individuals using internet in case of relationship with public authorities on high education from a cross-sectional and longitudinal perspective. The static results using FE/RE estimations are obtained using the Hausman test (Table 9), indicating that the null hypothesis of REs is accepted, thus RE estimates are appropriate.

Table 9.
Hausman test

Test summary	Chi-Sq. Statistics	Chi-Sq. d.f.	Prob.
Cross-section random	4.504	3	0.212

Source: own study.

Furthermore, for choose Fes or REs it was used also the Redundant Fixed Effects test (Table 10). These two tests can generate contradictory results and, in this case, it can be chosen OLS model. In our case, the Redundant FEs test confirmed the random effects is appropriate for our data (Table 11).

Table 10.
Redundant Fes Tests

Test summary	Chi-Sq. Statistics	Chi-Sq. d.f.	Prob.
Cross-section F	89.216	29.197	0.000
Cross-section Chi-square	609.164	29	0.000

Source: own study.

Table 11.
Cross-section REs test comparison

Variables	Fixed	Random	Var (Diff.)	Prob.
E-commerce sales	0.319	0.311	0.000	0.411
Fixed broadband coverage	0.334	0.292	0.001	0.120
Individuals using internet in case of relationship with public authorities	0.092	0.103	0.000	0.066

Source: own study.

Static results (Table 12) indicate the relationship of digitalization with higher education. All the variables describing digitalization are positively associated with tertiary education, being statistically significant, confirming hypotheses 1-3.

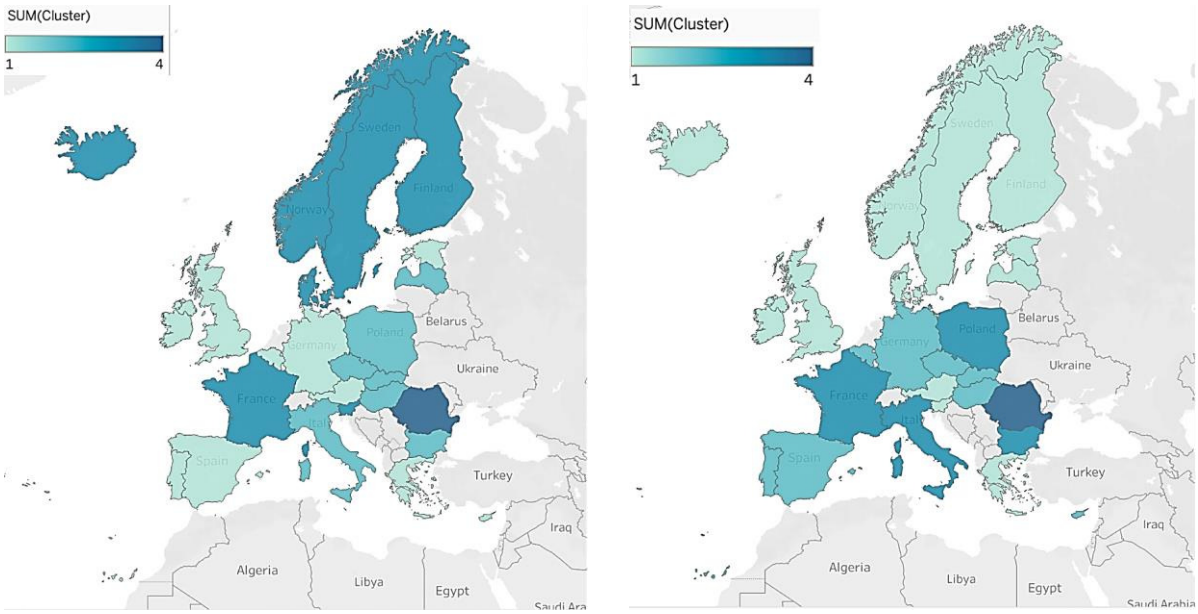
Table 12.
Statistic panel results

Variables	Coefficients	Std. Error	t-Statistic	Prob.
E-commerce sales	0.311	0.039	7.879	0.000***
Fixed broadband coverage	0.292	0.076	3.845	0.000***
Individuals using internet in case of relationship with public authorities	0.103	0.019	5.253	0.000***
Intercept	-10.945	6.065	-1.571	0.118
R^2	0.445			
F-statistic	60.430			
Prob. (F-statistic)	0.000			
Model applicability	Cross-section random			
No. of observations	230			

* 10% significance; ** 5% significance; *** 1% significance

Source: own study

Given that at the level of European countries, digitalizaton lead to a high education, the countries were clustered in this regard in 2013 and 2020 in order to identify if there are differences in those period of time. Thus, it resulted four clusters, both in 2013 and 2020 (Figure 3). The cluster 1 indicates the highest performance regarding digitalization and higher education and cluster 4 the lowest.



2013 2020

Figure 1. Resulted four clusters, both in 2013 and 2020.

Source: own study.

As it can be observed in Figure 3, In 2013 the four clusters are containing the following countries:

- cluster 1: Austria, Belgium, Cyprus, Estonia, Germany, Greece, Ireland, Lithuania, Luxembourg, Portugal, Spain, and UK,
- cluster 2: Bulgaria, Czechia, Hungary, Italy, Latvia, Malta, Poland, and Slovakia,
- cluster 3: Denmark, Finland, France, Iceland, Norway, Slovenia, Netherlands, and Sweden,
- cluster 4: Romania.

In 2020 the four clusters are presented as follows:

- cluster 1: Austria, Denmark, Estonia, Finland, Iceland, Latvia, Netherlands, Slovenia, Sweden,
- cluster 2: Belgium, Croatia, Cyprus, Czechia, Germany, Hungary, Ireland, Lithuania, Luxembourg, Malta, Portugal, Slovakia, Spain,
- cluster 3: Bulgaria, Italy, and Poland,
- cluster 4: Romania.

The clusters are different in 2020 comparing to 2013, confirming hypothesis 4.

Both, in 2013 and 2020 the cluster with lowest performance is comprising Romania. Cluster 1, the one registering the highest performance is containing, both in 2013 and 2020, Austria and Estonia. Instead, Belgium, Cyprus, Germany, Greece, Ireland, Lithuania, Luxembourg, Portugal, Spain, and UK were situated in cluster 1 in 2013, but in 2020 were situated in cluster 2, obtaining a lower performance compared to 2013. There are also different situations. For example, Denmark, Finland, Iceland, Slovenia, Netherlands, and Sweden were situated in cluster 3 in 2013, and in 2020 reached in cluster 1, improving their performance.

5. Conclusion

This study highlights the relationships between higher education and digitalization components in 31 European nations. In other words, this study shed light on multiple elements of innovation from several viewpoints that should be addressed in future higher education administration and development of digitalization capabilities and skills in academic profession. Higher education has a role in assisting a society that must adjust to digitalization and may be a beneficial addition to their productive high/hyper dynamic technology settings in the short, medium, and long term. First, the research demonstrates excellent levels of dependability with the Industry 4.0 dimensions through DESI calculation, as previously confirmed by studies (Caena, Redecker, 2019; Crawford et al., 2020; Grinberga Zalite, Zvirbule, 2020; Bullen et al., 2011).

However, in order to become a catalyst for change, higher education must also incorporate innovation into their future framework. Higher education will only be willing to work on digitalization competence if it perceives the framework as a beneficial guideline for professional innovation development. This has the potential to alter educational administration by promoting learning partnerships of innovation and digitalization inside and beyond educational environments. The manuscript aims to contribute to the academic world by evaluating the digitalization and differences in higher education institutions from 2013 to 2020. In doing so, the article includes 31 EU countries having similar education systems and international digitization processes. Furthermore, the study poses the following research question: *How to comprehend the discrepancies in higher education digitization among EU countries?* According to our research, the European countries evolved differently regarding digitalization and higher education across time. Especially, Austria, Belgium, Cyprus, Estonia, Germany, Greece, Ireland, Lithuania, Luxembourg, Portugal, Spain, and UK indicate the highest performance regarding digitalization and higher education. Crawford et al. (2020) (Caena, Redecker, 2019; Grinberga Zalite, Zvirbule, 2020; Bullen et al., 2011) and According to Márquez-Ramos (2021) digitalisation in higher education helps to bridge the divide between business and academia. Ronzhina et al. (2021) investigated digitalization of contemporary education and solutions to this gap, whereas Laufer et al. (2021) emphasized that leadership views are critical to closing this gap in digital higher education in EU member nations. Those researches support the current research hypothesis which prove that the European countries develop differently regarding digitalization and higher education across time.

Furthermore, the model verifies three hypotheses of the three research questions given in relation to the suggested sub dimension of digitalization. The first question is:

Does Use of Internet significantly influence higher education in EU countries?

It has been confirmed by encountered in DESI calculation that Use of Internet dimension that significantly influences higher education in current research. Therefore, the result is consistent with previous studies such as, Lynch et al. (2021) Billon et al. (2021) and Miranda et al. (2021) who claimed that Use of Internet dimension impacts higher education.

The second hypothesis question is:

Whether Integration of Digital Technology significantly influences higher education or not?

Other recent research demonstrating the importance of digital technology confirm this conclusion. Digital technologies fundamentally affect learning and teaching in higher education settings, and the rate of technological development creates challenge (Nikou, Aavakare, 2021). Students may continue to give information, knowledge, inspiration, and motivation by integrating high-quality education with digital technology (Bell, Jones, 2015). Higher education institutions should develop an integrated system that supports ongoing and high-quality interactive learning, taking into account technology developments and programming. Because this integration may allow higher education to broaden its instructional goals and achievements (Bozkurt et al., 2021). In conclusion, we think that the setting of higher education, the development of a set of abilities through the integration of digital technology that supports efficient and effective use of it is critical to educational achievement and lifelong learning.

According to the model's third hypothesis:

The more educators/managers promote Digital Public Services, the greater the development in digital competence in higher education.

In other words, we stated that Digital Public Services may have a direct positive influence on higher education; this discovery is in line with earlier findings from the current literature. Similarly, Kholiavko et al. (2021) demonstrated the need of recognizing the added value of using Digital Public Services from a pedagogical standpoint in order to boost effectiveness and motivation in higher education. It plays an increasingly essential function, position, and time period in the growth of each nation (Tri et al., 2021a). As a result, increasing awareness and refreshing higher education development ideas and training programs are necessary to rebuild higher education to meet labor market demands.

In light of our findings, the digitization of higher education, we established a method for measuring the extent of university integration, taking into consideration internet use, digital technology integration and public digital services and applied it to higher education learning and teaching systems. There are various advantages to digitalization in education. One of these advantages is smart learning and teaching technology. Both play an essential role in the modern university system's integration into the global educational services market. Universities should aim to build their own unique technologies that, under the impact of different risk factors, can provide a continuous learning process for students anywhere in the world in order to boost their competitiveness in global markets.

Such other researches our study has also some limitations and suggestions for future research. We believe that there are important opportunities to learn from the digitalization developments of other universities in order to strengthen our adaptation to technology and the future as a collective. We suggest new studies on these opportunities are dynamic variables and how agile managers can see them earlier and adapt them to higher education. We provide the digital process of thirty-one countries undertaken in our discussion and evaluate the innovation of higher education in relation to digitalization. But this is limited to EU countries. We recommend that future studies include other countries and test the model. However, it will also be necessary to analyze this model in perspective of developed countries in different cultures.

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CAPITAL STRUCTURE OF CHINESE FOOD COMPANIES AND THEIR MACROECONOMIC ENVIRONMENT

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Purpose: The aim of the article was to examine the level of debt value in companies pursuing international expansion.
Design/methodology/approach: The following methods were used in the article:1. Calculation of statistical descriptive values for debt level, revenue and total assets, 2. A parametric Student's t-test to test for differences in the capital structures of the companies studied, 3. The Pearson coefficient for determining the relationship between capital structure and the ratio of revenue generated from international sales to total sales revenue.
Findings: As a result of the study, hypothesis (H0: The level of total liabilities in companies in the food sector shows significant variation over time and between the companies studied in companies pursuing international expansion) was accepted. The results indicate that there is a large variation in the debt levels of individual Chinese companies. The large variation in the value of the debt level analyzed may also be due to the macro environment of the companies.
Originality/value: So far, the literature has pointed to a decrease or increase in debt levels in companies that are in the process of internationalization. This article presents the results of a study indicating a wide variation in the level of total liabilities in companies that are internationalizing, taking into account the reasons for this situation.

Keywords: capital structure, internationalization, total liabilities.

Category of the paper: Research paper.

1. Introduction

The modern world economy is dominated by large countries, with strong economies, whose activities are global and influence the economies of other countries. Such countries include China, which as recently as 10 years ago was regarded as a location for foreign direct investment and is now an investor that is playing an increasingly important role as an 'exporter' of foreign investment. The increasing internationalization of Chinese companies is likely to have an impact on changes in the capital structure of these companies and, consequently, on the financial strategy chosen by companies. One of the key sectors in the Chinese economy

is the food sector. Therefore, this sector was chosen as the subject of this study, as it is a good representative of the Chinese economy as a whole. The purpose of this article is to answer the following research question:

1. Does the internationalization of Chinese food enterprises have a significant impact on changes in the capital structure of enterprises operating in this sector with all the effects that this entails?

Thus, the research hypothesis is accepted that the internationalization of Chinese food enterprises has an impact on changes in their capital structure. The next research question is:

2. Is the development direction of the Chinese economy conducive to the internationalization processes of enterprises in the food industry?

The research was based on original statistical material, not used in other publications - configured in the author's own way. Thus, the idea is to investigate, on the basis of a representative sample of 135 Chinese food industry enterprises with internationalization processes, whether significant changes in capital structure associated with these processes occurred between 2014 and 2021, and whether these transformations were influenced by changes occurring in the Chinese economy as a whole (determined by the formation of macroeconomic quantities).

2. Internationalization and the transformation of the capital structure of companies

The internationalization of enterprises is one of the fundamental problems associated with the globalization of the world economy. This process can take capital and non-capital forms. Non-capital forms of internationalization include:

- export sales (direct and indirect exports),
- license sales abroad,
- franchising,
- creation of a sales representative office in the host country.

On the other hand, capital forms include:

- creation of a joint venture,
- creation of a branch or subsidiary abroad,
- creation of a fully international company.

Researchers are most interested in capital-based forms of expansion, i.e. foreign direct investment, as the involvement of one's own capital abroad is a greater guarantee of stabilization for a company that is internationalizing its activities and brings very tangible benefits to the country that hosts the foreign investor (the host country). Companies that internationalize their

activities generally make changes to their financial strategy and therefore also make changes to their capital structure.

Many publications confirm the correlation between the quality of the state and the internationalization opportunities of companies. For example (Dobrowolska et al., 2021) out research in all EU member states. The inflow of foreign direct investment into these countries was positively correlated with the quality of the institutions in a given country, which translated into the investment attractiveness of the host country. The authors showed unequivocally that the poor quality of state functioning is a barrier to the inflow of foreign direct investment. Among the countries surveyed, the undisputed leader in terms of the quality of state performance is Finland. A good rating was given to all Scandinavian and Benelux countries, Austria, France, Germany, Estonia. The weaker group consists of Croatia, Poland, Bulgaria, Italy, Greece and Portugal.

From the point of view of the topic of this article, it is therefore necessary to determine to what extent the efficiency of the Chinese government and its institutions positively affects the internationalization processes of Chinese companies.

This is all the more important as there is a certain re-evaluation in the global economy in terms of investments flowing into certain countries (or rather blocks of countries), but also outflowing from the countries concerned. And here, after a sudden increase in foreign investment by EU countries in 2015, there has been a marked decline since then, while Asian countries (including China), have been recording a steady, not very high, but systematic increase. Thus, the European Union is losing its leading position to the Asian countries, as discussed in an extensive study by (Witkowska, 2021) .

Kita (2017) draws attention to the increasing role of China in the agri-food sector. On the one hand, the demand for agri-food products in China is increasing, and on the other hand, despite the decreasing number of employees in this sector in China (from 50% of the total number of employees in China at the beginning of the 21st century, to 30% in 2016), China remains one of the most important food producers in the world (after the European Union and the United States). Kita K. predicts that exports of all basic commodity groups, with the exception of meat and meat products, will gradually increase, due to the competitiveness of these products (lower labour costs and, at times, an annuity of location).

In this context, the agri-food sector in China is a good sphere for scientific research on the relationship between internationalization and capital structure.

And it is Chinese scholars who highlight the resulting economies of scale and internationalization of Chinese enterprises (using the construction sector as an example), which translates into cost reductions and, of course, generates changes in capital structure .

Studies of the interrelationship between internationalization and capital structure by Asian scholars have a tradition. For example, (Lee, Kwok, 1998) conducted a study in 1998 on a sample of 834 US companies, which showed that multinational corporations had lower levels of debt than companies operating only domestically. The cautiousness of multinational

corporations in raising foreign capital may be due to the fact that operating internationally, firms are more exposed to political and exchange rate risks than firms operating domestically .

Chen, Yu (2011) conducted a study in 2011 in 566 Taiwanese companies . They found a positive relationship between internationalization and debt, but only for multinational companies operating in emerging markets. It also found that Taiwanese companies have a higher share of foreign capital in total financing than the same companies operating in developed market economies. It also all depends on the company's phase of internationalization, as companies in the initial stages of the internationalization process (exports) had lower levels of debt than those companies that opted for foreign direct investment.

There may also be differences depending on whether long-term or short-term debt is involved. (Singh, Neyadmalayeri, 2004) using the example of 360 multinational corporations, showed that these companies showed a positive correlation between total and long-term debt ratios and internationalization - whereas no such correlation occurred for short-term debt.

Thus, there is quite a bit of variation in the assessment of the interrelationship between the internationalization of companies and their capital structure. The relationship may develop differently in different countries. It is not only the phase of the internationalization process that is relevant here, but also the type of financing the companies are dealing with (long-term, short-term), as well as how the macroeconomic factors in the country in question affect not only the propensity to internationalize (or lack thereof), but also the willingness of companies to raise foreign capital in their development processes.

Against this background, it is worth analyzing these relationships, in the agri-food sector of a leading country, both from the point of view of its potential and the speed of its economic development, in China.

3. Materials and methods

The In the research sample included 135 companies. A random selection of representatives of companies in the food sector was used. Each of the companies that took part in the study was based in China, at the same time the assumption of the study, which was met in all cases, that all companies exported their products on international markets. Financial data was sourced from Emis and Thomson Reuters. The study period covered the years 2014-2021. The statistical analysis of the database thus collected was preceded by the collection of the following financial information for the companies in the study group. The financial data presented below allowed data to be collected for the relevant parametric tests to be carried out in stage two.

The following financial data were collected in the subsequent stages of the study:

1. Revenue level.
2. Level of international sales.

3. Level of equity capital.
4. Level of external capital.
5. Balance sheet total.
6. Selected values of macroeconomic indicators for 2014 and 2021.

The methods for verifying the research hypothesis were based on the calculation of parametric static tests. In order to structure the research procedure, the following steps were applied related to performing the relevant calculations in the statistical software:

1. Calculation of statistical descriptive values for debt level, revenue and total assets.
2. A parametric Student's t-test to test for differences in the capital structures of the companies studied.
3. The Pearson coefficient for determining the relationship between capital structure and the ratio of revenue generated from international sales to total sales revenue.

The final stage of the study was to collect information on selected macroeconomic indicators for the country.

4. Background of analysis

According to the World Bank, by the end of 2021. China was the second largest economy in the world, second only to the United States. Their economy was known for its rapid growth rate, large domestic market, growing middle class and significant investment in infrastructure and technology. One of the most important sectors in China is the food sector, if only because in 2022 the food sector was responsible for supplying food to 18% of the world's population (report, China, food sector). The goal of the food sector in China is, among other things, rural revitalization and optimal agricultural support policies.

China's 2060 carbon neutrality target has set new requirements for food sector support policies. Changing food sector support policies to promote and apply green and low-carbon technologies can bring mutual benefits in terms of food security and GHG emission reduction. It can also bring high economic returns and environmental benefits (report, China, food sector). In this way, the macroeconomic environment influences Chinese companies operating in the food sector placing them in a high position in terms of competitiveness and opportunities for their growth in international markets.

In view of the above, it was decided to examine whether food companies based in China and operating in international markets manage and depend on their expansion, the level of debt in their capital structure. Based on an analysis of the literature on the subject and the importance of the food sector in the Chinese economy, a hypothesis was formulated:

H0: The level of total liabilities in companies in the food sector shows significant variation over time and between the companies studied in companies pursuing international expansion.

Therefore, it was decided to carry out an empirical study to verify the research hypothesis set.

5. Research results

The empirical study of Chinese companies in the food sector included an analysis of debt levels for companies exporting their products in the food sector, which was presented in the context of the financial situation of the sector itself, taking into account revenue levels, total assets, and an analysis of differences in debt levels for individual companies. In the first stage, data of selected macroeconomic indicators for China were collected, taking into account the beginning of the analyzed period (2014) and the end (2021).

Table 1.
Macroeconomic data for China in 2014 and 2021

Years	GDP per capita	Exports (billion USD)	FDI (billion USD)	Taxes companies stock	Average interest rate working capital loans	Inflation
2014	7,589	2,344	119,6	25%	6,39%	2,01%
2021	16,304	2,759	149,3	25%	4,35%	0,78%

Source: Own research based on World Bank data.

We can see that China's economy grew significantly between 2014 and 2021. GDP has doubled, which means that China's economy has become more developed and profitable. Exports have also increased, suggesting growing international trade activity. Foreign direct investment (FDI) also increased, which may indicate foreign investors' interest in the Chinese market. Company tax remained at 25% in both years, which may be an important factor for companies operating in China. The average interest rate on working capital loans fell from 6.39% in 2014 to 4.35% in 2021, which may help companies to access financing and reduce debt servicing costs. Inflation has fallen significantly from 2.01% in 2014 to 0.78% in 2021. It is worth noting that these figures provide an overall picture of China's economic situation, but do not take into account other factors that may affect the economy, such as government policies, demographic changes or global economic events.

In step two, an analysis of the debt levels of individual food companies in China was carried out, taking into account changes in the value of the debt ratio over time. Due to the lack of all available financial data, the sum of observations in each year changes from year to year (90 observations in 2014, up to 127 observations in 2021).

Table 2.
Debt level analysis for companies in the food sector

	2015/14	2016/15	2017/16	2018/17	2019/18	2020/19	2021/20
increase	47	51	55	59	59	77	65
decrease	43	43	41	44	57	47	62
total	90	94	96	103	116	124	127
% share	53%	54%	57%	57%	51%	62%	51%
% share	57%	46%	43%	43%	49%	38%	49%

Source: Own research.

Until 2019, the increase in debt in the observed companies remained between 51% and 57% of all observations for companies that reported an increase in debt in their financial reports between 2014 and 2019. The decrease in debt between 2014 and 2019 was observed between 57% (2015) and 42% (2019) of all observations analyzed. On this basis, it can therefore be concluded that by 2019, the majority of the selected companies were systematically increasing their debt levels. The number of observed increases and decreases in debt in the studied collective was similar during the period under study. The exception is 2020, where 62% of all observed companies recorded an increase in the level of their debt in relation to 2019.

The second stage of the study examined how the level of indebtedness evolves in the studied population. Quartiles were used to describe this.

Table 3.
Statistical measures for the debt levels of the companies

	2014	2015	2016	2017	2018	2019	2020	2021
Q1	148523,77	189854,6	219833,4	162757,1	182166,8	162306	192816	283251,9
Q2	396657,78	480965,8	511912,3	357773,6	400796,3	373788,7	431164,1	706630,5
Q3	1236163,56	1343647	1314681	1179528	1266969	1421534	1518676	1972147

Source: Own compilation based on financial statements.

On the basis of the collected data, it is not possible to unambiguously show a trend in the area of debt levels in the analyzed companies for the years 2014-2021. At the same time, it can be seen that the greatest differences can be seen over the analyzed years for Q1 (quartile 1) and Q2 (quartile2). This means that almost half of the observed entities had debts ranging from PLN 357,773.6 thousand to PLN 706,630.5 thousand in the analyzed period.

In the third stage, information on the revenues of companies from the food sector was collected.

Table 4.
Statistical measures for revenue levels of the companies surveyed in China

	2014	2015	2016	2017	2018	2019	2020	2021
Q1	403434,5325	426318,7	475428,2	483444,3	418453,9	473400,1	478540,6	648907,3
Q2	775272,22	987927,6	1030451	859118,4	941248,2	991360,5	1119680	1233698
Q3	1174952,05	1599038	1834684	2046397	2338050	2473023	2200728	2671576

Source: Own compilation based on financial statements.

On the basis of the collected data, it is not possible to unambiguously show a trend in the area of the level of revenue in the analyzed companies for the years 2014 - 2021. The highest level of revenue was achieved by the analyzed companies in 2021, which accounts for 25% of all the companies under study (the grouping comprised 135), which achieved revenue less than or equal to the value of - PLN 648,907.3 thousand. Although it is not possible to unambiguously show a trend in any of the values of the quartiles presented, it should be noted that the changes in the values of the quartiles are maintained at a similar level during the period under study. Therefore, the food sector in China should be considered as a stable market. Minor changes in values that appear during the analyzed period may be due to changes in the macroeconomic condition of the analyzed economy (Table 1).

In the fourth stage, information on the balance sheet total was collected.

Table 5.
Statistical measures for the level of total assets

	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Q1	633117,5	875527,2	836447,1	639468	628022,9	667583,6	860886,6	1106622
Q2	1051206	1340328	1465645	1290216	1359704	1398826	1623235	2120963
Q3	2424442	2730306	3114118	2703944	2936991	2919504	3549683	4266173

Source: Own compilation based on financial statements.

The year 2021 should be considered in the surveyed collective as a development year compared to the others. The values of the individual quartiles increased significantly:

- Q1 - PLN 1,106,622 thousand - means that 25% of the entire audited collective reported such a value of the balance sheet total in their financial statements.
- Q2 - PLN 2,120,963 thousand - means that 50% of the entire audited population reported such a value of the balance sheet total in their financial statements.
- Q3 - PLN 4,266,173 thousand - means that 75% of the entire audited community reported such a value of the balance sheet total in their financial statements.

2021 is by far the best year in terms of total balance sheet results achieved by Chinese companies. Stage five examined statistically significant differences in the area of debt for individual companies.

Table 6.
Student's t-test for analysis of debt levels of companies in China

T- student tests	H0 rejection tests	Tests that do not reject H0
Total	2638	1594

Source: Own research.

The table shows the pooled result for all the implemented t-student tests. A total of 4232 tests were performed to assess differences in debt values for individual food companies. The vast majority of the tests performed (2638) indicated the need to reject the hypothesis H0.

Table 7.
Pearson correlation for international sales and capital structure in China

Pearson tests	H0 rejection tests	Tests that do not reject H0
Total	8	188

Source: Own research.

The table shows the aggregate result for all the Pearson correlation tests carried out. A total of 196 tests were performed to investigate the existence of a relationship between capital structure and the international sales ratio. The results indicate the existence of a relationship between capital structure and the international sales ratio.

6. Conclusions

The significant variation in the conditions in which Chinese companies operate results in a different response manifested in the direction in which debt levels are moving (increasing or decreasing), differentiating the results according to the situation in which the companies under study (environment) find themselves. It is not possible to conclude unequivocally that the entire studied set of Chinese food companies are increasing or decreasing their debt levels. With such a diverse level of indebtedness of Chinese food companies, it is also important to note that in the literature one can find conclusions about a decrease or increase in the level of indebtedness of companies pursuing international expansion.

From a research perspective, attention should be paid to the macro environment in which Chinese companies operate. The macro-environment in China is stimulating growth both domestically and in international markets (Table 1).

On the basis of the research carried out in this article, the research hypothesis should be adopted

H0: The level of total liabilities in food companies shows significant variation over time and between the companies under study in companies with international expansion.

The basis for the adoption of hypothesis H0 was:

1. Analyzing the level of indebtedness (Table 2) and indicating the existence of two groups of Chinese food companies: where group one is companies for which the values of this indebtedness were increasing, group two is companies for which the level of indebtedness was decreasing in the studied period 2014-2021.
2. To indicate statistically significant differences in the area of debt levels for the Chinese companies studied (Table 6).
3. Confirming the existence of a correlation between the level of debt and the international activity of companies in the food sector (Table 7).

The limitation of not including some factors that may have increased or decreased the indebtedness of Chinese food companies in the process of their internationalization was accepted, which can be considered as a certain weakness of the study. However, showing all factors would have required a multidimensional analysis, typical of monographic studies. Given China's growing role in the global economy, the analysis of its individual sectors is important for recognizing its strength and competitiveness, and deepening this research in the future is much needed for other companies operating in specific sectors in the global market. It is also important for banks and other financial institutions to get an idea of how the demand for foreign capital may develop in companies in, for example, the food industry in China. The presentation of macroeconomic data shaping the Chinese economy, gives information on the hypothetical impact of macroeconomic factors on the financial decisions of these companies. The results of previous research conducted in this area, presented in the theoretical part, confirm the results of the author's own research as to the different-directionality of the research outcome depending on a number of influencing factors.

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RISE OF INFLATION AND PUBLIC DEBT IN EU COUNTRIES IN 2020-2021 IN CONTEXT OF PUBLIC FINANCE SECURITY

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Purpose: The pandemic of Covid-19 virus between 2020 and 2021, brought about limitations in proper functioning of economies not seen until that moment. These constraints were accompanied by a radical increase in public spending that was supposed to be financing measures shielding various industries and sectors, which were forced to put their activity on pause. The purpose of this article is to thoroughly analyze the impact of the Covid-19 pandemic on the stability of public finance in the face of increasing government spending as well as multiple pro-inflationary factors.
Design/methodology/approach: Sound public finance is one of the most crucial challenges for the economic policy system of every country no matter the level of the liberalization of their economies. This stability is commonly regarded as the indicator of a country's financial credibility which directly affects the capital markets. It translates into confidence or lack thereof in financial securities. Fading public trust in the economy of a country calls for raising interest rates which consequently increases the cost of public debt management. The methodology used in the publication is based on the analysis statistical sources and literature reports relating to the stability of public finances of UE countries during the pandemic of Covid-19.
Findings: Undoubtedly, the most important cognitive values included in the paper are the problem of the resilience of national public finances to external shocks and their ability to stabilise them in the long term.
Practical implications, originality and value: There is no doubt that the last few years have brought some of the greatest challenges in the history of the modern world economy, such as the Covid-19 pandemic and the ongoing war in Ukraine. Both of these factors have caused lasting damage to public finances and require new, creative measures to ensure stability and national security. These topics are undoubtedly very important from an economic and scientific point of view and should be the subject of further in-depth research.

Keywords: Public finances, inflation, public debt, stability of public finances.

1. Introduction

The Covid19 pandemic has not only killed more than 7 million people worldwide and hit the foundations of the global economy, but has also significantly ruined public finances in many countries. A number of studies are available in the literature on the impact of the pandemic on public finances and price stability, but a more detailed analysis of the pandemic for EU countries is fully justified and certainly fills a research gap. An objective scientific analysis, such as that contained in this publication, is also of practical importance, particularly in the context of future prevention and stabilization measures, in the context of new global threats such as wars or supply shocks.

The outbreak of the Covid-19 pandemic disrupted a period of gradual reduction of public debt to GDP ratio that began in 2014 in countries belonging to the EU. The pandemic has also had a detrimental impact on other macroeconomic indicators. The crisis has brought unprecedented challenges to the global economy, forcing individual countries to look for completely new solutions and non-standard measures to maintain the continuity of economies and minimize their losses. Declining economic growth, a drastic deterioration in public finances, deepening current account deficits, rising unemployment and declining value of foreign trade are just some of the many problems faced by the governments around the world. To this must be added the reduction or even total cessation of economic activity in many sectors of economies, the lack of freedom of movement between countries and a significant decline in demand for certain goods and services, such as tourism, the organization of mass events and air passenger transport. This was undoubtedly an unprecedented event in the history of the world economy.

The main objective of the article is to analyse the dynamics of changes in key macroeconomic indicators related to the stability of public finances and the level of long-term interest rates. These indicators, on the one hand, belong to the so-called convergence criteria that every country joining the euro area must meet, and on the other hand they are a measure of the security limit of a country's economic policy (Caselli, Wingender, 2021). Another research problem addressed in the paper is an attempt to answer the question to what extent the measures taken had a positive impact on limiting adverse economic shocks caused by the aforementioned pandemic factors. These considerations are presented in three main points of work, including macro and microeconomic effects of the Covid-19 pandemic in EU countries, rise of public debt and inflation and their consequences on stability of public finances and conclusions and discussion presented in the summary.

Aiming to present the objective situation of the economies of the European Union countries under the conditions of the Covid-19 pandemic, the article uses a scientific methodology including statistical analysis, descriptive comparisons of macroeconomic indicators and a presentation of internal and external factors that are the direct cause of the described economic

shocks. Key macroeconomic indicators, such as public debt, inflation and long-term interest rates, were used as the benchmark, which, as mentioned earlier, are also the so-called convergence criteria. It is these indicators that are seen in the literature as key measures that guarantee an objective assessment of the state of the economy, including the security of public finances. Inflation is a measure of price stability, public debt and the related budget deficit are criteria for the stability of fiscal policy, while long-term interest rates are credibility and confidence in a given country's economy in the long run. That is why these indicators can be considered the most critical in assessing the impact of the coronavirus Covid-19 pandemic on the stability of the global economies.

2. Literature review and methodology

The literature sources used in the article mainly include official Eurostat data and other international reports. These sources make it possible to analyze changes in fundamental macroeconomic indicators, as well as to present their implications for the economy and, to a limited extent, forecast future scenarios. For instance, papers such as: "Impacts of the COVID-19 pandemic on EU industries", "How COVID-19 is changing the world: a statistical perspective Volume II"[1] or websites such as: https://ec.europa.eu/eurostat/web/covid-19/data, https://www.undp.org/coronavirus/socio-economic-impact-covid-19 were used amongst others. Of course, information on the economic consequences of the pandemic can also be found in scientific publications, such as: "The research on COVID-19 and economy from 2019 to 2020: analysis from the perspective of bibliometrics" (Liu et al., 2021), "Economic And Social Impacts Of COVID 19 On National Economies From The Point Of View Of Economic Theory" (Nový, Jarý, 2020), "Firm internationalization and long-term impact of the Covid-19 pandemic" (Nagarajan, Sharma, 2020), "COVID-19 Pandemic Impact on the Exports and Imports" (Belu, 2021). There are also scientific publications that directly address the issues of food security, the quality of social standards and the threat of hunger. an example of such publication may be an article "Impacts of Covid-19 on global poverty, food security, and diets. Insights from global model scenario analysis", in which the authors refer to the following topics: 1) income losses and demand shocks, 2) food chain disruptions, 3) consumer responses such as hoarding, food waste and dietary shifts, 4) policy responses, hoarding at country level (food export bans) and fiscal stimulus (Laborde, 2020).

The statistical and scientific sources mentioned above allow to objectively assess the research problems discussed and to evaluate the formulated research hypothesis. The main hypothesis states that "Covid-19 pandemic not only affected the social and economic activity

[1] https://unstats.un.org › covid19-report-ccsa_vol2

of companies, but also had a significant impact on the state of public finances of individual countries." The added value of this article is an attempt to analyse the resilience of EU countries to strong external factors and destabilising public expenditure.

3. Macro and microeconomic effects of the Covid-19 pandemic in EU countries

Only a few industries and sectors have not been affected by the restrictions caused by the Covid-19 pandemic in all countries of the world. In order to prevent the spread of the epidemic, the public authorities were forced to impose a series of restrictions, limiting or even temporarily freezing the activities of certain areas of economic and social life. Many sectors of the economy have suffered as a result of the pandemic restrictions, but the biggest losses have been in public transport, gastronomy, tourism and hospitality, and the entertainment industries. As a result, measures were needed to limit the effects of the so-called lockdown, i.e. supporting sectors of the economy at risk of bankruptcy. In order to prevent a sharp rise in unemployment and a decline in individual incomes, as well as to minimize the number of failing companies, the authorities and their subordinate institutions and other agencies decided to undertake a number of relief and protection measures which included, among others:

- suspension and, in some cases, temporary tax exemptions,
- co-financing of employees' salaries,
- temporary exemption from paying social security contributions and selected taxes,
- non-refundable loans for companies,
- parking benefits for persons performing civil law contracts.

The fight against the pandemic has become a priority in most countries of the world, including the countries of the European Union. Counteracting its effects included, above all, the struggle with the economic crisis, which occurred immediately with the outbreak of the pandemic. Among the most important actions taken by the European Union as a whole are: 1) launching economic support and social protection programmes; 2) coordinating the restrictions on population movements; 3) limiting the spread of the Covid-19 virus by using different methods of prevention; 4) introduction of universal vaccination, 5) financial and organisational support for health systems, 6) job protection, 7) direct financial support for national budgets, 8) improving solidarity between member countries to combat the effects of the pandemic more effectively, 9) strong economic support for essential industries such as food production, 10) global cooperation to combat the effects of the pandemic[2].

[2] https://www.consilium.europa.eu/en/policies/coronavirus/10-things-against-covid-19/

These objectives and programmes were accompanied by the appropriate financial measures and the budget for 2021-2027 amounted to €1824.3 billion[3]. In addition to the launch of Community programmes, national governments have also taken individual, often non-standard, action to protect businesses and individuals from the effects of job and income losses. For example, Germany has focused its programmes on ensuring stable and sustainable economic growth, with a focus on strengthening the weakest sectors, reforming the weakest parts of logistics chains, and intensifying the digital transformation[4]. The French plan focused on both reforms and investments aimed, as in the case of Germany, at strengthening the drivers of sustainable development including, in particular, strengthening the health system, reforming higher education and accelerating the digital transformation[5].

Apart from the described examples of national plans for the recovery of economies following the shock of the Covid-19 pandemic, it should be stressed that all EU countries have implemented programmes aimed at improving the economic and social situation. National Recovery Plans have also been drawn up at Community level, which have been individually tailored to the needs of individual countries. Together with the NextGeneration EU (NGEU), the temporary recovery facility, these plans constitute the largest ever financial recovery package in the European Union[6]. A total of €1 trillion has been earmarked for actions under these plans to improve the resilience of economies to internal and external economic shocks, digital transformation and the environment. In addition, the above-mentioned Next Generation EU programme was described as a turning point for Europe, encompassing sustainable mobility, digital transformation, increasing R&D spending, creating new and innovative economic sectors, improving the quality of social services, upholding the rule of law, fighting corruption, supporting small and medium-sized businesses and a range of other actions aimed at increasing the global competitiveness of EU countries[7].

[3] https://www.consilium.europa.eu/en/infographics/recovery-plan-mff-2021-2027/
[4] https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility/germanys-recovery-and-resilience-plan_en
[5] https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility/frances-recovery-and-resilience-plan_en
[6] https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility/frances-recovery-and-resilience-plan_en
[7] https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/thematic_analysis.html?lang=en

Table 1.
Growth dynamics in EU countries in 2019-2021

Country	2019	2020	2021
Austria	1,5	-6,5	4,9
Belgium	2,2	-5,4	61
Bulgaria	4,0	-4,0	7,6
Croatia	3,4	-8,6	13,1
Cyprus	5,5	-4,4	6,6
Czechia	3	-5,5	3,5
Denmark	1,5	-2,0	4,9
Estonia	3,7	-0,6	8
Finland	1,2	-2,2	3
France	1,8	-7,8	6,8
Greece	1,9	-9,0	8,4
Spain	2,0	-11,3	5,5
Netherlands	2,0	-3,9	4,9
Ireland	5,4	6,2	13,6
Lithuania	4,6	0,0	6,0
Luxembourg	2,3	-0,8	5,1
Latvia	2,6	-2,2	4,1
Malta	5,9	-8,3	7,1
Denmark	1,1	-3,7	2,6
Poland	4,4	-2	6,8
Portugal	2,7	-8,3	5,5
Romenia	3,9	-3,7	5,1
Slovakia	2,5	-3,4	8,2
Slovenia	3,5	-4,3	8,2
Sweden	2,0	-2,2	5,1
Hungary	4,9	-4,5	7,1
Italy	0,5	-9	6,7

Source: Own elaboration based on: https://ec.europa.eu/eurostat/web/hicp/data/database, 19.01.2023.

The negative effects of these restrictions have been sensed by all EU countries, as it is shown very clearly in Table 1. Negative growth rates in 2020 can be seen year-on-year in practically all the countries of the Community. In extreme cases, these values are below or close to -10%, as was the case for Spain -11,3%, Greece and Italy -9,0%, Croatia -8,6 and Malta -8,3. Analysis of the data of the following year, i.e. 2021, shows a strong reversal of declines and a return to the path of positive values of the rate of economic growth. In this context, one might venture to argue that, despite the clearly destructive impact of pandemic factors on the functioning of economies, the introduced protection schemes have to a large extent proved to be effective in shielding entrepreneurs and jobs. However, there has been a marked deterioration in the condition of public finances and an increase in inflation, which has undoubtedly had a very negative impact on the condition of the European Community as a whole.

4. Rise of public debt and inflation in EU countries during the Covid-19 pandemic

The reference point for the macroeconomic situation with regard to public debt, inflation and long-term interest rates is the base year 2019, when neither the impact of the pandemic nor the hedging programmes in place were yet visible. The research problem raised in the paper concerns the change in the values of the aforementioned indicators in two consecutive years, i.e. 2020-2021, when the governments of all EU countries had to face the problem of slowing down or even halting the activity of many industries and sectors.

Figure 1 shows that as many as 15 of the 27 EU Member States have exceeded the fiscal criterion of the Stability and Growth Pact, seven of which have exceeded 100% of GDP. In the first three places in this respect were Greece, which reached a debt level of 206,3% at the end of 2021, Italy (150,8%) and Portugal (127,4). According to the Eurostat data, public debt in Poland amounted to 53. 8%. This figure was close to that of the Netherlands (52%) and Slovakia (63,1%). The lowest results are indicated for Estonia (18. 1%) and Bulgaria (25,1%). This was very similar in 2020, when 15 Member States experienced an increase in their debt-to-GDP ratios and 12 a decline. The largest increase was observed in Spain (+7,8 percentage points), Hungary (+6,5 percentage points), Malta (+5,7 percentage points), Austria (+5,6 percentage points) and Romania (+5,5 percentage points). Among the countries with the most considerable decline, Cyprus (-6,4 percentage points), Ireland (-3,6 percentage points), the Netherlands (-2,5 percentage points), Denmark (-2,4 percentage points), Croatia (-2,3 percentage points) and Sweden (-2,2 percentage points).

To sum up the issue of public debt, it should be emphasized that the pandemic has undoubtedly led to an increase in the debt ratio in all EU countries. We can also hypothesize that the increase in public debt, which is a consequence of the protective measures taken, was also the cause of the increase in inflation in the analysed years 2020-21.

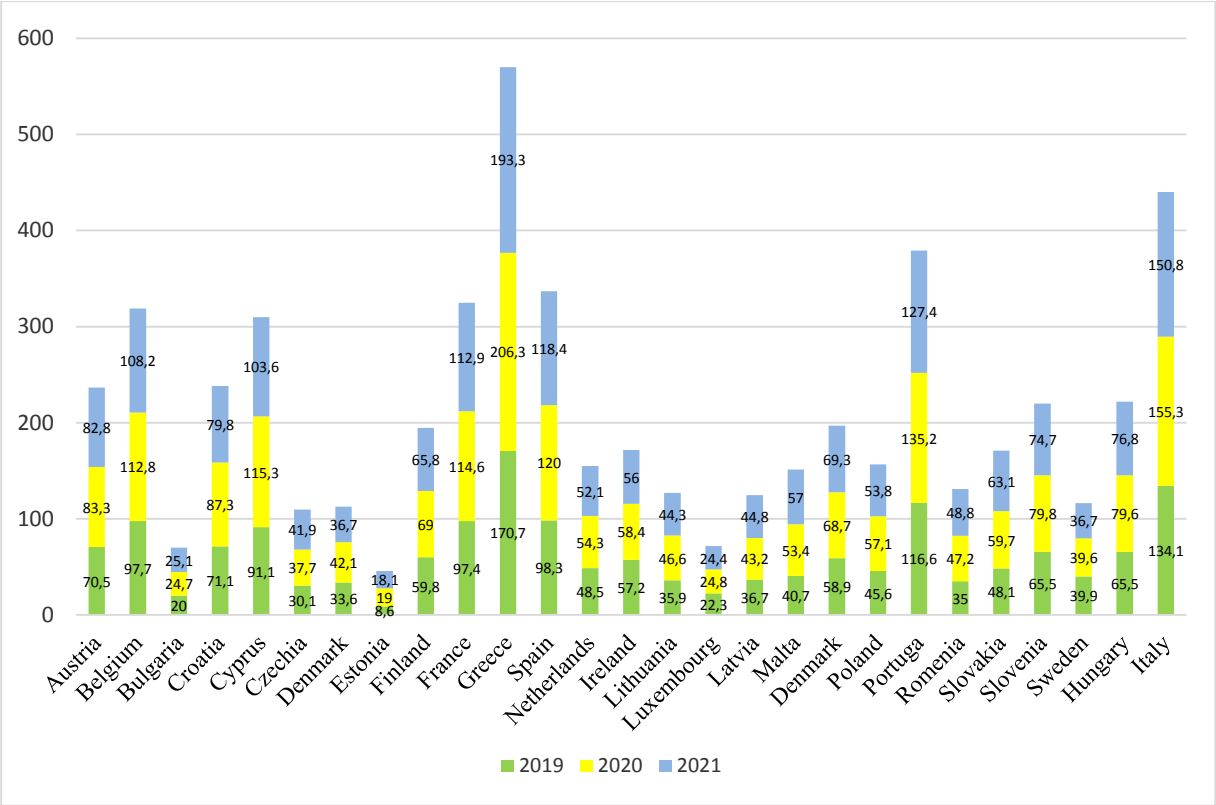

Figure 1. Public debt in the European Union in 2019-2021.

Source: own elaboration based on https://ec.europa.eu/eurostat/web/hicp/data/database, 20.01.2023.

Figure 2 shows that all the EU countries have experienced very high inflation over the last three years. Among the leading countries are Hungary (9,6%), Poland (5,2%) Latvia and Estonia with inflation rates of 4,5%. The lowest rate can be observed in countries such as Greece (0,6%), Finland and Portugal remaining at 0. 9%. The main factors responsible for such a sharp rise in inflation are, above all, increases in energy and food prices, which accelerated sharply in 2021. If we look at the criterion of price stability, only Croatia and Sweden had inflation rates below or well below the reference value of 4,9%. The reference value is based on the average inflation rates of the three best performing countries over the last 12 months (excluding atypical observations: Malta and Portugal): Finland, France and Greece. In the other five countries under review – Bulgaria, the Czech Republic, Hungary, Poland and Romania – inflation rates have been well above the reference value over the past 12 months, as in the case of the 2020 Convergence Report (Convergence Report, 2020).

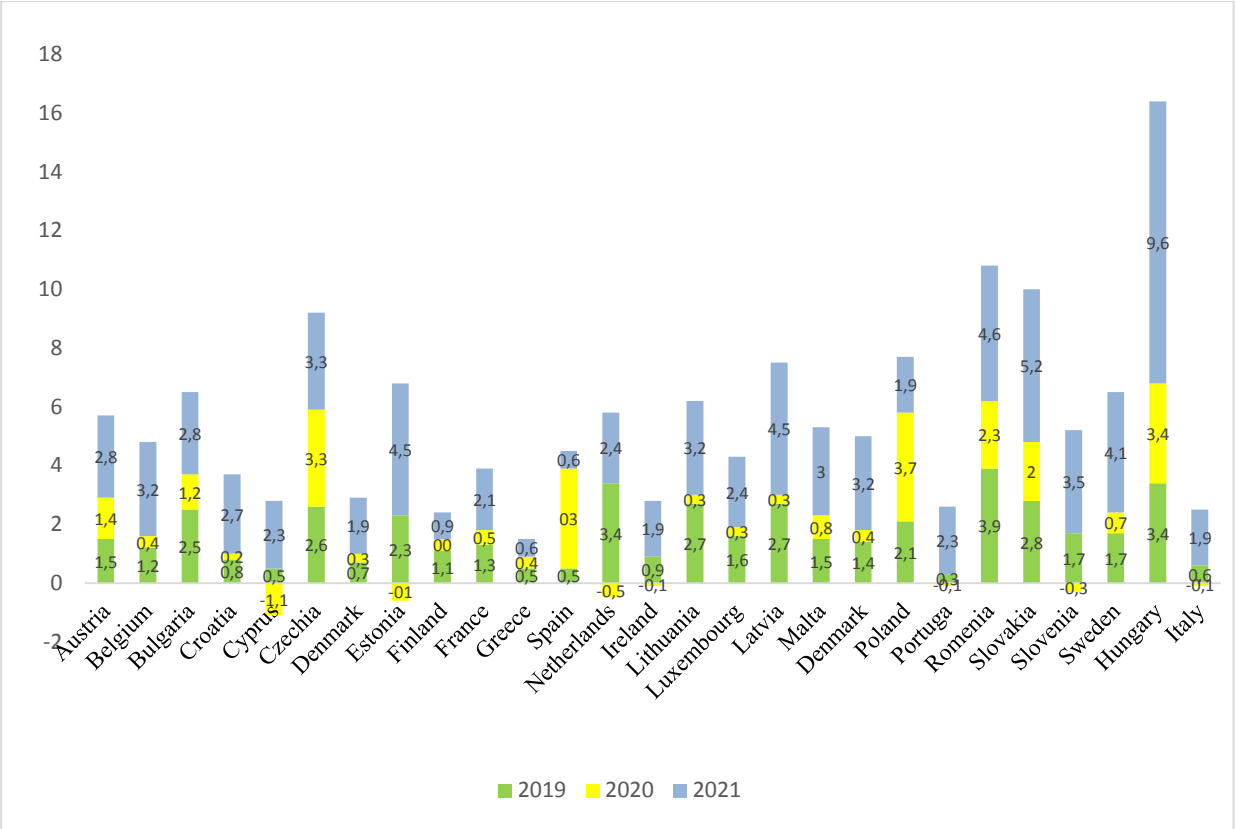

Figure 2. Inflation rates in the European Union in 2019-2021.

Source: own elaboration based on: https://ec.europa.eu/eurostat/web/hicp/data/database, 20.01.2023.

This information is also corroborated by the aggregate analyses contained in Table 3, where it is clearly showed that, while in 2020 price increases were not a significant problem in EU countries, in 2021 as many as 9 out of 27 countries reported inflation increases of more than 5%. This inflationary trend therefore seems to be the result of numerous financial support schemes for businesses, often implemented at the expense of an increase in public debt. This thesis is confirmed by the data from the next table, 4 which clearly shows the increase in the number of countries exceeding the 60% threshold of fiscal security in the period 2019-2021 (Malinowska-Misiąg, 2019).

Table 2.
Inflation growth dynamics 2019-2021 in EU countries

Year	**Max. 3%**	**3-5%**	**Above 5%**
2019	15	4	0
2020	24	3	0
2021	12	6	9

Source: own elaboration based on https://ec.europa.eu/eurostat/web/hicp/data/database, 22.01.2023.

Table 3.
Public debt to GDP in EU countries in 2019, 2020, 2021

2019		**2020**		**2021**	
Up to 60%	Above 60%	Up to 60%	Above 60%	Up to 60%	Above 60%
16	11	14	13	13	14

Source: own elaboration based on: https://ec.europa.eu/eurostat/web/hicp/data/database, 22.01.2023.

With regard to the long-term interest rates, the 12-month average interest rate was lowest in Bulgaria, Croatia and Sweden. The rate recorded in the Czech Republic, of 2.5%, was just below the reference value of 2.6%. In two of the countries examined, Hungary and Poland, the 12-month average long-term interest rate was above the reference value and in Romania it was significantly above the reference value. Detailed analysis of the dynamics of changes in the value of long-term interest rates between 2019 and 2021, shows that the pandemic did not visibly translate into their increase, and thus into the credibility of the debt securities issued. Generally speaking, EU countries, with a few exceptions, such as Romania, have maintained a high level of credibility on the international financial markets (Skrabacz, 2021).

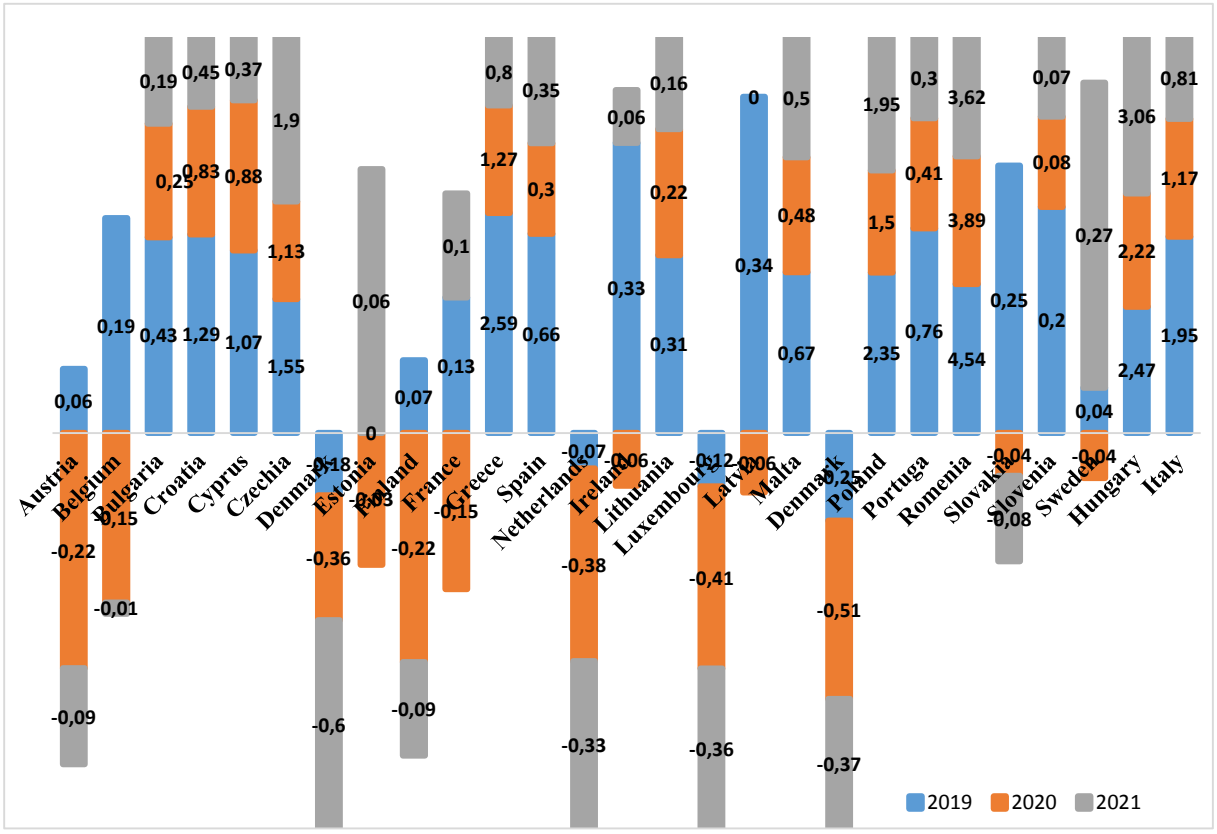

Figure 3. EU long-term interest rates 2019-2022.

Source: own elaboration based on: https://ec.europa.eu/eurostat/web/hicp/data/database, 20.01.2023.

5. Discussion of results and conclusions

Summing up the analysis of changes in inflation and public debt in EU countries in 2019-2021, it should be stated that the Covid-19 pandemic not only affected the social and economic activity of companies during the period mentioned, but also had a significant impact on the state of public finances of individual countries. Lower-than-planned tax revenues and the need to

spend additional resources to counter the effects of the pandemic, as well as additional financing of the healthcare system, have largely contributed to a significant increase in public debt and, consequently, to an increase in inflation. The data presented shows that in all 27 EU countries there was an increase in public debt between 2019 and 2021. The only exceptions are Ireland and Sweden, where debt increased in 2020, from 57.2% to 58.4%, and from 38.9% and 39.6%, respectively, and then declined slightly to 56% and 36.7% the following year.

The other 25 countries showed a clear upward trend. This means that the Covid-19 pandemic has worsened the state of European economies and has also put their financial stability at risk. Shielding programmes of various types cost individual countries additional funds, either from external financial markets or from additional money issuance. This has been done by the European Central Bank, as well as by the banks of countries that did not enter the eurozone. The consequence of additional money issuance is usually an increase in the level of inflation. While we do not see a visible increase in the price level in 2020, the following year in 9 out of 27 countries the increase exceeds the critical 5%. The countries with the highest inflation rates were Hungary and Poland. An analysis of the debt market, defined by long-term interest rates, shows that the European economies remain highly credible on the financial markets and that there has been no significant increase in interest rates. This means that EU countries have a high level of creditworthiness, regardless of the risks posed by the pandemic.

Based on the information in Table 1, we can see that the European economy recovered again in 2021. GDP in the euro area grew by 5.3%, and economic activity in the fourth quarter was higher than before the pandemic. Domestic demand, including in particular private consumption, was buoyed by an improvement in the labour market and an increase in household demand. On the other hand, the economy was negatively affected by persistent disruptions in global supply chains and high prices of energy raw materials. Combined with the successive waves of pandemics at the end of 2021 and the new threats that emerged at the beginning of 2022, notably the commodity supply shock caused by the war in Ukraine, the growth prospects for EU economies remain in serious doubt, and the Community as a whole and national governments face entirely new threats on an unprecedented scale. It seems that one of the biggest challenges will be the rising prices of energy raw materials and energy itself. The spectacular rise in the prices of natural gas, crude oil and other energy commodities such as hard coal, on the one hand, is accelerating the energy transition towards renewables and, on the other hand, is a very strong stimulus to inflation, posing a serious threat to the sustainability of public finances.

Undoubtedly, the most important cognitive values included in the paper are the problem of the resilience of national public finances to external shocks and their ability to stabilise them in the long term. There is no doubt that the last few years have brought some of the greatest challenges in the history of the modern world economy, such as the Covid-19 pandemic and the ongoing war in Ukraine. Both of these factors have caused lasting damage to public finances

and require new, creative measures to ensure stability and national security. These topics are undoubtedly very important from an economic and scientific point of view and should be the subject of further in-depth research.

Undoubtedly, the most important cognitive values included in the article are the problem of the resilience of national public finances to external shocks and their ability to stabilize them in the long term. In this sense, this publication fills the existing research gap in the literature and inspires further research in this area.

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THE IMPORTANCE OF DIGITALIZATION IN THE ORGANIZATION OF CYBER-PHYSICAL PRODUCTION NETWORKS OF POLISH SMEs IN INDUSTRY 4.0

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Purpose: The paper aims to explore the impact of the digitization of SME sector enterprises on cooperation in cyber-physical networks in the Industry 4.0 environment.
Design/methodology/approach: The literature analysis method and survey of SME sector enterprises were used in the research. 206 manufacturing enterprises took part in the study, including 35 micro, 87 small and 84 medium-sized enterprises. The selection of the sample was purposeful. A statistical analysis was performed using the IBM SPSS v. 28 statistical package in the empirical study. The analysis included the use of, among others, frequency analysis, one-way analysis of variance and linear regression analysis.
Findings: The survey revealed a positive correlation between company size and digitalization level. Larger enterprises report higher levels of digitization. Enterprises declaring a higher level of digitization also expect a correspondingly high level of digitization from their network partner. Moreover, a higher level of digitization of the enterprise is a factor that influences the willingness of the examined enterprise to join a cyber-physical cooperation network. The research also shows that an enterprise's digitization level is associated with the enterprise's declaration of connecting its intelligent resources with an external digital platform that guarantees the security of transmitted digital data and organizes the cyber-physical network in an automated manner.
Research limitations/implications: The research was conducted among selected Polish micro, small and medium-sized production enterprises. Due to the issue of networking and international cooperation of enterprises operating in the Industry 4.0 environment, research should also cover other European countries in the future.
Originality/value: Original achievements obtained during the research include demonstrating the relationship between the level of digitization of enterprises and the tendency to establish cooperation within cyber-physical production networks. Moreover, the survey results proved that investing in digital technologies is an additional motivating factor for enterprises wanting to cooperate within networks in the Industry 4.0 environment.

Keywords: Industry 4.0, digitization of enterprises, cyber-physical production networks, small and medium enterprises.

Category of the paper: Research paper.

1. Introduction

The Industry 4.0 concept means the widespread digitization of economic processes, forcing changes on enterprises, especially in using modern digital communication technologies and building a competitive advantage on the market through intelligent technologies and networking. Therefore, Industry 4.0 assumes creating a fully integrated system of suppliers, producers and customers, creating cyber-physical networks of enterprises, which will constitute open socio-technical systems capable of implementing many new functions and activities imposed by production, logistics and management. As a result, digitally supported production technologies, Data Mining, Big Data Analytics and ICT (Information and Communication Technologies) allow for free machine-machine and machine-human communication in real-time, regardless of the geographical location of resources. According to this concept, all subsystems are fully integrated within Cyber-Physical Systems (CPS) and one value chain, focusing on customer needs (Kagermann et al., 2011; Lee et al., 2015). CPSs ensure data collection, processing, and impact on physical processes within the entire value creation chain or enterprise network thanks to unlimited network connections, simultaneously with little human involvement, performing only supervisory functions. Cyber-physical systems are the integration of computational and physical processes. Embedded computers and networks monitor and control physical processes, usually with feedback loops in which physical processes influence computations and vice versa (Xu et al., 2018).

Industry 4.0 is a vision that comprises nine pillars related to digital technologies, including Big data, Autonomous robots, Simulation, Horizontal and vertical integration, Industrial Internet of Things (IIoT), Cloud Computing, Additive manufacturing, Augmented reality, and Cybersecurity (Rüßmannet et al., 2015). It is widely understood that Industry 4.0 and the opportunities provided by its digital technologies have a long-term impact on global industrial development. As a result, there has been an increasing interest in researching the challenges, solutions, and opportunities related to various aspects of the fourth industrial revolution (Culot et al., 2019).

Enterprises operating in the modern market are beginning to understand the need for changes, especially in implementing modern technologies and broadly understood digitization of processes. A competitive advantage in the market should be achieved through know-how, high market flexibility and the ability to communicate in real-time with business partners and customers. Therefore, companies should be aware of the need to invest in digital technologies and the use of new business models and decision-making systems generated by the challenges of Industry 4.0. According to the new concept of Industry 4.0, the way of building a competitive advantage in the market is changing. A new, more modern and innovative approach to production management is needed, which will significantly increase efficiency and help build fast, efficiently managed supply chains (Młody, 2018; Grabowska, Saniuk, 2023). This may

particularly apply to the sector of small and medium-sized enterprises, which, unlike large enterprises with high development potential, see an opportunity for development in the conditions of Industry 4.0 in cooperation and narrow specialization (Schröder, 2016; Wolniak, 2023; Adamik et al., 2023). Hence, there is a need to research the development of these areas of activity, especially considering the challenges posed by the fourth industrial revolution. Particular attention should be paid to small and medium-sized enterprises, which, as shown above, are the driving force of the economy and constitute the workplace of an essential part of society. Small and medium-sized enterprises unfortunately do not have access to knowledge, sources of financing, the possibility of investing in new technologies and the use of appropriate business models like large enterprises (Cotrino et al., 2020). Developing a network form of cooperation becomes a development opportunity for small and medium-sized enterprises. Currently, small and medium-sized enterprises are perceived as intelligent modules that can be used to jointly create value for the customer and create cyber-physical production networks (Grabowska, Saniuk, 2023).

The idea of a cyber-physical production network means the production order execution within shared intelligent resources of the individual network partners, and communication between resources takes place using real-time data and IoT (Saniuk, 2020). An essential feature of the cyber-physical network is that all network partners have access to the necessary information in real time, regardless of the geographic location of the required resources. Thanks to the direct communication of intelligent resources, partnership development is intensified based on combining essential resources and competencies. Incorporating the help of various enterprises into a network contributes to gaining a competitive advantage in the market and better orientation to the customer's needs (Czakon, 2015).

The participation of enterprises in the network is desirable for the SME sector. Enterprises in this sector can overcome the main competitive advantage of large enterprises in terms of access to all kinds of resources (capital, competencies, know-how, etc.) (Mahmood et al., 2018). Creating networks of SMEs is an excellent opportunity to increase the competitiveness of enterprises and knowledge transfer. Moreover, the main advantages of such structures are the mutual support of partners, more significant potential for market expansion, sharing of resources and a more favourable position in contact with the financial and administrative environment (Lachiewicz, Zakrzewska-Bielawska, 2012). One of the problems of the SME sector is the still low use of intelligent services, such as computer-aided systems for advanced production planning and control, as well as data analytics. There is a lack of integration of existing IT systems enabling external exchange of information and knowledge between partners or contractors (Perechuda, Sobińska, 2015). In the future, communication between various systems must be organized through cloud services, such as business e-platforms (Platform as a Service) and software (Software as a Service) (Hyrynsalmi, 2022). This means there is a need to research the digitization of enterprises and the development of cooperation in combining intelligent resources, especially micro, small and medium enterprises.

Hence, the article's main aim is to explore the impact of the level of digitization of SME sector enterprises on the cooperation of enterprises within cyber-physical networks in the Industry 4.0 environment. The article assessed the level of digitization of the surveyed micro, small and medium-sized enterprises, identified the most frequently used digital technologies identified with the fourth industrial revolution, and demonstrated the impact of enterprise digitization on cooperation within cyber-physical production networks. The article considered three hypotheses related to the digitization of micro, small and medium-sized enterprises:

H1: The declared level of digitization of an enterprise is related to the size of the enterprise.

H2: The enterprise's digitisation level affects the expected level of digitization of partners for network cooperation.

H3: There is a relationship between an enterprise's declared level of digitization and the enterprise's willingness to participate in cyber-physical enterprise networks to implement a joint production.

2. Materials and methods

The conducted research used the method of literature analysis and survey of enterprises. Polish micro, small and medium-sized enterprises were selected for the empirical study. The study involved selecting enterprises that indicated industrial production as their primary industry profile (mechanical processing, assembly, etc.). A total of 600 enterprises were selected for the study. The CAWI (Computer-Assisted Web Interview) data collection technique was used. Ultimately, a total of 206 responses were obtained. Therefore, the study involved N = 206 enterprises represented by employees, including n = 35 people representing micro-enterprises (17%), n = 87 people in small enterprises (42.2%) and n = 84 employees representing medium-sized enterprises (40.8%). The research was conducted between December 2022 and April 2023.

The SME sector (micro, small and medium-sized enterprises) constitutes the overwhelming majority of enterprises in Poland - 99.8%. Among them, the largest group (97.0%; 2.2 million) are micro-enterprises. Small companies' share in Polish enterprises' structure is 2.2% (49.5 thousand), and medium-sized companies 0.6% (14.4 thousand). Data from the Central Statistical Office show that only 10% of enterprises conduct industrial activities (PARP, 2022). Therefore, it can be considered that the number of industrial enterprises constitutes a total of 226,390 enterprises as the size of the population. Due to the above, the required number of companies in the research is a minimum of 196 companies for the fraction size assumed at 0.5. The maximum error was 7%, and the confidence level was 95%. The selection of companies was purposeful.

The article presents selected empirical research results using statistical analyses performed in the IBM SPSS v. 28 statistical package (Meyers et al., 2013). The research used, among others, frequency analysis, one-way analysis of variance and linear regression analysis.

3. Results of research

During the survey, the participants were asked to evaluate the degree of digitization in their company. The analysis revealed that 36.4% of the respondents considered their enterprise to have a high level of digitization, whereas only 17% of them rated it as an average level. On the other hand, 47% of the enterprises stated that the level of digitization was low or very low. The results of this evaluation are illustrated in Figure 1.

A one-way analysis of variance was performed to test the H1 hypothesis regarding the relationship between the size of the enterprise and the level of digitization of a given enterprise. As a result, it turned out that the compared groups of enterprises differ statistically significantly, which means that the size of the enterprise differentiates the level of advancement of the enterprise's digitization $F(2;203) = 206{,}802$; $p < .001$; $\eta 2 = 0{,}671$. The observed effect is a strong effect. It explains 67% of the total variability in the results obtained in terms of the measured level of enterprise digitization.

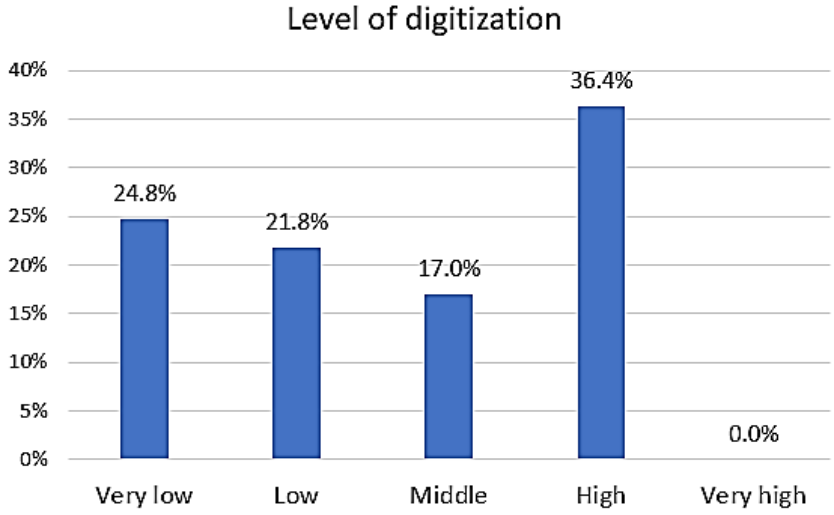

Figure 1. Declared level of digitization of the surveyed enterprise.

Then, to examine which compared groups differ statistically significantly, a post hoc test with the least significant differences (LSD) correction was performed. The correction was applied due to the assumption of homogeneity of variances in the compared groups. The results obtained indicate that all groups differ from each other. The enterprise's digitisation level is the highest among medium-sized enterprises, employing 50 to 250 employees ($M = 3.74$; $SD = 0.442$). The average level of digitalization in this group of enterprises was statistically

significantly higher than in other small enterprises employing up to 50 people (M = 2.23; SD = 0.961), p < 0.05, d Cohena = -2.005, 95%CIdifference[-2.37; -1.63] and micro enterprises employing up to 5 people (M = 1.09; SD = 0.284), p < 0.05, d Cohena = -6.585, 95% CI difference [-7.51; -5.65]. Therefore, it can be concluded that the larger the enterprise, the higher the level of digitization shown by enterprises. The result of the average level of digitalization for individual groups of enterprises is presented in Figure 2.

The answers regarding the technologies used in digitalization are also interesting. The respondents indicated Cloud Computing (81.1%), digital system integration (79.5%) and Internet of Things (52.5%) as the most frequently implemented digital technologies. However, the respondents indicated that additive manufacturing was the least frequently implemented digital technology (20.4%). None of the respondents stated the implementation of a digital twin. The result of the most commonly implemented digital technologies is presented in Figure 3.

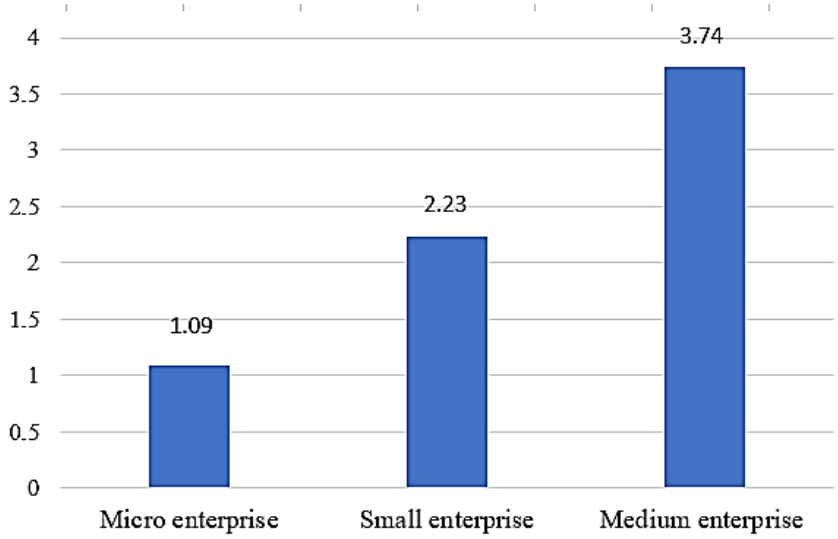

Figure 2. The average level of digitization of the micro, small and medium enterprises.

An interesting observation was also the examination of hypothesis H2, which states the influence of the declared level of digitization of the enterprise on the expected level of digitization of the network cooperation partner. Those enterprises that utilised machines and equipment at up to 80% in a calendar year were selected for the study. This means they have the production capacity to be made available through network collaboration. First, it was checked how the declared level of digitization of the examined enterprise was related to the expected level of digitization of a potential cooperator (network partner). For this purpose, a regression analysis was performed, where the declared level of digitization of the enterprise acted as a predictor, and the expected level of digitalization of the cooperator acted as a dependent variable. The proposed regression model was highly statistically significant $F(1;190) = 422.720$, $p < .001$. The declared level of digitization of the company turned out to be a significant positive predictor of the represented level of digitization of the cooperator ($\beta = 0.69$).

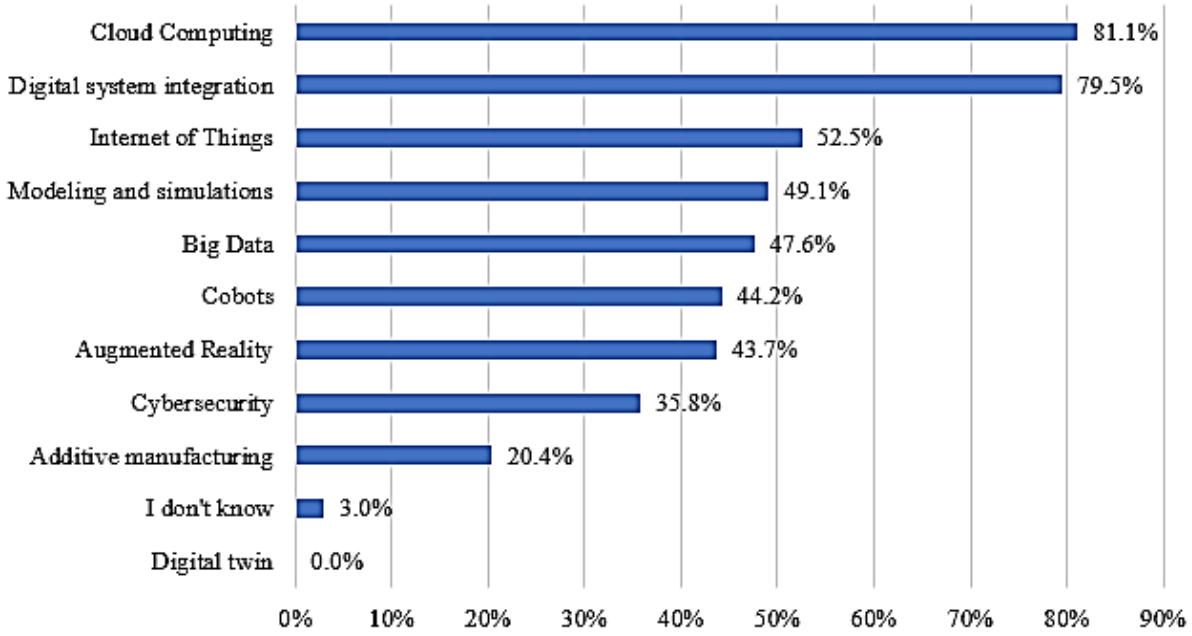

Figure 3. Digital technologies implemented in the surveyed enterprises.

In the next step, hypothesis H3 was tested regarding the existence of a relationship between the declared level of digitization of the enterprise and the company's tendency to join a network of enterprises to implement a joint venture, thereby increasing the degree of production capacity utilization. For this purpose, a regression analysis was performed, where the declared level of digitization of the enterprise acted as a predictor, and the tendency of the examined enterprise to join the network as a dependent variable. The regression model for this case was highly statistically significant $F(1;190) = 226.409$, $p < .001$. The declared level of enterprise digitization was a significant positive predictor of the willingness to join a business network ($\beta = 0.38$).

In the next step, it was checked how the level of digitization of the enterprise is related to the enterprise's declaration of connecting its intelligent resources with an external digital platform that guarantees the security of transmitted digital data and organizes the cyber-physical network in an automated manner. For this purpose, a regression analysis was performed, where the declared level of digitization of the enterprise acted as a predictor, and the declaration of connecting its intelligent external resources with an external e-business platform acted as a dependent variable. The considered regression model was highly statistically significant $F(1;190) = 478.715$, $p < .001$. The declared level of enterprise digitization turned out to be a significant positive predictor of the declared connection of one's intelligent resources with an external business e-platform that guarantees the security of transferred digital data and organizes the cyber-physical network in an automated manner ($\beta = 0.36$).

Also noteworthy is a significant percentage of enterprises that see the possibility of connecting their intelligent resources with an external business e-platform that will guarantee the security of transmitted digital data and organize a cyber-physical network in an automated manner. This answer was given by almost 53% of respondents. This represents a significant potential for developing intelligent resources, which result from the fourth industrial revolution and are increasingly found in the equipment of mainly medium-sized enterprises. However, such a variant requires a significant improvement in the level of digitization of Polish micro, small and medium-sized enterprises. Detailed analysis results are presented in Figure 4.

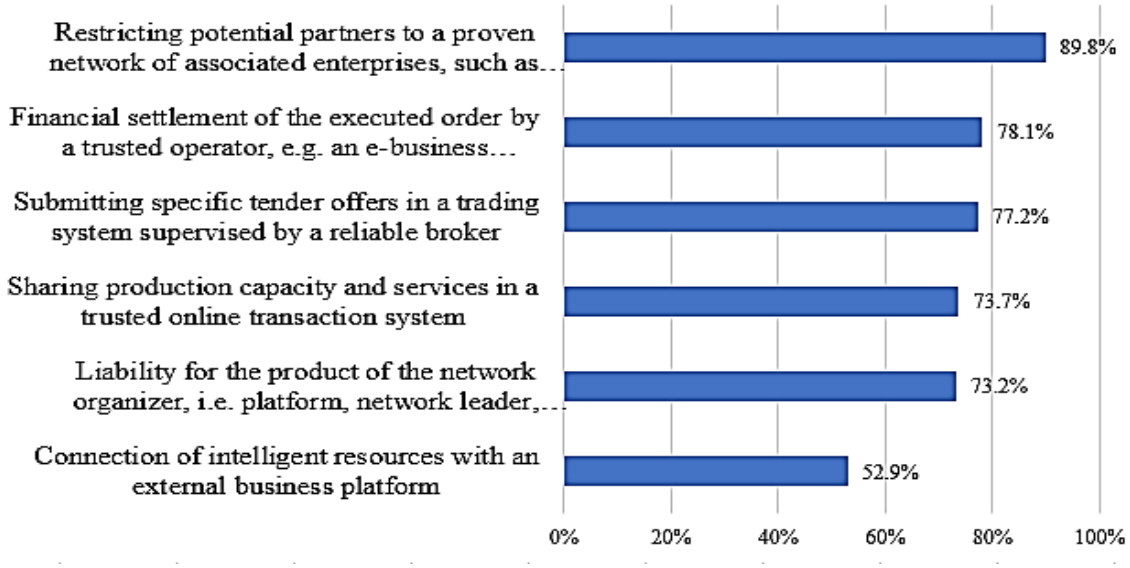

Figure 4. Variants of enterprise participation in cyber-physical production networks.

The study aimed to gather opinions from participants on cooperation in cyber-physical production networks. The majority of respondents (89.9%) expressed a preference for working with partners from a verified group of associated enterprises, such as a cluster or common business platform. This indicates a significant lack of trust when it comes to working with unverified partners. The survey also inquired about the difficulties participants faced while working with others in their network. The results showed that most respondents experienced disruptions in their production (95.7%), staff shortages, and a lack of knowledge and competence among employees (78.1%). Additionally, problems with settlements after completing a production order (69.4%), timely execution of orders (56.8%), product liability (43.3%), and complaint problems (42.3%) were reported as challenges.

The survey asked respondents about the challenges companies face while searching for and establishing cooperation with partners. The results showed that 100% of the respondents found it challenging to find partners. Additionally, 96% of the surveyed respondents faced problems due to a lack of information about the availability of resources. A high percentage of respondents also reported that a potential partner's assistance cost was too high (85%), and negotiations with potential partners were often long-term (85%). The surveyed companies also drew attention to the problem of financial settlements between partners, which

consequently leads to the choice of a variant in which the responsibility for the financial settlement of a jointly executed order will be taken over by a trusted external operator, e.g. a broker or an organization that will organize the network and contact the external client. As many as 78.1% of the surveyed enterprises represented this position. Over 77% of enterprises would prefer responding to a specific request for quotation from a reliable broker (network organizer) in the transaction system. Many enterprises (73.7%) are interested in offering spare production capacity and services in a trusted online transaction system. Product liability is often a significant problem in the case of joint execution of orders in production networks. Hence, the survey asked about the possibility of the entity organizing the network taking over responsibility for the product. As a result, over 73% of enterprises would be willing to use such an option.

4. Discussion

Creating network forms of cooperation is an excellent opportunity to dynamize the development of the SME sector within the concept of Industry 4.0 and increase enterprises' competitiveness (Birkel e al., 2019). This is confirmed by the presented results, which show that the technologies of Industry 4.0 enable and even facilitate and intensify the establishment of cooperation between companies within industrial networks. Creating a network for businesses has many benefits, but it's not an easy process and raises concerns for companies in the SME sector. Choosing the right partners for the network is a difficult task that requires consideration of several factors, including production capacity, technology, service quality, financial stability, experience, and communication skills (Baraldi, et. al., 2012; Xu and Duan, 2019). These factors have a significant impact on the success of joint tasks (Napoleone et al. 2020).

Another critical issue is building trust between partners, investing in digitalization and information technologies and addressing any problems that may arise—SMEs, in particular, face challenges in implementing advanced digital technologies due to high costs. The survey indicates that small and medium-sized enterprises face difficulties cooperating and forming networks. Hence, there is a need to conduct future research on models of cooperation of small and medium-sized enterprises in cyber-physical networks, the creation of e-platforms and network planning methods oriented towards the joint implementation of production tasks.

The presented research shows the significant impact of digitalization on the possibility of cooperation between enterprises within cyber-physical production networks. The research confirmed the hypothesis that an enterprise's declared level of digitization is related to the size of the enterprise. This means focusing more on smaller entities and supporting these enterprises in digitization. Moreover, it has been proven that the level of digitization of an enterprise affects

the expected level of digitization of network cooperation partners, which means putting pressure on network partners in the future to use digital technologies. Also noteworthy is the confirmation of a strong relationship between the level of digitization declared by the company and its willingness to participate in the organization of cyber-physical networks of enterprises to implement joint production.

5. Conclusions

Many enterprises in today's market are realizing the need for change, particularly in implementing modern technologies and digitising processes. The emergence of Industry 4.0 and the growth of network cooperation provide development opportunities for small and medium-sized enterprises. Micro, small, and medium-sized enterprises are seen as intelligent modules that can work together to create customer value and establish temporary production networks facilitated by e-platforms.

The research shows that the digitization of micro, small and medium-sized enterprises is one of the critical conditions facilitating cooperation within cyber-physical production networks. Implementing digital technologies will allow for better communication between enterprises and collaboration with e-business platforms, allowing for the quick organization of temporary networks capable of taking advantage of emerging business opportunities. Especially in the case of production orders requiring knowledge, competencies and distributed production resources of micro, small and medium-sized enterprises.The companies that were surveyed also highlighted the issue of financial settlements between partners. As a result, they opted for a solution where a trusted external operator, such as a broker or an organization that manages the network and communicates with the external client, takes responsibility for the financial settlement of a joint order. It's worth noting that many companies are interested in connecting their intelligent resources with an external business e-platform.

The article tested three hypotheses, which were confirmed. The survey revealed that there is a positive correlation between company size and digitalization level, with larger enterprises reporting higher levels of digitization. Enterprises declaring a higher level of digitization also expect a correspondingly high level of digitization from their network partner. Moreover, a higher level of digitization of the enterprise is a factor that influences the willingness of the examined enterprise to join a cyber-physical cooperation network. The research also shows that an enterprise's digitization level is associated with the enterprise's declaration of connecting its intelligent resources with an external e-platform that guarantees the security of transmitted digital data and organizes the cyber-physical network in an automated manner.

Future research will focus on developing cyber-physical network planning methods and business models describing the functioning of micro, small and medium-sized enterprises operating within e-business platforms responsible for network coordination and cooperation with external clients.

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THE DETERMINANTS OF START-UPS` DEVELOPMENT IN THE CONTEMPORARY ECONOMY

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Purpose: The paper aims to identify the determinants of start-ups' development in Poland. The research hypothesis H1 is advanced: Financial capital is a statistically significant factor determining the development of start-ups in Poland. The characteristics of start-ups and factors determining their development are discussed.
Design/methodology/approach: A detailed literature review is contained in the theoretical section. The empirical part uses the exploratory factor analysis, which serves to identify key factors and explicate correlations among variables, to verify the research hypothesis. The number of factors is indicated by means of Cattel's method and Kaiser criterion.
Findings: The paper contains the results of research into 60 start-up business undertakings. The exploratory factor analysis has helped to define statistically significant factors of start-up development in the Polish economy. Four factors determining this development are identified, namely, financial capital, human capital, legislative and fiscal issues, and networking, with the financial capital being the statistically significant factor of start-up development in Poland.
Practical implications: The results can be utilised by start-ups and business environment institutions for a proper selection of factors determining their development.
Originality/value: The results of the author's research into 60 start-ups are presented. Due to the specific nature of the group and difficulties reaching it with the traditional sampling methods, the snowball method is applied.

Keywords: start-ups, ecosystem, determinants.

Category of the paper: research paper.

1. Introduction

Organisations in the contemporary economic reality face a turbulent environment. Developments known as 'black swans' (Taleb, 2007), unexpected and sudden events of a substantial scale and huge consequences, have significant impacts on the reality. The COVID-19 pandemic, the military conflict in Ukraine or the climate crisis are some

instances. The unpredictability and opacity of the contemporary world and its growing uncertainty about the future are challenges to people, economy, and politics (Mączyńska, 2020).

Organisations' readiness to grasp the essence of innovation and take advantage of the opportunities offered by technological progress is greatly varied. Digitalisation, automation, artificial intelligence, and machine learning increasingly spread across the world of business. This requires the development of infrastructure and specialist staff competences, however. In a digital enterprise, data collected are used for the purposes of a more efficient and effective management that results in new products and services, new methods and tools of customer support, new professions and business models.

Not each organisation is up to emerging challenges. Competences requisite for development in an environment of interacting real and virtual dimensions are becoming necessary and determine competitiveness (Adamik, Nowicki, 2017). The creation and development of start-ups is an option, as they are oriented towards innovation and thus capable of meeting challenges and developing in difficult conditions. They proved able to respond flexibly, function remotely, creatively adapt their products to customer needs, and seen new markets and business models at the time of the COVID-19 pandemic (Startup Poland, 2020). Research shows (Patel, 2015; Walden 2014, after: Sobczak, Dudycz, 2016, p. 81) merely 10% of start-ups are successful in the market, the rest fail.

This paper aims to identify the determinants of start-up development in Poland. Answering the question, What factors determine start-ups' success the most, is important.

In order to find the answer and verify the research hypothesis based on the literature review, the results of a survey of 60 start-ups in Poland and exploratory factor analysis are utilised. Statisica 12 software and MS Excel 2016 spreadsheets assist with the statistical analyses.

2. The characteristics of start-ups and the determinants of their development – literature review

Start-ups are a relatively new form of economic undertakings. Their emergence and development are connected with the development of information and communication technologies, processes of globalisation and intensifying competition, reduced product life-cycles, and development of entrepreneurial attitudes among the young (Sieradzka, 2021, p. 188). Both Polish and international literature emphasise the absence of a single, universal definition (Said et al., 2022; Ehsan, 2021; Łukasiński, Nigbor-Dróżdż, 2022). Environment fluctuations have produced diverse approaches to the definition. Up till 2000, they had stressed the 'market novelty' factor (Carter et al., 1996, Looger, Koo, 2005), however, further analysis pointed to innovation in the face of the increasingly complex requirements of domestic and foreign markets (Krejci et al., 2015; Cho, McLean, 2009). Links between innovation and rapid

growth, connected to rising profits and risks, were highlighted as well (Reis, 2011; Hyytinen, 2015). This changing approach was also a result of dynamically altering customer needs and a necessity of innovative enterprise responses (Kozioł-Nadolna, 2018). 'The most important strength of a new company is new thinking, which is even more important than agility' (Hatammimi, Amiranti, 2023, p. 62). Connections among four key, overlapping elements are stressed now: the age of foundation, innovation, growth, and uncertainty/risk. Innovation is the crucial feature distinguishing start-ups, while the other elements, growth and risk, are its products (Ehsan, 2021). The current market requires innovations to be introduced on the basis of ITC technologies (ESM, 2016; Reis, 2017; Startup Commons, 2019; Hatammimi, Amiranti, 2023), which allows for a fast business scalability and new value chain configurations or reconfigurations. Other definitions are highlighted by (Damodaran, 2009): a high growth potential, early stage of development, dependence on various sources of capital, lack of history, and low survival. The following need to be added to this list (Sieradzka, Kaliszczak, 2018): capacity for knowledge, extreme market uncertainty, product or service innovation, scalability, absence of a stable business model, and internet environment.

The time of market operation, which defines an entity as a start-up, is a debatable part. A start-up should be understood as an organization specifically created for the purpose of producing and selling innovative goods and services, as well as testing an innovative business model; the threshold point, depending on the date of organization registration, is determined by the regulations of the country of registration (Ressin, 2022). The period is up to 10 years in most European countries (ESM, 2019).

A start-up is not a small version of a large company. It is a temporary organisation in search of a scalable, reproducible, and profitable business model. At first, the start-up business model is a canvas filled with ideas and guesswork, but it lacks customers and minimal customer knowledge (Blank, Dorf, 2013). Most start-ups are unique organisations that do not fit the development patterns of traditional enterprises. They base on the new business paradigm of multi-level openness and attempts at creating an effective business model (Chrzanowski, Zawada, 2018, p/ 42).

The conditions of start-up development are related to the notion of ecosystem that consists of all entities and organisations interested in the process of initiating innovation and transforming it into prosperous business undertakings. Start-up ecosystems are a union of localized cultural outlooks, social networks, investment capital, universities, and active economic policies that create environments supportive of innovation-based business (Spigel, 2017). A normal functioning of start-up ecosystems is largely dependent on adequate regional economic policies. The provision of an appropriate institutional and regulatory background fosters the development of these undertakings (Bigos, 2018). Easy access to the sources of financing is pre-requisite to start-up development in an ecosystem, though support from entities like venture capital funds or business angels is important to firms at the initial stages of development, too, since the former offer not only capital commitment but also mentoring,

business contacts, management experience, etc. (Lipińska, 2018). Acquiring capital is the chief challenge to start-ups (Muathe et al., 2022, p. 394).

Exo- and endogenous factors are distinguished among the conditions affecting the development of start-ups. The former include (Kuranowski, Szymańska, 2018): legal aspects, government programmes, financial support, cooperation with science, diffusion of innovation, institutions of business environment, sectoral elements and broadly-defined enterprise collaboration, regional, national and foreign markets, the impact of globalisation on customers and competition, social and cultural (demographic and ecological) factors, the protection of intellectual property (patents, licences), and the turbulent environment where start-ups operate. The endogenous factors comprise (Kuranowski, Szymańska, 2018): human resources, the flexibility of organisation, its structures and resources, business experience, capacity for adapting innovations from outside and from R&D, the flexibility of financial and tangible capital, ability to implement innovation, corporate culture, ability to take risk, the climate of innovativeness, the skill of cooperation, and rapid response to changes. In turn, R. Geibel, M. Manickam (2015) define 25 factors of start-up success, grouped into three categories: 'external factors', 'internal factors', and 'support from incubator/accelerator'. The first group encompasses: team, work culture, co-founders, organization structure, exit strategy, marketing strategy, customer network, product, ability to scale, company pitch, balancing work and family life. The external factors include: government policies, political stability, location, access to talent, new market access, access to existing market, competitors, and prior experience. Mentorship, expanding network connections, financial funding, tax, legal, business etc, support, infrastructure, and workshops/events are listed as part of group three.

The studies of (The Global Startup Ecosystem Ranking, 2022; The Global Startup Ecosystem Report, 2022) show the Silicon Valley (US) ranks top among the best start-up ecosystems worldwide, followed by London and New York, appreciated in a range of categories, from financing, business contacts to development opportunities. The Israeli start-up ecosystem stands out, too, as one of the best clusters of not only technology businesses.

Research into the largest global start-up ecosystem, the Silicon Valley, has demonstrated some factors driving its success, including (Piscione, 2013): the presence of scientific institutions, multicultural environment of experienced workers and investors, addressing risk and failure in business operations, appropriate legal regulations, a culture of knowledge sharing, and a strong representation of venture capital and business angels. The analysis of the New York start-up ecosystem has identified the following key factors of its success, in turn (Cometto, Piol, 2013): an easy access to financial capital, an important role of the business angel network, a tolerance of high risk and business failure, and an open community based on sharing and well-developed networking. The study of the Israeli start-up environment by F. Kohn et al. (2015), on the other hand, has proved the following play a substantial role in the success of firms in a given ecosystem: the experience of entrepreneurs, the diversity of a founding team and good communication, military service, the acceptance of risk and failure, capital access, high technological competences, staff education, openness, and cooperation.

Entrepreneurial ecosystems involve entities that make up the quadruple helix model, which determines the success of a given economic undertaking. Cooperation and mutual links between the four model elements (Ziakis et al., 2022): science institutions (including universities), government, industry, and the public, are particularly important in the case of start-ups, characterised by a high innovativeness and global reach. The following factors determining the development of start-ups in Greece are indicated (Ziakis et al., 2022):

- education and research - education, and especially start-up business training, is an important factor contributing to the profitability of a start-up business; start-uppers who have greater access to knowledge from the beginning are more likely to survive,
- human capital - choosing the right human resources and their loyalty to a start-up business are highlighted as the most important factors,
- finance and funding - financing is a crucial factor not only in the early phases of operation, but it greatly affects the profit of a start-up business; the impact of venture capital on innovation activities and the success of start-ups is particularly important and, in fact, of a long-term nature,
- government - the state can be involved in some areas of high-risk activities where the private sector consistently avoids participating. Governments can contribute by highlighting successful business models, removing bureaucratic barriers to start-ups, provisioning on tax incentives on R&D expenditures, and mitigating the social stigma of failure,
- business support and connectedness - the performance of start-ups is directly influenced by the quality of their networks and their ability to exploit the resources they have access to through these relationships,
- entrepreneurial culture and incentives for start-up creation - the social context in which the start-upper lives, works, and shapes both his business culture and business motivations is crucial.

An analysis of the maturity of the start-up ecosystem in Poland (Deloitte, 2016) covered five crucial areas: financing, legal regulations, human and social capital, and institutional environment, Poland scores 1.93 on a 1-4 scale. The results have shown social capital, financing, and human capital are the weakest developed areas in Poland (1.5, 1.68, and 2.27, respectively). The standards of legal regulations (2.55) and institutional environment (2.5) score far better.

A study conducted by the Polish Agency for Enterprise Development (PARP 2019) in 2017-2019 demonstrated excessive bureaucracy, high fiscal burden, lack of qualified personnel, and problems obtaining external funding are the greatest impediments to the development of young, innovative firms in Poland. Research by the Startup Poland foundation (2021) lists securing funding for the successive stages of development, high costs of employment, organisational problems of start-up expansion, rapidly changing and vague

legislation, as well as operational formalities as limitations to start-up development. An examination of start-up development conditions in north-eastern Poland (Kowalewski, 2018) points to financial limitations and a lack of business experience as key internal barriers. The internal factors obstructing start-up development include organisational and administrative issues and deficits in the regional job market, as evidenced with problems hiring adequately qualified workers.

The systematic research of Startup Poland foundation implies more than 76% operate as part of the research and development model (Białoń, Werner, 2018), proof of a great importance of new technologies to their development. A study by R. Sobczak, H. Dudycz (2016) indicates three factors that, depending on the way they are organised, contribute to either the success or failure of a business – these are: product, team, and financing.

This literature review helps to identify some characteristics of start-ups and key determinants of their development. Therefore, the research hypothesis H1 is posited: Financial capital is a statistically significant factor determining the development of start-ups in Poland.

3. Methods

A survey was conducted to explore the characteristics and determinants of start-up foundation in Poland and verify the research hypothesis. Due to the specific nature of the group and difficulties reaching it with the traditional sampling methods, the snowball method is applied.

As no standard definition of start-up is offered by the literature, the one suggested in the Polish Agency for Enterprise Development's report (PARP, 2017) is adopted, as it seems relevant to the Polish realities. There, the start-up is considered 'an entity represented … by an individual at the stage of starting a firm or running it for up to 3.5 years using technologies/ work methods available in the market for no longer than 5 years to manufacture their products/services'. This study was carried out between November 2022 and March 2023.

The process began with the choice of a start-up to act as the initial respondent. That active representative of a local start-up environment was the key source of information and contacts. The information received in this way helped to identify more start-ups as possible participants in the study. The data were obtained using the method of Computer-Assisted Telephone Interview (CATI).

As the study progressed, the representative start-ups were requested to take part in the survey by completing an original questionnaire using a seven-point Likert scale. The questionnaire consisted of 20 determinants to analyse some aspects of start-up foundation. As the data were gathered by means of the snowball method, special attention was paid to the diversity of start-up characteristics to produce a representative sample. That process continued until a saturation point, where more identified start-ups failed to contribute any significant new information.

On obtaining responses from 60 start-ups, data analysis commenced. The multidimensional nature of the study allowed for a variety of analytical techniques, such as an analysis of descriptive statistics and factor analysis, in order to grasp the patterns and relationships among the determinants and their effect on the foundation and development of start-ups in Poland.

Exploratory factor analysis serves to verify the hypothesis proposed. It helps to identify variables referred to as factors, which explicate correlation patterns within the sets of observed variables. The number of factors is indicated by means of (StatSoft, 1997):

- Cattell's method – the scree graph is linear; in order to select the number of components (factors), the point is sought where the graph is no longer steep (no longer a scree). The components above that point are the quantity of factors to be distinguished as part of the analysis,
- Kaiser criterion – it's assumed that if more than one component (factor) explains more variance than a single variable, or where the eigenvalue is more than 1, that component should be adopted as part of the factor solution.

Statisica 12 software and MS Excel 2016 spreadsheets assist with the statistical analyses.

4. Results

This section presents the results. 20 observable variables are analysed, assessed by the respondents for impact on start-ups' foundation and development. Descriptive statistics for each variable are discussed and interpreted for a better understanding of the sample's characteristics.

The values of such descriptive statistics as the mean, standard deviation, and the coefficient of variation are the tools of analysis designed to identify both the major determinants, ranked higher by the respondents, and those less appreciated. The analysis shows the diversity of opinions in the group and identifies the aspects crucial to the process of start-up creation in Poland.

The discussion of results for each of the 20 observable variables helps to better grasp their significance with regard to the phenomenon under analysis. The analysis will contribute to a view of the determinants key to innovative business activity in Poland and will help lay out some guidelines for a potential development of the start-up environment in future.

Table 1.
The descriptive statistics of observable variables describing the determinants of start-ups' development

Variable number	Variable name	Descriptive statistics		
		Mean	Deviation	Coefficient of variation
V1	Crowdfunding	4,60	1,53	0,33
V2	Venture Capital/Private Equity	4,82	1,38	0,29
V3	Incubators&Accelerators	4,35	1,90	0,44
V4	New technologies	5,62	1,52	0,27
V5	R&D institutions	5,42	1,15	0,21
V6	Seminars	5,18	1,17	0,23
V7	Legislation	5,03	1,43	0,28
V8	Taxation Policy	5,17	1,54	0,30
V9	Business partners	5,08	1,51	0,30
V10	Networking with industry	5,05	1,68	0,33
V11	Cooperation with universities	4,82	1,58	0,33
V12	Start-up events	4,90	1,51	0,31
V13	Human capital competencies	5,60	1,30	0,23
V14	Entrepreneurial education	5,02	1,33	0,27
V15	Business mentors	4,50	1,19	0,26
V16	Bank loan	4,30	1,44	0,34
V17	Innovation Contests	4,25	1,80	0,42
V18	Public funding	3,10	2,06	0,66
V19	European Union funding	4,48	1,37	0,31
V20	Business Angels	4,18	1,40	0,33

Source: The author's own compilation.

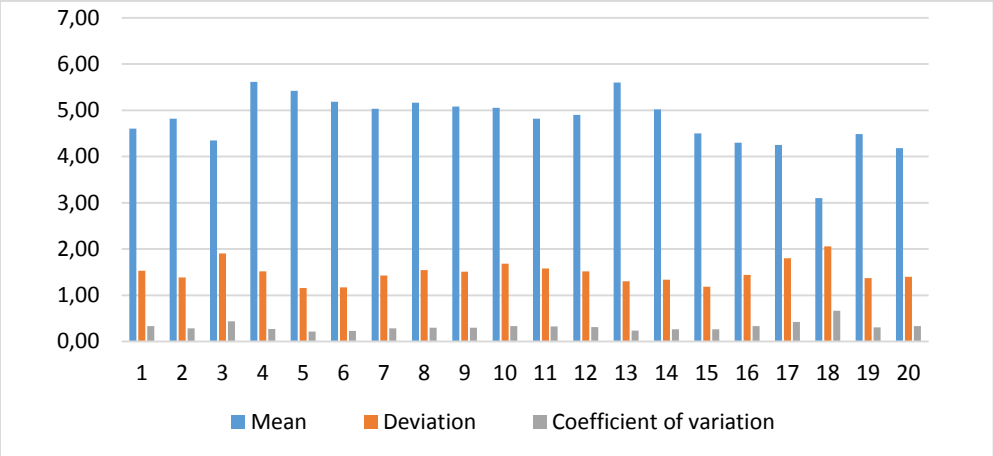

Figure 1. The descriptive statistics of observable variables describing the determinants of start-ups' development**.**

Source: The author's own compilation.

An analysis of observable variables in Table 1 and Figure 1 suggests nearly all mean evaluations of all the determinants of start-up foundation in Poland were greater than 4 and ranged <3.10; 5.62>. This shows all these variables were assessed as 'high and consistent'. In general, the respondents appreciated these determinants.

The mean evaluations were maximum for V4 (New technologies), with the mean of 5.62. That was followed by V13 (Human resources competencies) and V5 (R&D institutions), rated at 5.60 and 5.42, respectively. These determinants were seen by the respondents as the most important to the start-up creation.

As far as more variable components are concerned, the variables like V3 (Incubators & Accelerators), V17 (Innovation Contests) and V18 (Public funding) can be underlined with their higher standard deviations and coefficients of variation. This may suggest the responses relating to these determinants were more varied, that is, not all the respondents were of identical opinions about them.

Variables V18 (Public funding) and V20 (Business Angels) had the lowest mean evaluations of 3,10 and 4,18, respectively. This suggests that group of respondents see public financing and support from investors – business angels as having little impact on the creation of start-ups.

The variables whose coefficients of variation were relatively low, such as V5 (R&D institutions), V6 (Seminars) or V13 (Human resources competencies), deserve some attention, too. The respondents' opinions about them were more consistent and less varied.

These results indicate various determinants of start-up foundation received different respondent evaluations. Some were more appreciated and assessed more consistently, with others receiving more varied opinions of the research sample. This may prove useful information for those dealing with start-up development and making decisions to allocate resources and support for the various aspects of these economic undertakings.

Exploratory factor analysis was then undertaken to clarify the mutual relationships among the observable variables. To determine an appropriate number of factors, Cattell's scree test was applied to analyse eigenvalue reductions and the Kaiser criterion to address only the factors with eigenvalues above 1. A drop to the right of the scree point indicated the presence of the so-called 'factor scree', which helped to determine the number of factors subject to further analysis.

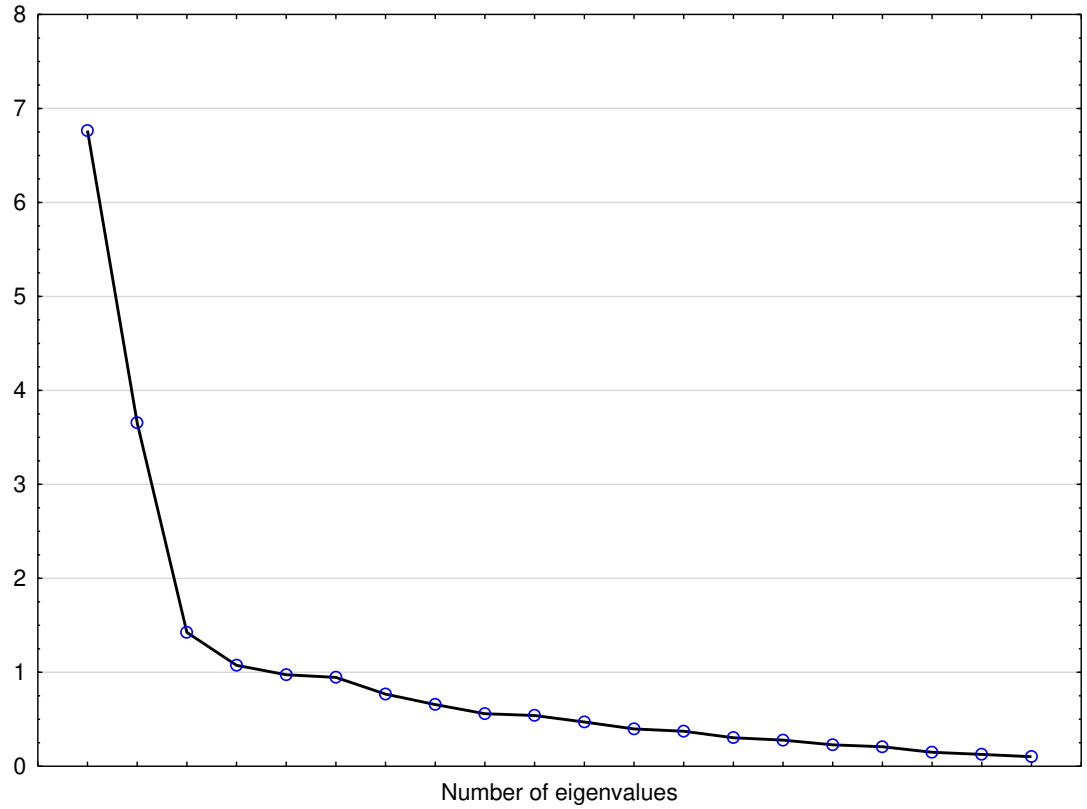

Figure 2. The scree diagram of eigenvalues for the factors describing the development of start-ups.
Source: The author's own compilation.

Figure 2 illustrates a steep declining curve turning into a mild factor scree with four distinct factors. This means the successive factors contain but little information. They have low eigenvalues and are thus rejected. A model of four factors is selected for the continuing analysis, therefore. Table 2 contains a matrix of eigenvalues for the selected factors and Table 3 a matrix of factor loads for the factors describing the start-up development, i.e., a correlation between the observable variables and the factors introduced to the model. 0.7 is assumed as the minimum correlation qualifying as important.

Table 2.
A matrix of eigenvalues for the factors describing the determinants of start-up development

Factor	Eigenvalue	Percentage of total variance	Accumulated eigenvalue	Accumulated percentage
1	6.77	33.83%	6.77	33.83%
2	3.65	18.27%	10.42	52.10%
3	1.42	7.12%	11.84	59.22%
4	1.08	5.38%	12.92	64.60%

Source: The author's own compilation.

Table 2 shows the subsequent eigenvalues or parts of the variance explicated for the individual three factors are as follows:

- for factor one, 6.77, or 33.83% of the total variance,
- for factor two, 3.65, or 18.27% of the total variance,
- for factor three, 1.42, or 7.12% of the total variance,
- for factor four, 1.08, or 5.38% of the total variance.

The accumulated eigenvalue for the four factors is 12.92. This means such a system of factors explains as much as 64.60% of the total variance.

Table 3.
A matrix of factor loads for the determinants of start-up development

Factor loads (normalised Varimax) Key components (The loads identified are greater than 0.7)				
Variable	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**
V1	**0.85**	-0.12	-0.28	-0.12
V2	**0.87**	0.20	-0.06	-0.08
V3	**0.77**	-0.33	-0.12	-0.08
V4	-0.22	0.27	0.54	0.11
V5	-0.11	0.66	0.08	0.40
V6	-0.02	0.62	0.09	0.20
V7	-0.07	0.15	**0.82**	0.17
V8	0.09	0.17	**0.81**	0.04
V9	0.04	0.19	0.36	0.68
V10	-0.01	0.17	0.01	**0.84**
V11	0.06	0.68	0.16	-0.06
V12	-0.09	0.38	0.16	0.28
V13	-0.25	**0.75**	0.23	0.08
V14	-0.33	0.57	0.39	0.10
V15	-0.13	**0.83**	0.04	0.06
V16	**0.77**	-0.23	0.10	0.14
V17	**0.84**	-0.16	0.01	0.02
V18	**0.78**	-0.26	-0.12	-0.10
V19	**0.84**	-0.04	0.02	0.03
V20	**0.85**	0.06	-0.01	0.02

Source: The author's own compilation.

Table 3 implies:

- the first factor is loaded with a total of 8 variables numbered: V1-V3 and V16-V20,
- the second factor is loaded with two variables numbered V13 and V15,
- the third factor is loaded with two variables numbered V7 and V8; while
- the fourth factor is loaded with one variable, V10.

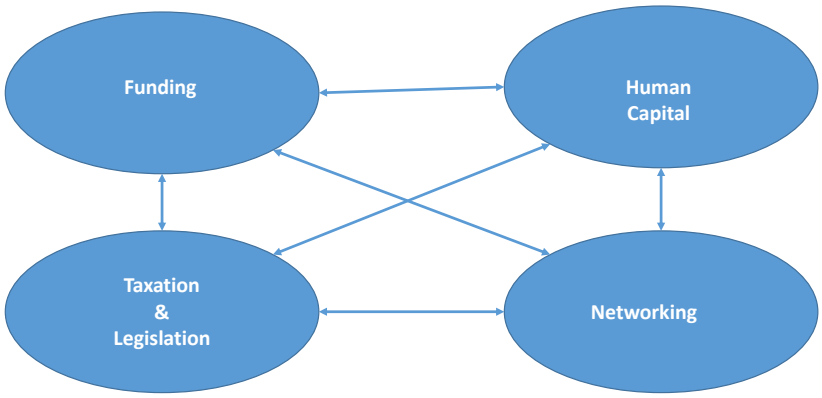

Figure 3. The factor-based model of start-up development.

Source: The author's own compilation.

The factor analysis supplies some important information on the interrelations among the observable variables with regard to the determinants of start-up emergence. The factor loads, normalised by means of Varimax, help to identify which variables are significantly related to the particular factors and to what degree.

As suggested by the literature, the factor names are derived from the variables of maximum factor loads. Thus, the first factor is named 'Funding', factor 2 – 'Human Capital', factor 3 – 'Taxation & Legislation', and factor 4 – 'Networking.

Factor 1: Funding

The variables with strong positive loads in factor 1: V1 (Crowdfunding), V2 (Venture Capital/Private Equity), V3 (Incubators&Accelerators), V16 (Bank loan), V17 (Innovation Contests), V18 (Public funding), V19 (European Union funding), and V20 (Business Angels). The results indicate factor 1 may be interpreted as 'Funding'. The high loads of these variables suggest start-ups taking advantage of crowdfunding, VC/PE funds, bank loads, incubators, accelerators, and public financing, EU funds, business angel capital or innovation contests are strongly linked to this factor.

Factor 2: Human capital

The variables of significant positive loads in this factor: V13 (Human capital competencies) and V15 (Business mentors). They point to the benefits from the intellectual capital of founders, workers, and investors.

Factor 3: Taxation & Legislation

Relatively high loads in factor 3 are exhibited by variables V7 (Legislation) and V8 (Taxation Policy). The factor can be named 'Taxation and Legislation', indicating that good legislation applicable to the foundation and running of business and to taxation is an important part of start-up development in Poland.

Factor 4: Networking

The variable of a very significant positive load in factor 4 is V10 (Networking with industry). This factor concentrates around business networks and contacts that can affect the growth and development of start-ups through knowledge sharing and collaboration with the industry.

Some variables display significant loads on a single factor only, which may point to their clear links with a given aspect of start-up development. Some variables may affect more than one aspect of start-up emergence, which is a valuable finding.

In general, the analysis of factor loads helps to identify crucial areas and determinants that influence the process of start-up creation and development in Poland. The clear patterns of relationships among the variables help to understand which factors are important to the development of innovative enterprises in Poland.

5. Discussion

Specialist literature points to a number of factors influencing the development of start-ups. The sources of funding are among the key factors of start-up operation. Ziakis (2022) points out the lack of funding and the high dependence of start-ups on personal capital jeopardize their success and viability. At the same time, their level of co-operation with other institutions is considered unsatisfactory, with the private sector dominating and research institutes playing a limited role. Potdar et al. (2019) stress a special role of financing business undertakings at the early stages of development. Venture capital and business angels have the greatest effect on promoting innovative entrepreneurship (Johnson, Sohl, 2012). The role of crowdfunding is rising (Sieradzka, 2023). Cash flows and holdings contribute emphatically to the productivity and profitability of businesses (Dimitropolous, 2019).

Chorev and Anderson (2006) highlight the role of the team, its attitudes and skills. They found that success factors could be grouped as critical or important. The first group categorised the idea, strategy, the core team's commitment, expertise, and marketing as critical. Important factors were deemed to be management, customer relationships, and research and development. The least important factors proved to be those external to the firm, i.e., the economy, politics, and the general business environment. The major role of human and intellectual capital in the development of innovative undertakings is also emphasised by Tavorn, Chandrachai (2020). Unger et al. (2011) point out human capital helps owners to obtain other resources, including financial and material capital, and enhances owners' capacity for discovering and using business opportunities. Mai et al. (2022) underline the important role of workers' and management's competences in the process of organisational learning, which enables a permanent and sustainable development. A study of generation Z (born in 1995-2012) in Poland, carried out by Łukasiński and Nigbor-Dróżdż (2022), suggests the young (those aged 20-40 are the most numerous among start-up founders – Raport Polskie Startupy, 2022) regard intellectual and financial capital, new technologies, and collaboration with corporations as having maximum impact on start-up development.

Ziakis, Vlachopoulou, Petridis (2022) stress the role of business environment institutions in start-up development. The most significant issues affecting the successful development of start-ups are government incentives, such as tax incentives and the acceleration of starting procedures, availability of funding opportunities, connectivity of stakeholders, entrepreneurship education, previous start-up experience, incubator support, and mentoring. Incubators (McAdam, 2008) and science and technology parks play a special role (Ratinho, 2010) in supporting the development of young, innovative economic undertakings.

6. Summary

Literature fails to offer a standard approach to either a definition or conditions of start-up development. A range of authorial definitions identify it with some characteristics including innovation, a fast rate of development, the absence of a business model or an early stage of development. Methodological problems arise not only from the lack of definition but also the different treatments of start-ups by various authors. In addition, my literature review discloses a great number of factors determining start-up development which are differently classified. Endogenous and exogenous factors are cited most commonly, related to the operation of these enterprises and to broadly-defined business environment institutions.

The author's research has identified four factors determining the development of start-ups in Poland. These include: financial capital, human capital, legislative and fiscal issues, and networking. Financial capital is the most statistically significant factor.

The conclusions of my study are important to an understanding of the processes of start-up creation and development in Poland. The results help to verify the research hypothesis and supply valuable information to the start-up ecosystem, including the institutions supporting the development of new enterprises. The snowball method proves a valuable tool of research into hard-to-access social groupings that enables more in-depth and diverse perspectives.

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IDENTIFYING DIVERSE USES OF VIRTUAL REALITY IN HIGHER EDUCATION AND EXPLORING PERCEPTIONS OF VR IN THE CHOSEN FIELD

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Purpose: This scientific paper to present the results of the research on perception of the selected university in terms of using VR. Practical research was carried out during Researchers' Night 2022 and was concerned with the perception of university by event participants who tried virtual reality at that time. The participants assessed how virtual reality workshops influenced the perception of the university.
Design/methodology/approach: The article uses the method of literature review as well as the survey, conducted during virtual reality workshops on participants of the Researchers' Night 2022.
Findings: The results of the survey provide valuable insight into the impact of VR on university perception by participants, their assessment of its attractiveness, and their preferences for VR classes. The findings show the positive influence of VR usage on the university image.
Research limitations/implications: The most important research limitation was the research sample due to the time limit as the research was conducted during the Researchers' Night which had a limited duration – VR workshops lasted 3 hours. For this reason, research is planned on a larger scale in the future. However, these preliminary studies show a highly positive trend regarding virtual reality in education.
Practical implications: The paper contains practical results of research on virtual reality perception and insights that universities can use to expand the technical infrastructure in the form of virtual reality equipment and improve the educational offer and marketing activities.
Originality/value: The paper explores the perception and feedback on virtual reality of participants in Researchers' Night 2022 after VR workshops. It presents how virtual reality affects the perception and image of the university that offers it. The article also shows the attitude of people towards the implementation of VR in education. This approach distinguishes the paper from existing literature by fulfilling the gap between theoretical discussions and practical application.

Keywords: virtual reality, VR, education, Researcher's Night.

Category of the paper: Research paper.

1. Introduction

Virtual Reality (VR) has emerged as a transformative technology, revolutionizing the way people perceive and interact with the digital world. This rapidly evolving technology enables users to experience simulated environments that engage multiple senses, blurring the boundaries between reality and virtuality. In recent years, VR has witnessed an unprecedented surge in popularity, encompassing diverse fields such as education, medicine, entertainment, training, and social interactions. By employing specialized VR headsets, users can explore virtual worlds, manipulate objects, and interact with simulated elements in a remarkably lifelike and engaging manner. VR has found applications in diverse fields, including training (Fracaro et al., 2021), healthcare (Izard, Juanes Méndez, Palomera, 2017), architecture (Dinis et al., 2020), entertainment and many more. The usage of virtual reality in entertainment can be observed on many digital platforms where users, mostly gamers, can play VR games and applications. One of the example of such platform is Steam, where the number of games is more than 126,500, and among them almost 7,000 were VR games and applications, according to Steculа's paper from December 2022 (Steculа, 2022a). The most numerous groups of VR applications on Steam include action, and subsequently casual, simulation, and adventure. On the other hand, there are puzzle, fantasy, exploration, and anime apps. With its potential to revolutionize the way we learn, work, and socialize, VR represents a gateway to a new era of immersive experiences, pushing the boundaries of human-computer interaction and paving the way for innovative advancements in various industries. VR can also be applied at universities, including technical universities (Steculа, 2019). However, this usage can on a different scale, it may concern different areas of the university's activity as well as different people.

This scientific paper aims not only to discuss the potential areas of application of virtual reality at the university, but also to present the results of the research on perception of the selected university in terms of using VR. Practical research was carried out during Researchers' Night 2022 and was concerned the perception of university by event participants who tried virtual reality at that time. The participants assessed how virtual reality workshops influenced the perception of the university.

The paper consists of 5 chapters. Chapter 2 includes methods applied in the research. Chapter 3 includes the identification and discussion of fields of virtual reality usage in the university based on the literature review. Chapter 4 describes the results of experimental research on virtual reality perception, carried out during the Researchers' Night 2022 at the Silesian University of Technology. The last chapter of Conclusions summarizes the paper and the research.

2. Materials and Methods

This study is characterized by a mixed method approach that incorporates a review of the literature and a survey. The method used in the first part of the research is a review of the literature on different fields of usage of VR. The other part of the study was carried out using the survey, conducted during virtual reality workshops with participants of Researchers' Night 2022 at the Silesian University of Technology. This part is experimental research on virtual reality perception. The survey included seven questions plus a question about the age of the participants; however, in this paper only the answers for three of them (plus the age question) are presented and analyzed. Researchers' Night participants were able to try virtual reality during the workshops, which was for 3 hours – between 5 pm and 8 pm. Participants could play various VR games and applications. All people who left the VR laboratory were asked to complete the questionnaire voluntarily. Therefore, the research sample was limited by the duration of the event. Finally, the research sample included 35 people who completed the questionnaire.

3. Fields of Virtual Reality Usage at the University

Virtual reality has a great potential to be used for different purposes and in different fields of human activity. The most popular is entertainment. VR games and applications can be found on popular international digital platforms, in addition to regular games. Additionally, some games are dedicated in different modules, for example, the computer module but also a VR module. In the literature, there are many papers that discuss applying VR, despite entertainment, in the following: medicine (Li et al., 2017), architecture (Bashabsheh, Alzoubi, Ali, 2019), psychology (Parsons et al., 2017), military (Pallavicini et al., 2016), aviation (Fussell, 2020), rehabilitation (Smits, Staal, Van Goor, 2020), manufacturing (Roldán et al., 2019), automotive industry (Lawson, Salanitri, Waterfield, 2016), tourism (Beck, Rainoldi, Egger, 2019), marketing (Ozdemir, 2021), in therapy (Caponnetto et al., 2021), to overcome depression (Baghaei et al., 2021), and many others.

The investigation, presented in this chapter and subchapters, aims to discuss the roles that virtual reality can play in different fields of university's activity, contributing to a comprehensive understanding of its impact within the university environment. Based on the literature review and the author's own experience, the use of virtual reality at the university can be considered broken down into the following fields:

- education,
- training for academics,
- university marketing,
- occupational and safety training,

and others.

The following sections discuss each area of application of virtual reality at the university.

3.1. Education

Virtual reality can improve traditional teaching methods by providing immersive and interactive experiences. In order to conduct classes in the virtual world, it is necessary to develop a given subject from scratch. Then, it is necessary to identify learning outcomes. They can include improving the understanding of complex concepts, improving practical skills, or providing unique experiences. The content of the classes should be carefully planned. Other aspects to consider include the outline of classes, learning outcomes, the method of verifying the knowledge acquired by the students, and many similar aspects related to the preparation of the subject. It should also be noted that a very important element is to write class scenarios or select VR content, applications, or experiences that align with learning objectives. There are various VR platforms and educational applications available (di Lanzo et al., 2020), covering a wide range of subjects and topics; however, the more professional way would be to create the dedicated educational application from scratch. There are many companies on the market that can prepare virtual reality applications dedicated to a given subject, according to the teacher's need. VR can be used to conduct classes in the virtual world in its entirety, but also partially support them (Stecuła, 2019). It can be used for subject-specific simulations, virtual field trips, and hands-on training in various disciplines. Figure 1 shows screenshots of different practical virtual laboratories used in mechanical engineering courses showing traction machine, Rockwell hardness tester, and industrial radiology equipment from a paper of (Vergara et al., 2022).

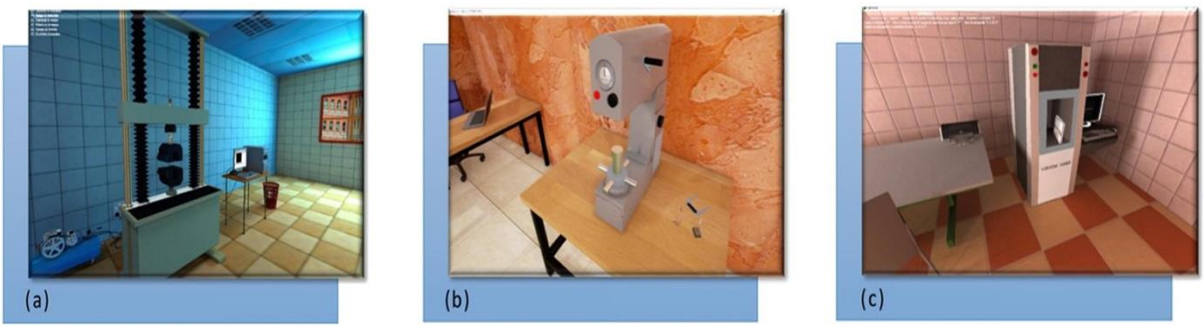

Figure 1. Different practical virtual laboratories used in mechanical engineering courses showing the following machines: a) traction machine, b) Rockwell hardness tester, c) industrial radiology equipment. Source: (Vergara et al., 2022).

Another element connected with virtual reality is the VR headset and controllers (Angelov et al., 2020). To conduct virtual reality classes, the appropriate equipment must be purchased. On the market, there are many headsets available to users all over the world. The most popular headsets include the following: HTC Vive (Pro), HTC Vive Cosmos, Oculus Rift, Oculus Rift S, Oculus Quest, Oculus Quest 2, Valve Index HDM, Windows Mixed Reality, Sony PlayStation VR and many more (Valve Corporation, 2022). Lately, VIVE XR Elite were released in March 2023 (HTC, 2023b). Depending on the size of the groups, the university must decide how many virtual reality headsets it can purchase, considering that VR equipment is not cheap. Some academics set up virtual reality laboratories with multiple workstations (Zhang et al., 2018); however, it is not yet a common phenomenon. It should also be mentioned that there are many suppliers of virtual reality equipment on the market and the equipment differs in quality, cost, parameters, and elements of equipment.

It should also be remembered that the purchase of virtual reality equipment is not an investment for years because the modern technology industry is very changeable, and the technology that was on top, for example, 3 years ago, has now found its replacement. On the example of HTC Corporation, the following models were released in the following years: HTC Vive (2016), HTC Vive Pro (2018), HTC Vive Pro Eye (2019), Vive Cosmos (2019), Vive Focus (2019), Vive Focus Plus (2019), Vive Cosmos Elite (2020), HTC Vive Pro 2 (2021), Vive Focus 3 (2021), Vive Flow (2021), and Vive XR Elite (2023) as the newest (HTC, 2023a). Figure 2 shows some VR headset models from HTC Corporation.

Figure 2. Selected VR headset models from HTC Corporation.

Sourve: own preparation based on: (VRcompare, 2023).

Another important issue is also preparing the teacher to conduct classes in virtual reality, because not every lecturer has the knowledge and skills to conduct classes in such a modern style and with the usage of new technology. Preparing teachers to effectively conduct classes in virtual reality (VR) is a crucial aspect of integrating this modern technology into education. By providing adequate support, educational institutions can empower teachers to conduct classes confidently and effectively in virtual reality, ensuring successful integration of this modern teaching approach into the study program.

Universities should also pay great attention to safety issues during classes conducted in the virtual form. Ensuring the safety of both students and teachers is crucial. Efficient safety measures must be taken to protect participants from potential risks associated with immersive environments. There are many dangers to which VR user can be exposed. Generally, they can be divided into physical (for example hitting a wall, falling or getting tangled in a cable) and psychological (for example, stress, pression, isolation) (Stecuła, 2022b). Regular assessments of VR content for age-appropriateness, motion sickness prevention, and following ethical guidelines are essential. Additionally, educators must be trained to monitor and address any discomfort or distress experienced by students while engaged in virtual activities, promoting a secure and conducive learning environment.

Last but not least, it should be noted that VR promotes active learning by necessitating engaged participation and cultivating critical thinking (Fabris *et al.*, 2019). VR-based lessons require students to take an active role, forcing them to make informed decisions, solve complex problems, and often collaborate with peers within the immersive digital world. This interactive nature of VR not only stimulates cognitive processes, but also improves memorizing and then applying knowledge. Learners are encouraged to explore, analyze and manipulate virtual scenarios and due to this, develop a deeper understanding of the subject matter through direct experience (Hussein and Nätterdal, 2015). This active engagement results in a more dynamic and effective educational experience, where students become proactive learners rather than passive recipients.

3.2. Trainings for Academics

Another way to use virtual reality is for academic training. Universities should consider developing training programs to enhance skills and professional development of academics. The first type can be pedagogical training. It could include workshops and courses focused on teaching methodologies, study program design, assessment strategies, active learning techniques, and effective classroom management. Such an interactive training would bring many positive results for teachers. A similar type of training would be training to increase competences in the field of mastering online tools used for teaching. It can refer to the use of educational technology tools, online learning platforms, and multimedia resources.

Communication training would certainly help scientists work better with students and other academic teachers. Virtual reality training in this area would offer the enhancement of effective communication, presentation skills,, and public speaking skills which is important especially in relation to giving interesting lectures (Khan et al., 2017). It should be noted that sometimes teachers must deal with the difficult or challenging behavior of students. The results from the paper of Chen (Chen, 2022), revealed that the immersive VR training experience improved the speed and effectiveness of the participants' (they were preservice teachers) management of challenging behaviors of students and it enabled the teachers to transfer all of they learned to an actual classroom setting. Due to training, teachers were more confident in halting

challenging behaviors by approaching students, taking appropriate actions, and using oral commands.

In addition, effective communication skills empower academics to share knowledge, collaborate, mentor, and contribute meaningfully to their field and society. They enable academics to bridge gaps between experts and non-experts, fostering a greater understanding of research and its implications. This, in turn, concerns another type of training, which is research skills training. Universities should consider VR workshops on research methods, data analysis, grant writing, literature review techniques, academic writing, and publishing in peer-reviewed journals. This is highly important for academic teachers as well as for the entire university. Supporting academic staff in this regard would be beneficial to both.

As academics participate in VR training, they unlock a sphere of possibilities that go beyond traditional teaching and research methodologies, shaping the future of education and scholarship. Additionally, VR training lets academics explore new research paths, enhancing their ability to investigate complex phenomena and contribute to cutting-edge advancements in their respective fields.

3.3. University Marketing

Virtual reality can be a powerful tool for the marketing of a given university. There are many ways to use it. First, the university can develop special 360-degree movie for the VR headset, available on the Internet, which presents the entire campus, its location, dormitories, and other elements such as offer, student events, benefits of studying in the given faulty, and other advantages. Through VR, potential students can virtually explore campus facilities, academic departments, student accommodation, recreational spaces, and other key areas. Such movies allow them to "walk" around the campus, interact with virtual guides, and gain a realistic sense of the university's atmosphere and environment. VR can also showcase special events, student activities, and campus life, providing a comprehensive preview that helps potential applicants make informed decisions about their educational journey. This type of modern marketing can attract many future students, because generation Z searches for information on the Internet (Desai, Lele, 2017), and videos and photos attract attention and allow to remember things that one saw to a greater extent than what one read. Young people often make decisions based on information found on the Internet, which is an inseparable element of the life of the modern generation. According to research by Shen et al. (Shen et al., 2020), in which many future students experience a virtual reality tour through the university campus, telepresence is positively correlated with intentions to recommend the visited campus to others. Therefore, the opportunity to visit the university campus would certainly attract many new students, allowing the university to develop and increase its market position.

Another way to use virtual reality for university marketing is to provide VR equipment for visitors (future students and their relatives) during various events, for example, open days of the university. Virtual reality can be used to present the campus and the university's offer to visitors if the university has a movie or application like this. Additionally, virtual reality equipment can be presented as one of the technologies that are used at the university during classes. Showing something attractive like a new educational application to future students is certainly very beneficial for visitors and especially for people who want to decide whether to study at a given university. Modern technologies and their presentation during important university events certainly contribute to improving the image and the attractiveness of the university. This innovative use of VR not only shows the university's commitment to modern technology but also enriches the open-day experience, leaving a lasting impression on potential students as they start a new phase within education.

3.4. Occupational and Safety Training

Virtual reality creates the opportunity to conduct health and safety training. In the university, both staff and students must undergo occupational health and safety training (OHS). On the market, companies offer applications that allow participants to be trained in this field. An example of a company that offers services for the preparation of a dedicated virtual reality application is Epic VR (EpicVR, 2022). This company developed an application for a production company with four modules that contain the following areas: occupational health and safety engineering, hazards within production plants, personal protective equipment (PPE) and fire hazard. Figure 3 shows a screenshot of the mentioned application – the moment of putting out a fire. The company offers the service of developing different types of applications; therefore, ordering a dedicated application written for a given scenario is possible. On the market, there are more and more companies offering such a service.

Figure 3. A screenshot of the occupational health and safety training by EpicVR.
Source: (EpicVR, 2022).

OHS training in virtual reality offers several advantages. Firstly, it provides a safe and controlled environment for employees to perform hazardous tasks without exposing them to real-world risks. Secondly, VR allows for realistic simulations of various workplace scenarios, enhancing employees' situational awareness and decision-making skills. Thirdly, interactive VR training promotes active learning and engagement, increasing knowledge retention and skill development. Additionally, VR can be easily adapted to cater to different industries and job roles, making it a versatile and scalable solution for OHS training. Lastly, by reducing the need for physical training equipment and space, VR training can lead to cost savings for organizations while ensuring effective OHS preparedness.

3.5. Other Fields

Virtual reality can also be used in other than the mentioned fields of university activity. Beyond educational purposes, universities can offer VR experiences for entertainment and relaxation, enhancing campus life and student engagement. Making virtual reality available to students, for example, in student zones or in relaxation zones, would certainly be a great benefit to the well-being and comfort of students and the university image. The application of virtual reality continues to expand, offering universities innovative ways to enhance education, research, and various aspects of campus life. Moreover, VR can create interactive fitness and training experiences. On the one hand, the use of VR sports application can allow students and employees to move after sitting for several hours in class, which is good for their health, both body and mind. On the other hand, virtual reality can also be used in physical education classes. It should be mentioned that according to research of Stecuła's (Stecuła, 2022a), the sport application called Walkabout Mini Golf VR got the highest score (ex aequo with a shooter Half Life: Alyx) of all VR applications available on the Steam platform (data from 2022). It got an "overwhelmingly positive" status, receiving 98% positive reviews from users all over the world. Figure 4 shows a screenshot of this application.

Figure 4. A screenshot of the Walkabout Mini Golf VR application.

Source: (Valve Corporation, 2023).

Furthermore, there is a huge potential to use VR in the social area of the university. Virtual reality can revolutionize the social area of the university, offering students unique and immersive experiences that enhance social connections and engagement. If developed, VR can facilitate virtual meetups, clubs, and interest groups, allowing students, but also workers, to socialize and collaborate (Zhaparova et al., 2023). Additionally, according to Schutte and Stilinović (Schutte, Stilinović, 2017), VR can facilitate experiences that promote empathy and perspective-taking, allowing people to better understand diverse perspectives and social issues. What is more, virtual reality can be used for therapy (Boeldt et al., 2019; Caponnetto et al., 2021), stress reduction (Kamińska et al., 2020; Lyu, 2021), and cognitive rehabilitation (Rizzo, Buckwalter, Neumann, 1997).

The usage of virtual reality depends on the needs, will, and limitations of imagination. Technology offers many possibilities in various fields, from education and training to entertainment, healthcare, research, and beyond. It allows one to create and experience virtual worlds, scenarios, and simulations that were unimaginable years ago. As VR continues to evolve and become more accessible, its potential to change the way people work, study, and even live grows. Virtual reality can unlock new ways of learning, communicating, collaborating, and exploring, shaping a future where the limits of human experiences are expanded. The possibilities are great, and the limitation is people's willingness to explore this cutting-edge technology.

4. Perception of Virtual Reality: A Study from Researchers' Night 2022

This chapter and its subchapters describe the results of research that concern one of the above-mentioned fields of application of virtual reality at the university. The author conducted research on the perception of virtual reality in the field of university marketing.

4.1. Experimental Framework and Research Trial

On October 8, 2022, Researchers' Night took place at the Silesian University of Technology (SUT), at all of the faculties. Researchers' Night is an initiative organized by the SUT as part of the nationwide event. It is a special night dedicated to the presentation of the popular science of various fields of science and the achievements of scientists and researchers from the university. During this event, laboratories are opened, workshops, lectures and presentations are conducted, aimed at bringing the public closer to various scientific issues and inspiring interest in science and technology. This event is also an opportunity to meet scientists, ask questions, and participate in interactive experiences, helping to promote scientific and educational awareness.

The author prepared a virtual reality laboratory that was exposed to be visited by the participants of the Researchers Night. Anyone willing could personally try virtual reality and experience an unforgettable immersion. The opportunity to try virtual reality took place between 5 pm and 8 pm. During this time, participants could play various VR games and applications. Then, all people who left the virtual reality laboratory were asked to fill out the questionnaire voluntarily. Therefore, the research sample included people who used virtual reality in the given laboratory during the event and decided to complete the survey immediately after leaving the laboratory.

Due to the fact that the event lasted three hours, the number of people who were able to try VR and participate in the study was limited. Because within three hours it is not possible for a very large group of people to experience virtual reality, the research trial was limited. Finally, the research sample included 35 people who decided to complete the questionnaire. 54% of them were under 18 years old, 29% were between 19 and 35 years old, and 17% were 36-60 years old. No one was older than 60 years. The data are presented in Figure 5.

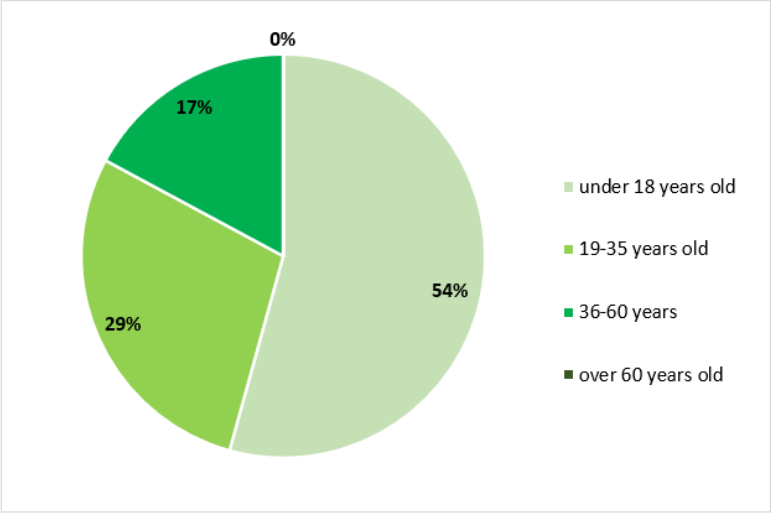

Figure 5. Age of the participant (results rounded to full values).

4.2. Survey Results

Participants were asked if virtual reality workshops influenced the perception of the university they visited. The results showed that 69% of the participants selected the answer ‘yes, very positively’, while 20% indicated ‘yes, quite positive’. This implies that nearly 90% of the respondents acknowledged a favorable effect of VR usage on the university image. No individuals endorsed a negative impact response (‘yes, quite negatively’ or ‘yes, very negatively’). The remaining 11% stated that VR had no influence on their university perception. The results were rounded to full values. The data are presented in Figure 6.

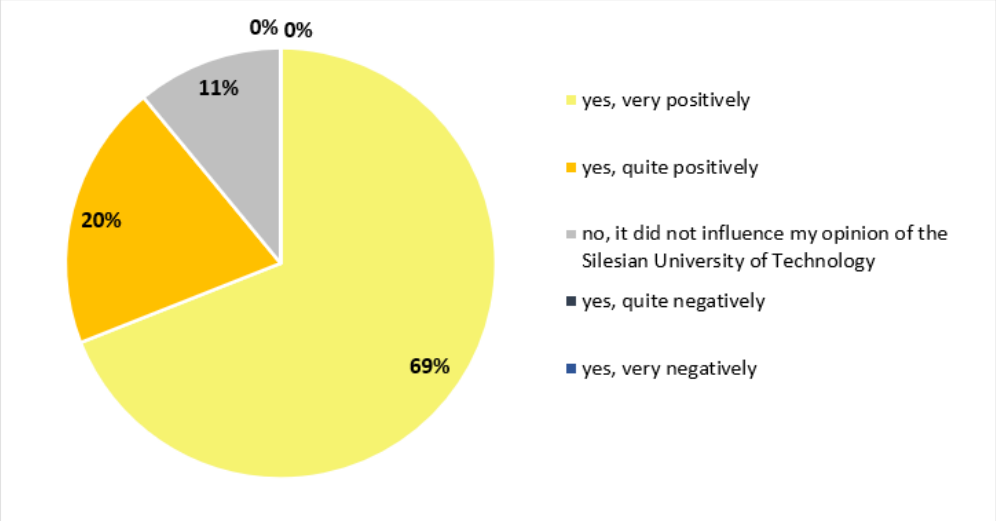

Figure 6. Answers to the question 'Has the virtual reality workshop influenced your perception of our university?' (results rounded to full values).

In the next question, participants had to specify, on a scale of 1 to 5, whether the virtual reality show or workshop made the university more attractive to visitors. 1 stood for 'not at all', and 5 – 'yes, very much'. More than three-quarters of the participants (77%) awarded the highest score of 5 points. Meanwhile, 11% assigned 4 points, and the intermediate value of 3 points was selected by a mere 6%. A smaller percentage, specifically 3% of respondents, allocated 2 and 1 point, respectively. In the case of the answer to this question, the median was 5, and the arithmetic mean was 4.57. The data are presented in Figure 7.

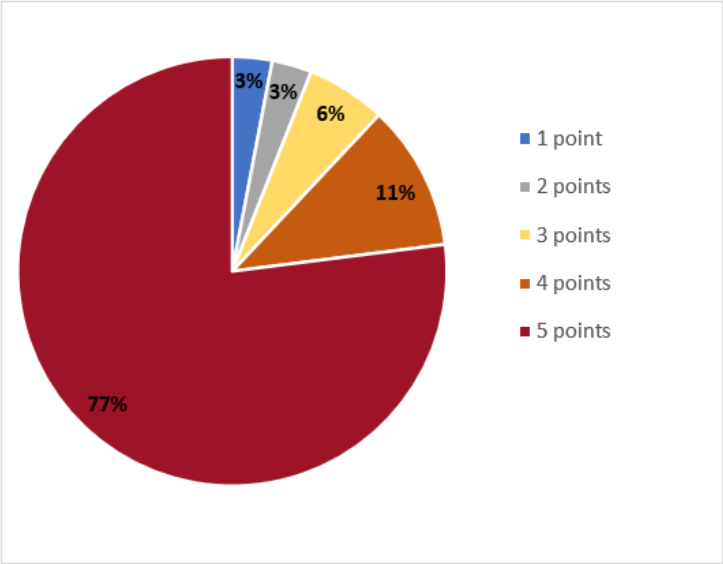

Figure 7. Answers to the question 'Did the virtual reality workshop make the university seem more attractive (1-not at all, 5-yes, very much)?' (results rounded to full values).

In the next question, participants were asked to express their preference for classes using virtual reality. They were asked to rate the level of attractiveness of these classes on a scale ranging from 1 to 5, where 1 signified 'no, not at all' and 5 – 'yes, very much'. A significant majority of participants, comprising 86%, rated this concept with a 5-point evaluation,

while 9% rated it 4 points. This indicates that nearly all participants expressed a highly positive view regarding virtual reality and its application in university class settings. Among the survey respondents, 3% assigned 3 and 2 points, respectively, and no participants gave a 1 point. The data obtained, the median was 5, and the average value was 4.77. The data are presented in Figure 8. The average rating for this question is higher compared to the previous one, indicating that while participants had highly positive evaluations in both cases, classes enriched with virtual reality garnered even higher scores than the university's attractiveness perception through virtual reality.

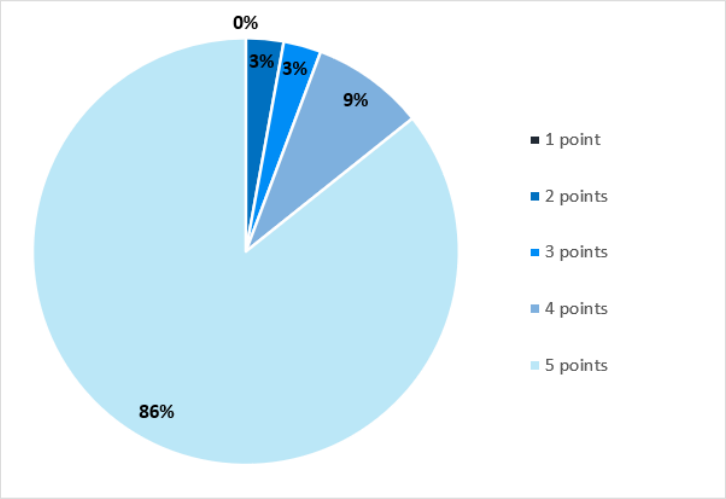

Figure 8. Answers to the question 'Would classes using virtual reality seem more attractive to you (1 - no, not at all 5 - yes, very much)?' (results rounded to full values).

5. Conclusions

The paper discusses the multiple applications of virtual reality within the university environment. In the first part of the research, it focuses on exploring the roles of VR in the university, dividing the possible use of it into the following fields: education, training for academics, university marketing, occupational and safety training, and others. Education can benefit greatly from virtual reality's immersive and interactive experiences, transforming traditional teaching methods into innovative ones. From developing subject content to identifying learning outcomes for classes using VR, careful planning and alignment with educational objectives are key. Integration of VR into classrooms enables active learning, critical thinking, and practical skill enhancement. Moreover, virtual reality expands the possibilities of training academics in diverse areas, including pedagogy, communication, research skills, and the mastery of online tools. These trainings equip academics with the necessary skills for effective teaching and contribute to their professional growth. Virtual reality can also serve as a tool for university marketing. Through 360-degree videos and

VR experiences, potential students gain insight into campus life, facilities, and student activities. Through this, universities can engage potential applicants and shape their decisions. The use of VR during open days enhances the university's image and modernizes its informational efforts. Additionally, VR finds its place in occupational and safety training, offering a controlled environment for people to simulate hazardous tasks, improve situational awareness, and promote active learning.

The second part of the research focused on examining the perception of virtual reality in a selected area. Survey research was carried out during Researchers' Night 2022 while the workshop on virtual reality took place. People who tried VR were encouraged to participate in the survey. The results of the survey provide valuable insight into the impact of VR on university perception by participants, their assessment of its attractiveness, and their preferences for VR classes. The findings show the positive influence of VR usage on the university image, as nearly 90% of the respondents recognize the favorable impact of VR on the university image. The subsequent questions based on the answers on the scale from 1 to 5. The first of them referred to the attractiveness of university in the context of using VR by it. 77% of the participants awarded the highest rating of 5 points, 11% – of 4 points, 6% – of 3 points, and 3% – both, of 2 and 1 points. The mean score stood at 4.57, suggesting a general tendency towards a positive impact on the university's attractiveness due to VR initiatives. The last question prompted participants to express their preference for virtual reality-based classes. 86% assigned the highest rating of 5 points, while 9% gave 4 points. This trend highlights the overwhelmingly positive attitude of participants towards incorporating virtual reality into university class settings. It should be noted that no one selected the lowest score of 1 point. The calculated average value was 4.77. The average rating for this question surpassed that of the previous question, suggesting that participants evaluate VR classes even higher compared to the impact on the university's overall attractiveness through VR.

In sum, the survey outcomes indicate the highly positive participants impressions toward virtual reality's integration within the university context. These findings emphasize the potential of VR to not only enhance the university's image and attractiveness, but also significantly increase the effectiveness of education. As technology continues to evolve, these results encourage further exploration and integration of virtual reality to enrich various areas of university life. The transformative potential in education, research, and daily life remains great. By using virtual reality's capabilities, universities can shape a future where learning, collaboration, and innovation have no limits.

Future research directions should focus on the ways virtual reality is used for educational purposes within the university environment. This includes conducting more extensive studies on the development of educational applications, the effectiveness of VR-based teaching methods, exploring the impact on different learning styles and subjects, and investigating the potential of VR to be used in various university courses. Much practice should be put into supporting regular classes with VR. Furthermore, research can focus on the development of

standardized guidelines and best practices to integrate virtual reality into university curricula. This would help to ensure consistency and quality in the use of VR in different academic disciplines and institutions. It should also be noted that as technology advances, educational methods must also evolve to remain effective and engaging. Virtual reality offers a promising way for this transformation, providing a dynamic and immersive educational experience that aligns with the changing needs and expectations of students and educators.

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APPLICATION OF BLOCKCHAIN TECHNOLOGY IN THE ENERGY SECTOR

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Purpose: The reason for writing the paper is growing complexity of management of the electric grid. Our collective electric system faces accelerating, multi-dimensional needs that must be addressed to deliver to our communities.
Design/methodology/approach: The supply, transmission, distribution, and consumption of electricity are closely coupled, and must be actively coordinated. This requires the coordinated sensing, measurement, and control of devices and systems spread across the grid. This paper assesses the suitability of blockchain for this purpose, as a platform for transactive energy.
Findings: Blockchain technology can facilitate secure and transparent record-keeping and transactions and thus may have many potential applications in the energy sector.
Practical implications: Blockchain technology is still evolving and faces some challenges, such as scalability, interoperability, regulation, and adoption. However, blockchain has the potential to revolutionize the energy sector by transforming the way energy is produced, distributed, consumed, and traded.
Social implications: High electricity demand, aging power grids, and climate disasters are straining our current energy system. As a result, more people are looking to optimize energy usage—and transactive energy may offer an answer. A Blockchain-enabled transacted energy framework can help everyone from consumers to corporations benefit from improved energy efficiency and profit in the process.
Originality/value: Distributed energy resources, such as energy efficiency, smart demand response, smart electric vehicle charging, building-level energy storage and distributed solar photovoltaics, become more critical every year. Review of recent papers on these issues may be a valuable source of knowledge for interested parties.

Key words: Blockchain, power grid, smart grid, energy.

Category of the paper: Literature review.

1. Introduction

In 2023 the Institute of Electrical and Electronics Engineers (IEEE) - the world's largest technical professional organization, published a 'Guide to Transactive Energy: What Everyone Needs to Know' (IEEE, "Guide to transactive energy", 2023). In this Guide the concept of transactive energy was introduced since …"High electricity demand, aging power grids, and climate disasters are straining our current energy system. As a result, more people are looking to optimize energy usage—and transactive energy may offer an answer".

First, the outdated nature of legacy grid systems were described in the Guide as follows: "Over the past century, utility companies built electrical grid systems to serve as large generation hubs for certain geographies. These entities operate using a centralized model and are typically responsible for all aspects of managing and provisioning energy. Legacy grid systems are inefficient and costly. Furthermore, it's clear that our current power grid model is under a great deal of stress. Electrical grids operate using fragile, outage-prone lines that can fail when they take on too much power, or when disasters occur, such as floods and heavy storms. Due to the centralized nature of a legacy system, if one component fails, the entire infrastructure can suffer. Legacy grid operators use strict processes to ensure that plants generate the right amount of electricity at the right time to meet demand. However, intermittent renewable output disrupts this planning process, making it difficult to incorporate sustainable energy. In the past, the idea that someone could generate kilowatts of electricity using a device on their roof was unfathomable. However, these technologies are now a reality".

Finally, after defining what are transactive energy systems, the advantages and challenges of their implementation were presented as follows: "Transactive energy systems make it easier for anyone to trade and sell energy, whether they are an individual consumer, a micro-grid, or a major power company. Although this system promotes energy efficiency, it also faces significant implementation challenges. Advantages of Transactive Energy. Electrical grids distribute electricity from energy producers (large utility companies) to consumers using a traditional centralized infrastructure. Transactive energy enables decentralization, where multiple groups can produce their own energy at a local level, relying on a series of smaller devices and power grids instead of a central hub. As the legacy grid framework ages, transactive energy systems may be the future of energy. And the benefits of distributed energy resources, a variety of small, system-connected devices and virtual assets that work to provide services to the energy grid—are far reaching. A decentralized energy infrastructure can unlock several important benefits. Transactive Energy Challenges (IEEE Implementation challenges, 2023). However, there are some implementation challenges that are important to understand. Utility business models will need to evolve for transactive energy to work. Current systems rely on a centralized grid that supplies electricity to all consumers in a certain area. The utility primarily controls the excess energy and does not engage in two-way transactions. Evolving

these systems will require significant effort, incentives, and consistent standards. Security issues may arise (IEEE Security, 2023). Cybercriminals can harm transactive energy systems by manipulating energy requests, siphoning excess power, and injecting false data that prevents successful transactions. Strong security protocols are necessary to prevent cybersecurity threats. Transactive energy systems require distributed energy resources. Installing these resources requires time, money, and labour investments, which can pose barriers to adoption. All devices in a transactive energy system must be able to perform autonomous computing functions and communicate with one another to exchange data. This can be difficult to accomplish in a decentralized environment. However, distributed ledger technologies, such as Blockchain, can help enable these capabilities" (Zia et al., 2020).

Benefits of Distributed Energy Resources: Shifting the Energy Landscape

Transactive energy enables everyone to participate in the energy economy. Homeowners can install small devices like rooftop solar panels to generate electricity and engage in bidirectional energy transactions. The market has many devices ready to take advantage of transactional energy, such as smart fridges or outlets that are part of the Internet of Things (IoT) ecosystem (IBM, 2023). Many IoT-connected devices can be adjusted so that they consume energy at the most cost-efficient times. Transactive energy promotes resilience (Bhattarai et al., 2019). If one part of a centralized energy system suffers damage, the whole system could fail. With a decentralized framework, only the affected infrastructure suffers an outage. The length and frequency of power outages may decrease. Transactive energy can enable a more efficient balance between supply and demand, ensuring that consumers use energy at optimal times and levels.

In this paper a concise review of the electric power system and differences between traditional power grid and smart grid is presented followed by a description of key technology trends in transactive energy applying distributed energy resources and, first of all, how the blockchain technology may be applied in energy trading.

2. Methods and Results

2.1. Electric power system

According to Edvard Csanyi from the Electric Engineering Portal (Csanyi, 2017) an electric power system is a network of electrical components that generate, transmit and distribute electricity to consumers and industries. It consists of three main parts: power generation, transmission and distribution. Power generation converts the energy stored in fuels or renewable sources into electrical energy. Transmission systems carry the electricity over long

distances using high-voltage lines. Distribution systems deliver the electricity to the end-users using lower-voltage lines. Power generation is the production of electricity at power stations or generating units where a form of primary energy is converted into electricity. Power plants convert the energy stored in the fuel (mainly coal, oil, natural gas, enriched uranium) or renewable energies (water, wind, solar) into electric energy. Power from generation plants is carried first through transmission systems, which consist of transmission lines that carry electric power at various voltage levels. A transmission system corresponds to a networked, meshed topology infrastructure, connecting generation and substations together into a grid that usually is defined at 100 kV or more intermediate steps at which the voltage is converted down (transformed) to lower levels. The electricity flows over high-voltage (HV) transmission lines to a series of substations where the voltage is stepped down by transformers to levels appropriate for distribution systems. Distribution finally delivers the power to the final loads (a majority of which are supplied at low voltage) via intermediate steps at which the voltage is converted down (transformed) to lower levels. The distribution system ends up at the energy consumption points or loads where power is used for its final purpose (see Figure 1).

Edvard Csanyi considers the distribution segment of the electric power system as the most challenging part of the smart grid due to its ubiquity.

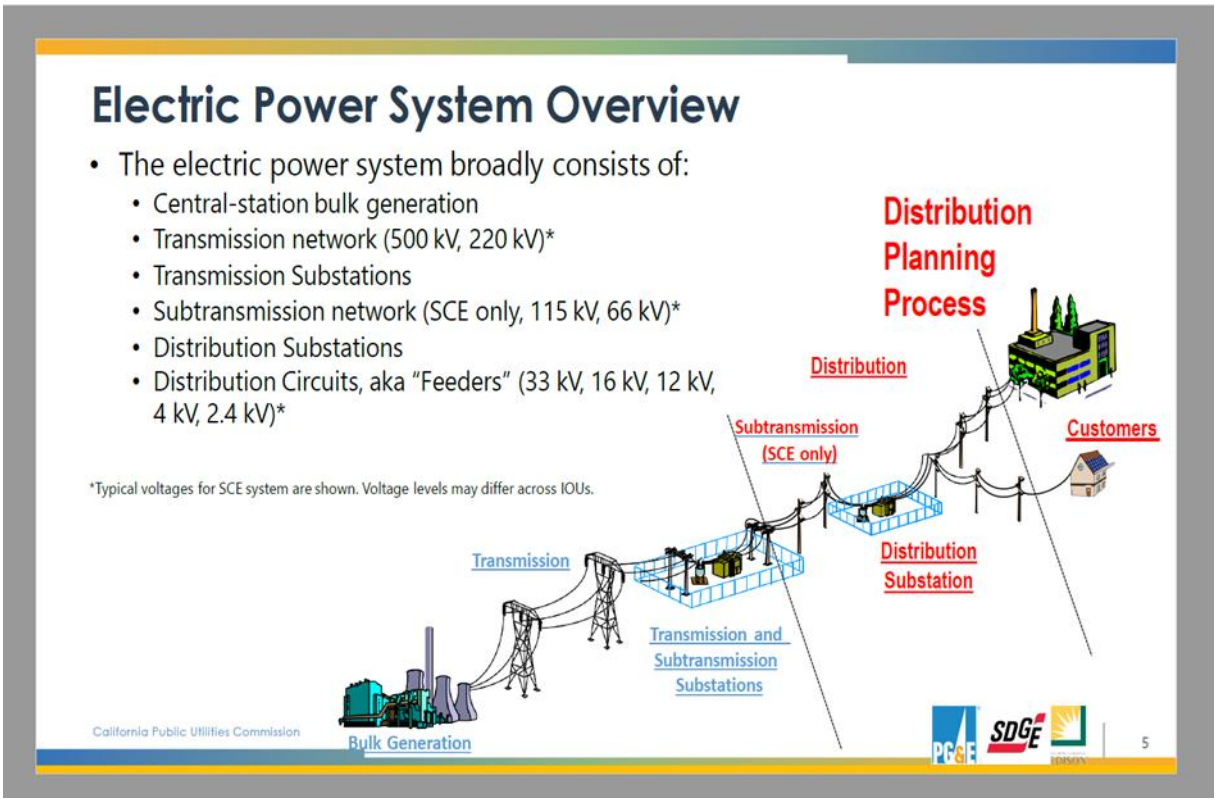

Figure 1. Structure of an electric power system.

Source: The California Public Utilities Commission. San Francisco, April, 21, 2022www.cpuc.ca.gov.directionplan.

2.2. Smart grid

Basic details of the smart grid technology and its applications as well as differences between traditional power grid and smart grid are concisely presented in papers by Ahmed F. Sheikh on the Electrical Academia Portal (Sheikh, 2016). Smart Grid is the name of the communication between the utility and the consumer. A smart grid is a powerfully manufactured plant that consists of computer programming, digitalization, automation, and control analyst that performs a two-way communication between the power provider and the consumer. If electricity system fails in a standard power grid system, the service provider will only come to know about the issue once the consumer calls and lodges a complaint. But in the smart grid system, as soon as the grid shuts down, the service provider will be notified and not just he but it will also provide data from the transmission lines, transformers, and distribution centres along with the home supplies, all will be notified at once. The smart grid is capable to monitor activities of the grid-connected system, consumer preferences of using electricity, and provides real-time information of all the events. The key components of smart grid include smart appliances, smart substations, smart meters, and advanced synchrophasor technologies, i.e. time-synchronized electrical measurements that represent both the magnitude and phase angle of the electrical sinusoids. (Application of…, 2023). Development of the smart grids has led to many changes in the current power grid structure. Application of new devices, technologies, renewable energy resources, and electric vehicles increases the need for decentralized energy management and the data transactions, i.e., the secure and economic transactions are realized through the decentralized networks (see Figure 2).

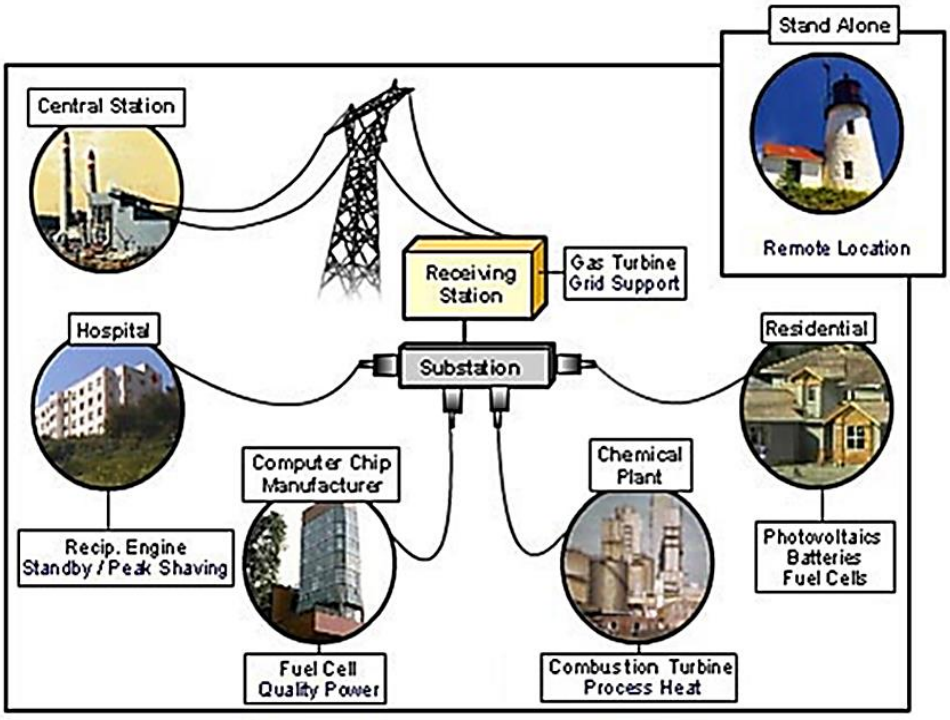

Figure 2. Types of distributed energy resources and technologies Image courtesy of the California Energy Commission.

Source: https://www.wbdg.org/resources/distributed-energy-resources-der#A.%20Der%20Taxonomy.

Authors of a recent comprehensive literature review (Hasankhani et al., 2021) observed that "the future of the smart grid considering the energy industry is very complicated, and the development of uncertain renewable resources, in addition to the rising cost of smart grid systems, has led to changes in the present networks. Therefore, Blockchain technology can be considered as an appropriate option due to these modifications. A Peer-to-peer approach for smart grids can support the renewable energies and provide economic benefits for both the consumers and the prosumers. However, the rapid development of Blockchain and the promising perspective of peer-to-peer based smart grids requires a careful study and a proper structure design".

3. Blockchain technology in the energy sector

Applying the Microsoft's Bing platform the following concise description of the application of Blockchain technology in the energy sector was received: "Blockchain technology is a form of distributed ledger technology that can facilitate secure and transparent record-keeping of transactions. Blockchain has many potential applications in the energy sector, such as energy trading, energy management and energy security. Energy trading: Blockchain can enable peer-to-peer energy trading between consumers, producers, and grid operators, without the need for intermediaries or centralized authorities. This can reduce transaction costs, increase efficiency, and empower participants to have more control over their energy usage and generation. Energy management: Blockchain can help improve the management of distributed energy resources, such as solar panels, batteries, smart meters, and electric vehicles. Blockchain can provide real-time access to energy data, transparent recording of energy transactions, and an immutable record of greenhouse gas emission savings. Energy security: Blockchain can enhance the security and reliability of the energy grid by preventing cyberattacks, fraud, and tampering. Blockchain can also enable smart contracts, which are self-executing agreements that can automate energy transactions based on predefined conditions. Blockchain technology is still evolving and faces some challenges, such as scalability, interoperability, regulation, and adoption. However, blockchain has the potential to revolutionize the energy sector by transforming the way energy is produced, distributed, consumed, and traded". Hadi Ganjineh most recently described examples of Blockchain disruption in transforming the energy industry with transparency, efficiency and decentralization (Ganjineh, 2023).

3.1. Suitability of Blockchain technology as a platform in energy sector

Ben Hertz-Shargel and David Livingston. representing the Atlantic Council, published in 2019 a comprehensive report on the suitability of blockchain applications in transactive energy (Hertz-Shargel, Livingston, 2019). This report assessed the suitability of Blockchain as a platform. It performed "a first principles analysis of Blockchain's technical attributes in order

to align them with the expected needs of a transactive market, regardless of its precise design." In the opinion of the authors … "while Blockchain has many other potential energy-relevant applications for which it may be a far more logical and valuable tool, this does not currently extend to serving as the key platform for transactive energy markets. This conclusion resulted from the identification of a fundamental trade off, in which Blockchain's disintermediation of a central authority is achieved at the expense of six costs: (1) Efficiency, (2) Scalability, (3) Certainty, (4) Reversibility, (5) Privacy, and (6) Governance". Hertz-Shargel and Livingston consider that ... "the upside of this Blockchain trade-off has questionable value, and viability, in the context of transactive energy as there exist natural central authorities: public utility commissions, which have statutory authority over retail energy, and the electric utilities they oversee, which are tasked with ensuring the safe, reliable, and efficient operation of the electric distribution system".

3.2. Blockchain-enabled transacted energy (BCTE)

Within the frames of IEEE activities in the same year 2019 Muhammad F. Khan Sial, published a paper entitled: 'Blockchain Technology – Prospects, Challenges and Opportunities' (Khan Sial, 2019) in which key trends in transactive energy were discussed. In particular, the issue of how Blockchain technology may be used in energy trading was described as follows: "Blockchain-enabled transacted energy (BCTE) is a technology that has the potential to create an open, trusted, and transparent energy marketplace. This is important to society as it has the potential to lower the cost of renewable energy investments, improve our ability to combat climate change, encourage more participants into the renewables market, and increase the amount of innovation through transparent standards and access to the grid. Blockchain utilizes technologies like, distributed consensus mechanism, digital signature and cryptographic hash. The key strengths of this technology are that the records are reliable, persistent, auditable, anonymous and decentralized. To keep data secure, Blockchain systems store information using cryptography, requiring keys and signatures from users in order for them to access data. These capabilities help meet the strict regulatory requirements of various geographies, facilitating a path to transactive systems. This technology can help devices speak to each other and with the power grid while devices assess the availability and usage of energy". Later, in 2021, the IEEE has initiated a Blockchain-enabled Transactive Energy (BCTE) program. The program's Position Paper (IEEE Position & Vision Statement Paper v. 3.0, 2021) describes the basic framework and principles for using Blockchain technology in power and energy domains with the emerging participatory grid. A key goal is the development of the most promising global Transactive Energy use cases which can be advanced toward broader commercialization using Blockchain technology. This IEEE Position Paper describes potential Blockchain-Enabled Transactive Energy (BCTE) methods that can enable an economically driven, democratized, efficient energy production and market process for highly transparent yet secure distributed energy trading. While not exclusively required to implement Transactive Energy based solutions, the use of Blockchain removes some of the fragility and market

domination of the traditional central generation and radial distribution grid paradigm. One can read in the Position Paper that it … "describes the IEEE initiative's goal to create a system architecture, and pursue certain real world demonstrations that will be used to inform the IEEE standardization efforts, and to advance other business model development activities. Furthermore, a set of selected use case demonstration projects and techno-political analyses covering the legislative and regulatory issues associated with these instantiations of Blockchain technology are planned to be developed within the scope of the framework. Lastly, the initiative serves to provide a cohesive structure that can align and grow worldwide local group contributions, which will be continuously refined and distributed through formal IEEE education and certification mechanisms. It is the ongoing intention of the BCTE program to catalogue the relevant initiatives that are underway worldwide to structure and deploy these energy Blockchain concepts, and to help evaluate their efficacy for energy system transformation. This paper is intended to offer a path to harmonize and unify these initiatives toward a worldwide standard. Electricity systems and markets have evolved significantly over the past forty years through five distinct yet overlapping phases: (1) Deregulation, (2) Decentralization, (3) Decarbonization, (4) Digitalization, and (5) Democratization". In the Position Paper IEEE formulates the objectives of the running project as follows (IEEE Position & Vision Statement Paper v. 3.0, 2021, pp. 8-9): "The knowledge domains for both Transactive Energy and Blockchain are intersecting and rapidly evolving. Accordingly, the underlying project (BCTE Initiative) that is launched with this paper should be intentionally pursued using a "Lean Design" methodology, where core architectural framework requirements are established and applied early to select high-value use case development and demonstration which, in turn, informs refinement and expansion of the core requirement set based on outcome data. The intention is to quickly validate and consolidate those core requirements that support all (or at least most) Blockchain applications for Transactive Energy that will lead to a formal IEEE Standards development Project (IEEE Blockchain standards, 2023)".

3.3. IEEE Standards development Project

The BCTE Initiative (IEEE Blockchain standard, 2023) … " welcomes global participation and collaboration along these lines to open bulk power and distribution system operations to include grid-edge participation through peer-to-peer and community aggregation and microgrids in these ecosystem value exchanges. Moreover, by incorporating Blockchain methodologies, the initiative seeks to reduce barriers to entry and transaction costs for these markets and to ensure open, secure access to introduce AI and automation to continually improve efficiency. There are three primary anticipated results of pursuing this project using this recursive and iterative methodology. The program is intended as a globally deployed and facilitated one, with regional clusters of organized participants each contributing to the common definition and application of Blockchain-based transactive energy solutions. The selected demonstrations and corresponding fast track architectural development, along with a highly focused Communication strategy, advanced from the framework: 1. Document existing

practices for and develop improvements for the most efficient, scalable, and secure design of incremental energy systems and markets that can operate primarily through decentralized participant transactions. 2. Lower the barriers to, and improve the efficacy and security of, data access on energy demand elasticity, forward price offers, and the valuation and monetization of environmental and resilience attributes. 3. Create an effective outreach and education capability to influence the adoption of the emerging standard, to pave the way for consistent and efficient regulatory reform options where needed. 4. Ultimately leading to a formal certification path for assuring the performance and quality of compliant solutions that are built from the emerging standard. Each of the objectives is intended to reinforce the advancement of practical applications of Blockchain in energy transactions, as a foundational technology that enables more efficient, secure, and resilient market-driven value exchange processes in the production, transport, and consumption of electric power. The primary work streams of architectural framework development, rapid demonstration and expansion of user profiles, global outreach, and engagement will create an actionable roadmap to accelerate the adoption of BCTE".

4. Discussion

Results of the literature survey are the basis for formulating the following theoretical and practical implications: 1. The supply, transmission, distribution, and consumption of electricity are closely coupled, and must be actively coordinated. This requires the coordinated sensing, measurement, and control of devices and systems spread across the grid. 2. The Blockchain technology can facilitate secure and transparent record-keeping and transactions and thus may have many potential applications in the energy sector. 3. Blockchain technology is still evolving and faces some challenges, such as scalability, interoperability, regulation, and adoption. However, blockchain has the potential to revolutionize the energy sector by transforming the way energy is produced, distributed, consumed, and traded. 4. Within the power and energy sector, Blockchain technology also provides new and overwhelmingly undiscovered perspectives to enable the democratization phase of power systems and markets.

5. Summary

The electric power system is undergoing a rapid transition toward decarbonization and decentralization. The legacy model of one way power flow from large, primarily fossil-based generators to consumers on the distribution grid is being upended, driven by the plummeting costs of distributed renewables, battery storage, and smart energy technologies. Residential and commercial utility customers, once simply consumers of electricity, are deploying these

distributed energy resources at scale alongside project developers, becoming producers themselves in a new, increasingly decentralized power system. These changes pose a threat not only to the business models of utilities and conventional generators, but to the stability of energy markets and the electric grid itself. At the same time, they offer an opportunity: the flexibility of these new resources and technologies, their low carbon footprint, and their proximity to consumer loads could permanently reduce electricity and infrastructure costs while enabling the power sector to meet ambitious decarbonization targets. In order for this opportunity to be realized, however, legacy retail energy markets must be reformed to allow all distributed resource owners to participate and provide value, regardless of asset size and customer classification. Conclusions and key points of the IEEE Position Paper on the Blockchain Transactive Energy A Bridge to a Democratized Energy Marketplace (IEEE Position & Vision Statement Paper v. 3.0, 2021, p. 35) read as follows: "Digitalization of power systems has evolved over the past two decades to the point where artificial intelligence and Blockchain technology has become possible to introduce to these digital ledger technologies (DLT) platforms. With more recent advances in cryptography, local compute power, and higher bandwidth network services, Blockchain technology appears to be a promising technology which opens up disruptive new paths toward cost-effective, ultra-efficient, and innovative service offers from various prosumer, commercial, and industrial domains to make, distribute, or consume electric power. This is the emerging world of Transactive Energy. It is expected to influence the development of the next-generation energy systems and the creation of new power markets for their enablement of future Transactive Energy use cases. The resulting stretch of the boundaries of existing market rules with novel forms of sharing and self-reinforcing digital economic models, all in search of ever cleaner and less wasteful energy production and consumption, will be strongly supported by Blockchain technology". Finally, based on the most recent relevant literature positions it was realized in this review paper that Blockchain technology has many potential applications in the energy sector. This technology is still evolving and faces some challenges, such as scalability, interoperability, regulation, and adoption. Within the power and energy sector, Blockchain technology also provides new and overwhelmingly undiscovered perspectives to enable the democratization phase of power systems and markets.

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VR TECHNOLOGY IN MANUFACTURING PROCESSES – A BIBLIOMETRIC ANALYSIS

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Purpose: The aim of the article is to understand how research and practices related to the use of VR in production processes are developing. As well as providing information on the diversity of VR applications in industry.
Design/methodology/approach: The bibliometric analysis is based on data from the Scopus database and Web of Science, focused on research and scientific publications related to the use of VR in the context of manufacturing processes. The subject scope of the article includes identifying, among other things, the dominant authors and organizations in the analyzed topic. Analysis of keywords and visualization of their connections using VOSviewer software, and identification of the resulting topic clusters. In addition, identification of research trends and areas for further work.
Findings: The bibliometric analysis conducted reveals several research trends and research areas related to the use of virtual reality technology in the manufacturing industry. The research includes, but is not limited to, the exploration of innovative teaching and training delivery methods and the impact of VR on manufacturing processes. In addition, they include the development of digital manufacturing, the creation of smart factories in line with the concept of Industry 4.0. The trends reflect the drive to use VR as a tool for optimization, achieving industrial sustainability goals and shaping the future of manufacturing.
Research limitations/implications: Limitations are due to the very nature of bibliometric research and the use of two databases for publication selection (Scopus, Web of Science).
Originality/value: The value of the article lies in providing information that can be useful to practitioners and researchers interested in this topic. The work identifies and discusses specific research areas and trends related to the use of VR in the manufacturing industry. Includes analysis of new approaches and innovative methods that are emerging in research.

Keywords: bibliometric analysis, Virtual Reality, Industry 4.0, digital factory, Artificial Intelligence.

Category of the paper: Research paper, Literature review.

1. Introduction

Virtual reality (VR) is not a new idea, but some of the innovative VR technologies that have recently appeared in the gaming industry are now being tested and increasingly implemented in the manufacturing industry. (de Giorgio et al., 2017) VR is the induction of a specific behavior in an organism using artificial sensory stimulation, with minimal or no awareness of this intervention. Virtual reality consists of four key components. The first is “Targeted Behavior”, which includes virtual experiences designed by the creators, such as the ability to move, explore, and interact. The next component is “Organism”, which refers to both the VR user and other forms of virtual life such as humans, animals, and chatbots. The third element is "Artificial Stimulation of the Senses," which means the ability to recreate sensory experiences using modern engineering technologies. The final component is “Awareness”, which ensures seamless user interaction with the virtual world, allowing the user to fully immerse themselves in this reality. A VR system sustains a perceptual illusion for the organism (LeValle, 2023). Virtual reality and augmented reality (AR) are considered the most revolutionary technologies of the 21st century. By providing computer-generated visual stimuli, these technologies are able to immerse our minds in experiences that we temporarily accept as subsequent real versions of reality (Nayyar et al., 2018). With increasingly dependable hardware and more user-friendly software, the operation of VR systems is becoming more straightforward. Nevertheless, due to the complex interaction of these technologies, VR is not yet a plug-and-play solution. While it's possible that in the future, people will be as comfortable with VR systems as they are with modern desktop workstations, we haven't reached that point yet (Berg et al., 2017). There are many publications in the literature addressing virtual reality. However, no attempt has been made to provide a comprehensive picture of the current state of research on virtual reality in manufacturing processes from a bibliometric perspective. The study included a bibliometric analysis of publications from 2012 to 2022 available in Scopus and Web of Science databases. Keyword analysis is one of the methods used in bibliometric analysis, which involves analyzing words found in the title, abstract or keywords of scientific publications. Keywords are words or phrases that best describe the content of a publication and are used to index publications in scientific databases. Keyword analysis identifies the most frequently occurring words or phrases in a given publication or an entire set of publications, which can help assess trends or developments in a given area of research. This can be useful, among other things, to determine what topics are most frequently researched in a given scientific field or what are the most important research directions in a given area.

The work presents new approaches and methods that appear in the literature regarding the use of VR in the manufacturing industry. This publication answers the following question:

- What are the main trends in the application and development of virtual reality technology in manufacturing processes?
- What priorities and activities will be important in the context of using virtual reality technology in industry? The article consists of five parts. An introduction describes the VR technology. The second part presents the research methods. The third part is a description of the results obtained from the research and presents the results of the study. Section fifth undertakes a discussion. The last part summarizes the paper and suggests directions for future research.

2. Methods

A bibliometric analysis method was used to review the literature on virtual reality technology in manufacturing processes. It is a research method that uses data contained in scientific publications, such as the number of citations, the number of publications, the number of authors, etc., to assess the impact or scientific reach of a given researcher, institution or field of research. It can be used for various purposes, such as assessing specialist knowledge, assessing the quality of scientific publications or assessing the impact of scientific institutions on the scientific community. Bibliometric analysis is often used in the social sciences and humanities, but can also be used in other scientific fields such as medicine or engineering. This method is often used by researchers at the initial stage of interest in a selected topic. Based on many available publications, it enables identification, synthesis, analysis and critical content analysis (Bornmann, Haumschild, 2017; Keathley, Herring et al., 2016).

Figure 1 shows the operationalization of the process used in the article by bibliometric analysis.

The research methodology used consists of 7 stages, which include: selection of bibliographic databases (stage 1), selection of keywords (stage 2), criteria limiting the search for publications (stage 3), data extraction and selection (stage 4), analysis of the set of publications (stage 5), identification of research areas (stage 6) and creation of thematic clusters (stage 7). During the first stage, the bibliographic databases Scopus and Web of Science were chosen because of their accessibility, thematic breadth and wide range of publications within all scientific disciplines.

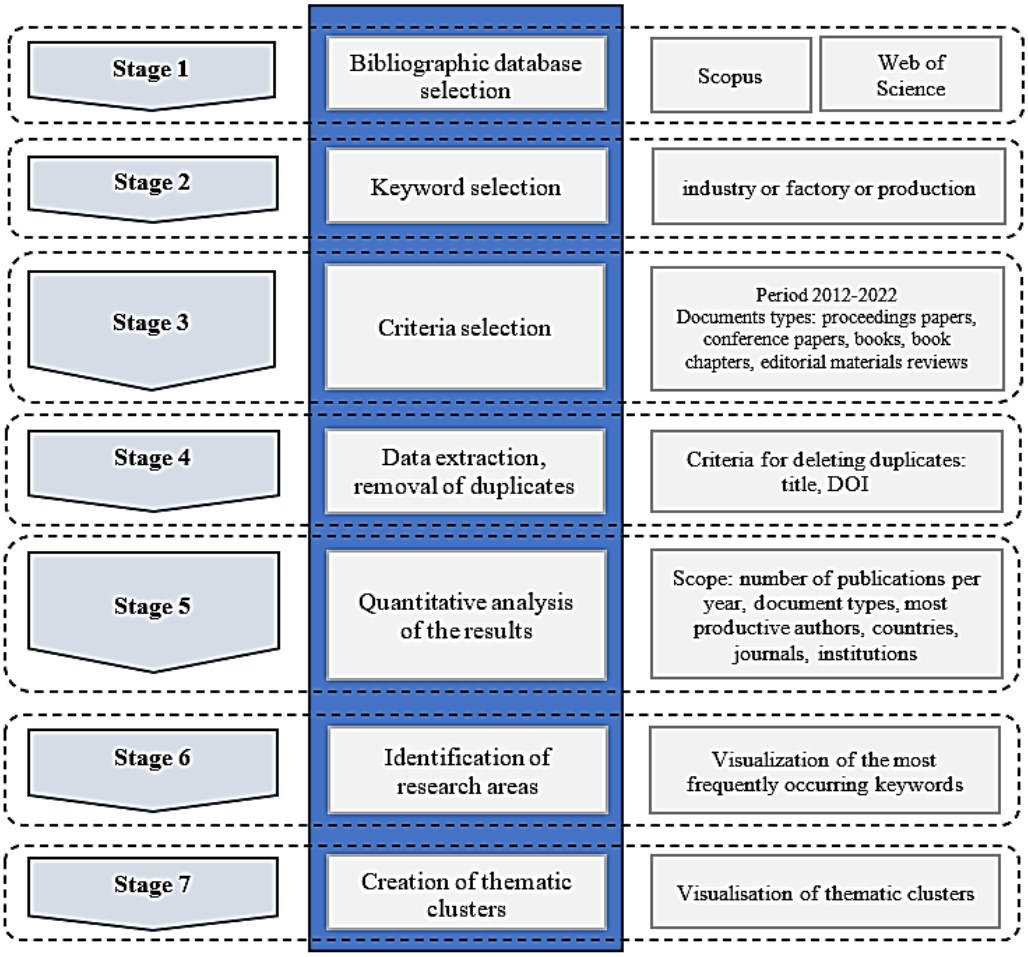

Figure 1. Methodology of bibliometric analysis.

Source: author's work.

The bibliometric analysis included publications related to "Virtual Reality." The first step of the research was to include publications containing this phrase in every type of document, while the next step was only in titles, abstracts and keywords. Keywords such as "industry", "factory", "production" were selected and the search for publications was narrowed to the period 2012-2022. Proceedings papers, books, book chapters, reviews, editorials were selected for further analysis. Other types of documents like note and short survey were not considered. The results are shown in the table (Table 1).

A first search for the phrase "Virtual reality" in the Scopus database generated 286706 publications, while Web of Science generated 88598 publications. The initial area represents a huge number of publications, also unrelated to the research direction. Therefore, in the second attempt, the search was limited only to publications that contained the indicated phrase in the title, abstracts and keywords. This yielded 104057 publications in the Scopus database and 78946 in Web of Science. Taking into account another limit of the criteria (the occurrence of the words "industry" or "factory" or "production"), 9083 and 4054 publications were obtained. Given that this is still a huge number of records, another limit was applied in the form of searching for the phrase in the title only. This approach significantly refined the filtering of the data. The results are shown in the table (Table 1).

Table 1.
Preliminary and principal search results

Stage	Scopus	Web of Science
First research query	ALL ("Virtual Reality")	ALL ("Virtual Reality")
Number of articles before inclusion criteria	286 706	88 598
Number of articles after inclusion criteria	77 716	7 080
Second research query	TITLE-ABS-KEY ("Virtual reality")	TITLE-ABS-KEY ("Virtual reality")
Number of articles before inclusion criteria	104 057	78 946
Number of articles after inclusion criteria	9 083	4 054
Third research query	TITLE ("Virtual reality")	TITLE ("Virtual reality")
Number of articles before inclusion criteria	22 125	26 460
Number of articles after inclusion criteria	267	162

Source: author's work based on the Scopus and Web of Science databases.

Finally, after applying the adopted restriction in the form of document type and taking into account the criteria, 267 and 162 records were obtained (Table 1). Files in "csv" format were generated from each of the databases. The downloaded files were merged into one, after removing duplicates the content was obtained in the form of 284 records.

Then, based on the received file, an analysis was made of the number of publications in the 2012-2022 interval, the most productive authors, countries, organizations, journals. The most cited articles were identified. Then, based on the received file, an analysis was made of the number of publications in the 2012-2022 interval, the most productive authors, countries, organizations, journals. As well as the most cited articles were identified. Using VOSviewer software, the most frequent keywords were obtained, and a map of the co-occurrence of keywords related to "Virtual Reality" was presented. A thesaurus file was prepared to eliminate terms with the same meaning (e.g. VR, Virtual Reality) or not relevant to the study (e.g. tourism). The resulting data was analyzed and subject areas were identified that represented the main and emerging research directions.

3. Results

The first stage shows the interest in the topic, in the form of the number of publications over the years analyzed (Figure 2).

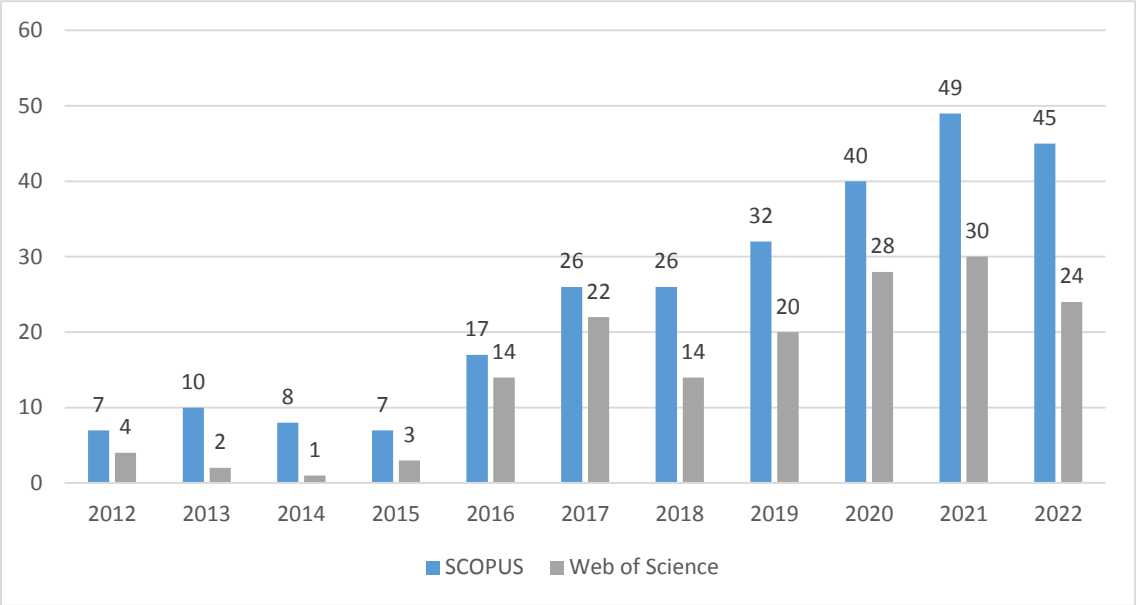

Figure 2. Number of publications in the field of VR technology in manufacturing processes in Scopus and Web of Science databases (indexed from 2012 to 2022).

Source: author's work based on the Scopus and Web of Science databases.

In the case of both Scopus and Web of Science databases, numerous publications appeared between 2012 and 2022, with the largest number in 2021. In 2012-2015, they occurred in small numbers, even sporadically.

Figure 3 shows the structure of publications by document type.

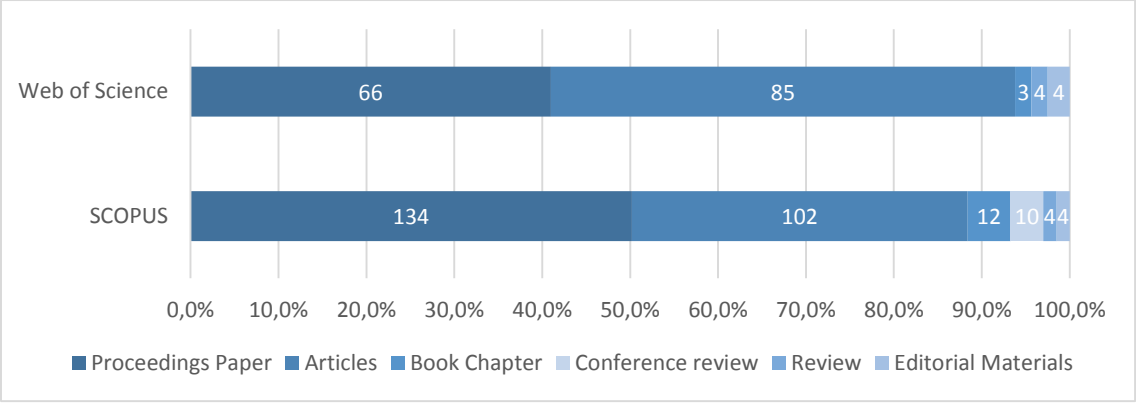

Figure 3. Type of documents of publications in the field of VR technology in manufacturing processes in Scopus and Web of Science databases (indexed from 2012 to 2022).

Source: author's work based on the Scopus and Web of Science databases.

Both databases were dominated by proceedings paper type publications and articles (Scopus - 88.4%, Web of Science - 93.8%). Most publications in the Scopus database are assigned to Computer Science (55%) and Engineering (51%). This is followed by (16%) Social Sciences, (15%) Mathematics and (10%) Business, Management and Accounting. Meanwhile, in the Web of Science database, 25% are assigned to the Engineering Electrical Electronic category, 21% to Computer Science Artificial Intelligence, 16% each to Engineering Manufacturing and

Computer Science Theory Methods. Another 14% in the Computer Science Interdisciplinary Applications category. Nomenclature between the databases varies.

The authors who published the highest number equal to 6 were Palmisano, Pedram and Perez. They were also the authors with the highest average number of citations per publication equal to 2.1%. This was followed by Farrelly with 5 published papers and an average number of citations per publication of 1.7%.

Table 2 shows a detailed summary of the data.

Table 2.
Most productive authors, countries, organisations and journals

No.	Item	NP	%	Average citation count	
				Scopus	Web of Science
Authors					
1	Palmisano, S.	6	2,1%	4,3	N/A
2	Pedram, S.	6	2,1%	4,3	0
3	Perez, P.	6	2,1%	4,3	N/A
4	Farrelly, M.	5	1,7%	4,4	N/A
5	Zawadzki, P.	4	1,4%	12,5	9,3
6	Agethen, P.	3	1,0%	14,7	12
7	Cardona-Reyes, H.	3	1,0%	0,0	0
8	Górski, F.	3	1,0%	12,7	9
9	Pfeiffer, T.	3	1,0%	18,3	9
10	Rukzio, E.	3	1,0%	14,7	12
Countries					
1	China	45	15,4%	5,64	8,6
2	United States	30	10,3%	31,4	36,16
5	Germany	18	6,2%	17,28	16,91
4	United Kingdom	14	4,8%	31	34,22
6	Spain	12	4,1%	18,67	13,82
3	Australia	11	3,8%	4,18	3,28
8	Italy	11	3,8%	28,81	23,89
7	Poland	9	3,1%	12	8,29
9	Sweden	9	3,1%	16,7	11,86
10	France	9	3,1%	5	5,2
Organisations					
1	University of Wollongong	6	2,1%	4,3	N/A
2	Politechnika Poznanska	4	1,4%	12,5	9
3	Center for Research in Mathematics	3	1,0%	0	N/A
4	Mines Rescue	3	1,0%	6	N/A
5	Chalmers University of technology	3	1,0%	19,7	15,5
6	The Royal Institute of Technology KTH	3	1,0%	18,3	12
7	Universidad Autónoma de Aguascaliented	3	1,0%	0	0
8	Universität Ulm	3	1,0%	14,67	12
9	Universität Bielefeld	3	1,0%	18,33	14,33
10	University of York	3	1,0%	7,7	N/A

Cont. table 2.

Journals					
1	Virtual Reality	2	0,7%	229	166,5
2	Concurrent Engineering Research and Applications	1	0,3%	196	140
3	Advanced Engineering Informatics	1	0,3%	136	100
4	IEEE Transactions on Human-Machine Systems	1	0,3%	136	100
7	Robotics and Computer-Integrated Manufacturing	1	0,3%	112	75
6	International Journal of Mining Science and Technology	1	0,3%	109	83
5	Advances in Engineering Software	1	0,3%	101	71
9	Data	1	0,3%	86	68
8	Journal of Computing and Information Science in Engineering	1	0,3%	75	49
10	Procedia Manufacturing	3	1,0%	49,33	N/A

Note. NP – number of publications, [%] – the percentage of the total number of publications (284), N/A – not applicable.

Source: author's work based on the Scopus and Web of Science databases.

The largest number of publications came from China (45 publications) and the United States (30 publications). Considering the affiliation/organization of the authors, the most publications came from the University of Wollongong (6 publications). The organization with the highest average number of citations in the Scopus database and Web of Science is Chalmers University of technology, followed by Universität Bielefeld. Among the most productive journals is Virtual Reality (2 publications), at the same time being the highest average cited in both databases. The total number of citations of publications on Virtual Reality in the Scopus database was 458, and in the Web of Science database was 327. The following journals were ranked next: Concurrent Engineering Research and Applications, Advanced Engineering Informatics, IEEE Transactions on Human-Machine Systems, Robotics and Computer-Integrated Manufacturing, and International Journal of Mining Science and Technology, Advances in Engineering Software, Data.

Among the most-cited publications in the Scopus (451) and Web of Science (327) databases was the 2017 article "Industry use of virtual reality in product design and manufacturing: a survey" by Berg and Vance published in the journal Virtual Reality. Next also highly cited by both databases (196 and 140) was a 2015 article by Choi et al. titled "Virtual reality applications in manufacturing industries: past research, present findings, and future directions" I published in the journal Concurrent Engineering Research and Applications. Next in the Scopus database (136) highly cited is "Construction industry offsite production: A virtual reality interactive training environment prototype" by Goulding et al. from 2012, while in the Web of Science database (100) it is "Discrete Event Simulation and Virtual Reality Use in Industry: New Opportunities and Future Trends" by Turner et al. published in IEEE Transactions on Human-Machine Systems in 2016. The full list of the 19 most-cited publications is shown in the table (Table 3).

Table 3.
The most cited articles about VR technology in industry

No.	Number of citations		Authors	Article title	Journal
	Scopus	Web of Science			
1	451	327	(Berg, Vance, 2017)	Industry use of virtual reality in product design and manufacturing: a survey	Virtual Reality
2	196	140	(Choi et al., 2015)	Virtual reality applications in manufacturing industries: Past research, present findings, and future directions	Concurrent Engineering Research and Applications
3	136	100	(Goulding et al., 2012)	Construction industry offsite production: A virtual reality interactive training environment prototype	Advanced Engineering Informatics
4	136	100	(Turner et al., 2016)	Discrete Event Simulation and Virtual Reality Use in Industry: New Opportunities and Future Trends	IEEE Transactions on Human-Machine Systems
5	134	88	(Damiani et al., 2018)	Augmented and virtual reality applications in industrial systems: A qualitative review towards the industry 4.0 era	IFAC-PapersOnLine
6	112	75	(Roldán et al., 2019)	A training system for Industry 4.0 operators in complex assemblies based on virtual reality and process mining	Robotics and Computer-Integrated Manufacturing
7	109	83	(Zhang, 2017)	Head-mounted display-based intuitive virtual reality training system for the mining industry	International Journal of Mining Science and Technology
8	101	71	(Manca et al., 2013)	Bridging between Virtual Reality and accident simulation for training of process-industry operators	Advances in Engineering Software
9	97	N/A	(Nayyar et al., 2018)	Virtual Reality (VR) & Augmented Reality (AR) technologies for tourism and hospitality industry	International Journal of Engineering and Technology(UAE)
10	93	60	(Eschen et al., 2018)	Augmented and Virtual Reality for Inspection and Maintenance Processes in the Aviation Industry	Procedia Manufacturing
11	86	68	(Noghabaei et al., 2020)	Trend analysis on adoption of virtual and augmented reality in the architecture, engineering, and construction industry	Data
12	86	60	(Salah et al., 2019)	Virtual reality-based engineering education to enhance manufacturing sustainability in industry 4.0	Sustainability (Switzerland)
13	75	49	(Berg, Vance, 2017)	An Industry Case Study: Investigating Early Design Decision Making in Virtual Reality	Journal of Computing and Information Science in Engineering
14	72	57	(Delgado et al.., 2020)	Augmented and Virtual Reality in Construction: Drivers and Limitations for Industry Adoption	Journal of Construction Engineering and Management
15	70	41	(Liagkou et al., 2019)	Realizing Virtual Reality Learning Environment for Industry 4.0	Procedia CIRP

Cont. table 3.

16	67	53	(Dunnagan et al., 2020)	Production and Evaluation of a Realistic Immersive Virtual Reality Organic Chemistry Laboratory Experience: Infrared Spectroscopy	Journal of Chemical Education
17	62	45	(Joshi et al., 2021)	Implementing Virtual Reality technology for safety training in the precast/ prestressed concrete industry	Applied Ergonomics
18	59	52	(Leung et al., 2020)	A fad or the future? Examining the effectiveness of virtual reality advertising in the hotel industry	International Journal of Hospitality Management
19	46	42	(Xie et al., 2018)	The consensus of probabilistic uncertain linguistic preference relations and the application on the virtual reality industry	Knowledge-Based Systems

Note: N/A – not applicable.

Source: author's work based on the Scopus and Web of Science databases.

As part of the bibliometric analysis, the most frequently occurring keywords related to the topic of "Virtual Reality" were extracted using VOSviewer software. A total of 33 words or phrases were generated that occurred at least 3 times in the keywords included in the 284 articles analyzed. The set included words with the same meaning as the abbreviations VR and Virtual Reality or AR and Augmented Reality. A thesaurus file was prepared to organize the data set. The notation of terms and abbreviations with the same meaning was standardized, and words irrelevant to the analysis were removed (for example, "tourism", "serious game" "covid-19"). The final file contained 29 keywords. Figure 4 shows the most popular ones.

Figure 4. The most frequently occurring key words.

Source: elaborated by the author using WordArt.

The most frequently occurring keywords related to VR technology included terms related to technology (virtual reality had 166 occurrences in this set, augmented reality 26 occurrences, mixed reality – 3, technology – 6), industry (industry 4.0 – 27, engineering – 6, smart factory – 6), science (virtual reality training – 20, education – 13), simulation 8.

The VOSviewer program allowed for the creation of a graphical representation of a network (Figure 5), illustrating the frequency of occurrence of individual terms in the bibliographic descriptions of articles selected for analysis and showing how often these terms co-occurred. This visualization presents each word as a point, with its size and font size reflecting the frequency of its occurrence in the analyzed texts. The program also enabled the grouping of related terms into clusters, which were differentiated using different colors. These clusters represent terms that often appeared together, although this does not exclude their co-occurrence with other terms.

The VOSviewer program allowed for the generation of a network (Figure 5) showing how frequently individual items appeared in the bibliographic descriptions of articles selected for analysis and how often specific elements co-occurred. Each point on this network represents a word or phrase, with its size and font size reflecting the frequency of occurrence of that element. The program also enabled the grouping of elements into clusters, which were then differentiated by different colors. It is worth noting that elements from the same clusters often appeared together, but this did not exclude their simultaneous occurrence with other terms. Additionally, the closer the circles on the graph were to each other, the more frequent the co-occurrence of terms, and the thickness of the lines connecting them reflected the degree of significance of this co-occurrence.

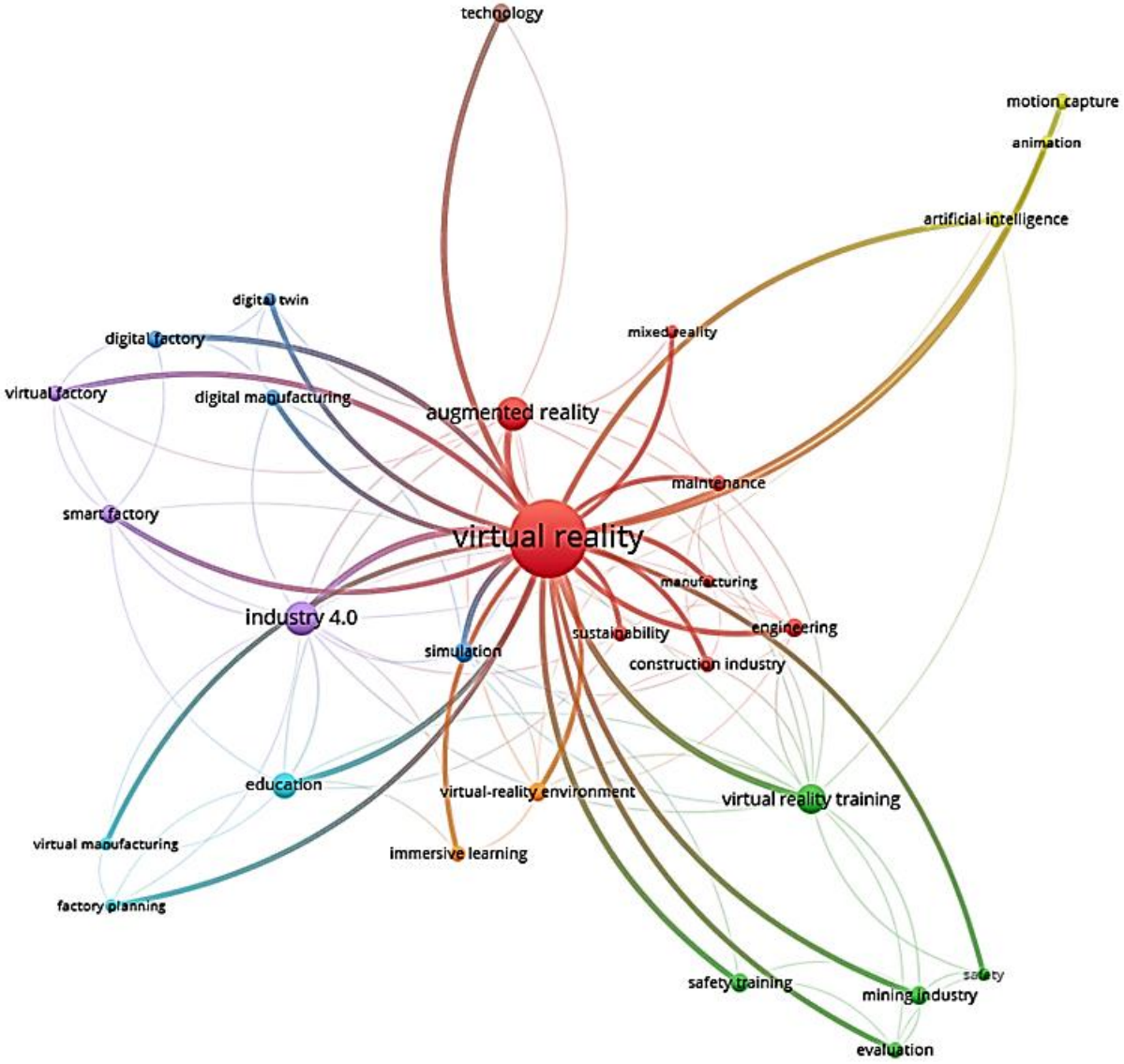

Figure 5. Keyword co-occurrence map on VR technology in industry.

Source: author's work based on the Scopus and Web of Science databases.

It is worth paying attention to the emerging new terms related to VR technology in recent years, which contribute to creating new thematic areas (Figure 6).

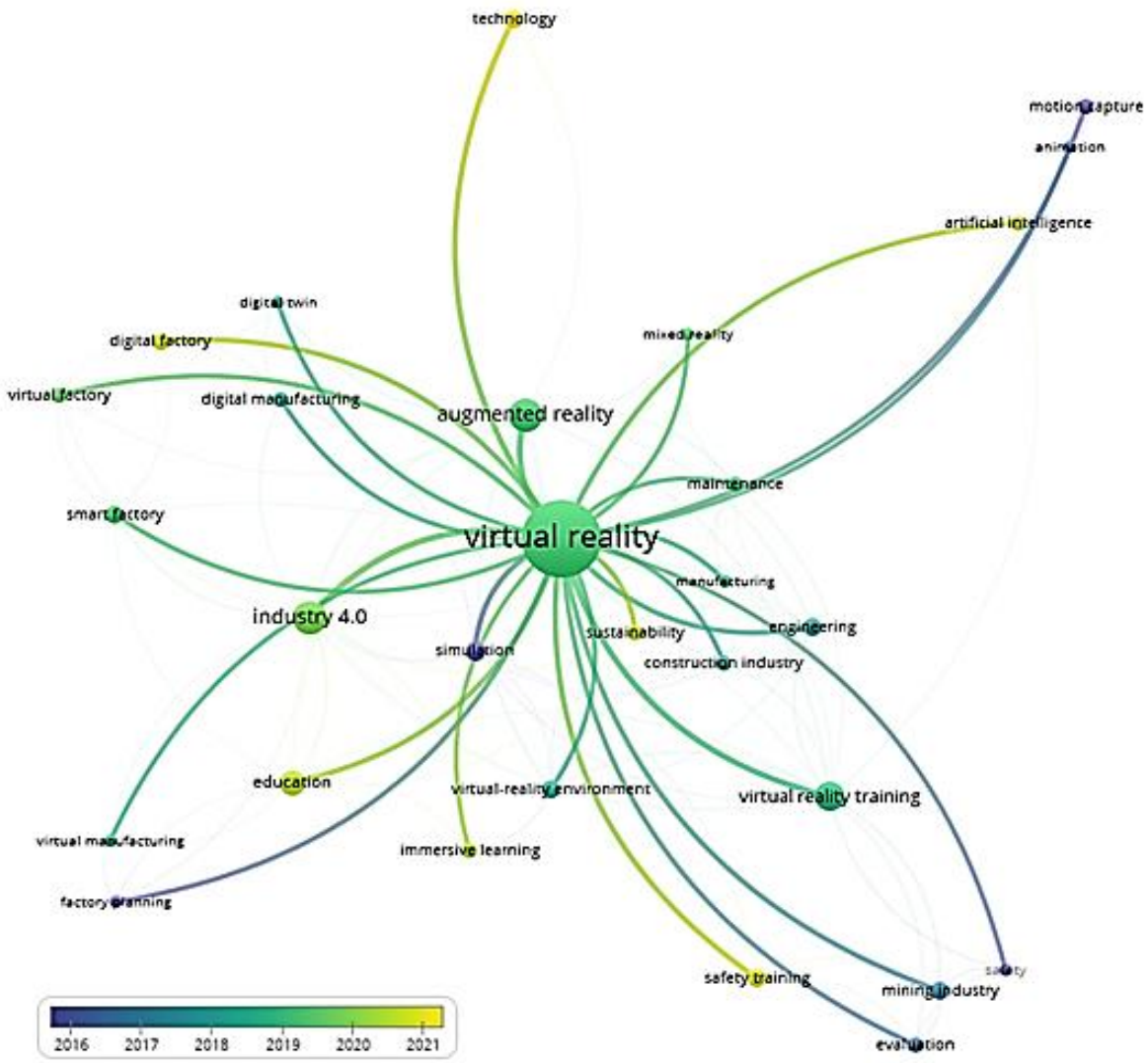

Figure 6. Keyword co-occurrence map on VR technology in industry in time perspective.
Source: author's work based on the Scopus and Web of Science databases.

The beginnings of discussing virtual reality in the manufacturing industry in literature were associated with topics such as factory planning, simulation, evaluation, and motion capture. From 2020 to the present, there has been a significant increase in the exploration, analysis, presentation, and interest in areas of education, immersive learning, training, digital factory, and artificial intelligence. The emergence of new terms and clusters indicates the development and growing interest in these topics.

4. Discussion

The VOSviewer program enabled the identification of 7 main thematic clusters, the so-called Clusters. Table 4 presents the thematic threads within each cluster along with examples of publications.

Table 4.
Main thematic clusters of the use of VR technology in manufacturing processes

No.	Cluster name	Key words	Selected publications
1.	Technology and Sustainability	augmented reality	Damiani et al., 2018; Eschen et al., 2018; Leung et al., 2020; Nayyar et al., 2018; Noghabaei et al., 2020
		construction industry	Noghabaei et al., 2020; Delgado et al., 2020
		engineering	Berg, Vance, 2017; Goulding et al., 2012; Noghabaei et al., 2020; de Giorgio et al., 2017
		maintenance	Eschen et al., 2018; Barkokebas et al., 2019; Rendeniya et al., 2019
		manufacturing	Choi et al., 2015; Salah et al., 2019
		mixed reality	Eschen et al., 2018; Leung et al., 2020
		sustainability	Salah et al., 2019; Krupnova et al., 2020
		virtual reality	Noghabaei et al., 2020; Bellalouna, 2020; Carretero et al., 2021; Checa et al., 2022
		technology	Xie et al., 2018
2.	Safety and Training	evaluation	Pedram et al., 2019
		mining industry	Roldán et al., 2019; Zhang, 2017; Pedram et al., 2014
		safety	Paszkiewicz et al., 2021; Pedram et al., 2014; Pedram et al., 2017; Pedram et al., 2018
		safety training	Joshi et al., 2021; Manca et al., 2013; Zhang, 2017
		virtual reality training	Górski et al., 2018; Zawadzki et al., 2019
3.	Digital Production and Simulation	digital factory	Shamsuzzoha et al., 2021; Chandra et al., 2021; Schlegel et al., 2022
		digital manuacturing	Dahl et al., 2017
		digital twin	Kuts et al., 2017; Kritzler et al., 2017
		simulation	Turner, 2016; Manca et al., 2013; Firu et al., 2020; Jiang, 2012
4.	Animation Technology and Artificial Intelligence	animation	Yan, 2021; Ji, Zhang, 2016
		artificial intelligence	Butean et al., 2019
		motion capture	Novak-Marcincin et al., 2013; Spada et al., 2012
5.	Industry 4.0 and Smart Factories	industry 4.0	Roldán et al., 2019; Turner et al., 2016; Nayyar et al., 2018; Berg, Vance, 2017; Choi et al., 2015; Eschen et al., 2018; Xie et al., 2018; Pandya et al., 2018; Żywicki et al., 2018, Liagkou et al., 2019
		smart factory	Żywicki et al., 2018,
		virtual factory	Damiani et al., 2018
6.	Education and Production Planning	education	Salah et al., 2019; Dunnagan et al., 2020; Paszkiewicz et al., 2021; Tovar et al., 2020; Tan et al., 2022
		factory planning	Menck et al., 2012; Gong et al., 2019; Bellalouna, 2020
		virtual manufacturing	Abdelkhalik, Elngar 2020; Choi et al., 2015
7.	Science and Virtual Reality Environments	immersive learning	Dunnagan et al., 2020; Berg, Leif, Judy, 2017; Radhakrishnan et al., 2021
		virtual-reality environment	Roldán et al., 2019; Liagkou et al., 2019; Horejsi et al., 2020; Ulmer et al., 2020

Source: author's work based on the Scopus and Web of Science databases.

The "Technology and Sustainability" cluster focuses on virtual and augmented reality technologies used in engineering, maintenance and production. Augmented reality is currently a useful tool for presenting data to users and has promising development prospects in the future. Investments and the growing development of this sector make it more and more attractive on the market. There is potential to improve the quality of sensors used in AR, especially in terms of precision and cost (Paszkiewicz et al., 2019). Once hardware issues are overcome, smart AR glasses become a promising candidate as a daily-use tool in future smart factories (Horejsi et al., 2020). According to research, the use of VR enables the collection of data such as task completion time, distance traveled, and the identification of ergonomic hazards and system efficiency. Additionally, it allows you to observe many users performing the same tasks in laboratory conditions. Virtual reality shortens the time and costs of testing machine designs by simulating realistic operating conditions (Barkokebas et al., 2019). According to the literature, older generations are more confident about the future of AR/VR technologies and see greater benefits from their use. The industry is intensifying the implementation of these technologies (Noghabaei et al., 2020). In 2022, the study compared the training effectiveness of VR, AR, and actual equipment for maintenance tasks was conducted. For single-level maintenance tasks, the traditional training group had better training effects than the AR and VR groups. However, for multi-level maintenance tasks, the AR group had significantly better training effects than the VR group. The AR group also had higher training efficiency and lower cognitive load as the difficulty of maintenance tasks increased. Details can be found in (Liu et al., 2022). A comparative study (Joshi et al., 2021) was conducted between VR training and traditional video-based training, showing that VR training is more engaging and provides a better understanding of safety protocols and real-world experiences. Other researchers (Carretero et al., 2021) presented virtual tools to improve the creation of VR training for industry. The methodology focused on reconstructing workplaces in 3D, applying expected behavior to the 3D models, and delivering online training in a virtual environment. They will make the development of VR systems more efficient and cost-effective, enabling safe and productive operator training. Through the use of these virtual tools, it becomes possible to enhance the efficiency and affordability of developing VR systems, facilitating the training of operators in a productive and safe manner. Further researchers (Checa et al., 2022) emphasize that VR applications can provide a high rate of similarity to real training programs, filling the gap in traditional training and reducing unnecessary investment and economic losses. Many studies present the use of VR applications surpasses real teaching modules, offering a safe environment for testing systems without risk to operators (Andaluz et al., 2017). This opens the door to new VR applications that can significantly improve production and operator efficiency in industry.

The second area focuses on safety issues, both in the context of industry and training. Striving to improve safety practices, companies decide to use technologies that increase safety in industry, including risk assessment and training. The safety of employees and the environment is a key aspect here. Future research directions for a VR training system for the

mining industry focus on analyzing the main components of the system as user, tasks, and software with databases (Zhang et al., 2017).

The third cluster is a set of technologies related to digital factory, digital manufacturing, digital twin and industrial process simulation. Research data from international companies and statistical organizations, such as PwC, IDC, Statista, clearly indicate the developing VR/AR industry and its shift in focus from the entertainment to the corporate sector. AR and VR technologies and appropriate tools are effective and useful in business process management, especially in the area of human resources and basic operational processes such as 3D visualization, production modeling, large-scale project management, automation and cybersecurity (Firu et al., 2020). Jiang's article (2012) details innovative method centers on using virtual reality technology to improve industrial production simulation systems.

As part of the work focused on "Animation Technology and Artificial Intelligence" cluster, developing research trends are presented, including technologies related to animation, the use of artificial intelligence and motion capture in various industrial fields. Advanced animation solutions and the use of AI to create more interactive and intelligent products are presented. Cluster 4 was created relatively recently and has the potential for dynamic development due to the continuous progress of technology in this field. The future trend is the integration of artificial intelligence and virtual reality, where both technologies complement each other. Therefore, it is necessary to further improve computer technology, especially the level of advancement of artificial intelligence systems, to increase the use of virtual simulation technology among employees (Yan, 2021).

Then, cluster 5 "Industry 4.0 and Smart Factories" focuses on industrial innovations, industrial development, especially the implementation of industry 4.0 technologies, smart factories and virtual factories. According to available literature, it includes technologies enabling the automation and monitoring of production processes, innovations in production and the use of data to create more intelligent and effective factories. VR digital tools cannot operate separately, so it is important to integrate them with other simulation tools and machine controllers to create a realistic virtual factory in real time. A virtual reality-based digital factory approach requires standardization of data formats and protocols, increased interoperability with digital tools and physical components, providing a deeper sense of immersion, and a more intuitive user interface (Chandra et al., 2021).

The “Education and Production Planning” cluster is focused on technologies related to education in the context of production, factory planning and virtual manufacturing. These technologies are aimed at effectively educating and preparing employees to work in modern production environments and planning production processes. The growing interest and increasing popularity of AR/VR in education and training emphas the need to explore new strategies for improving teaching processes using these technologies (Tan et al., 2022). Researchers (Paszkiewicz et al., 2021) have developed a methodology suitable for planning, managing, and implementing VR technology-based projects within Industry 4.0. The use of

VR in education aims to enhance the skills of future workers. With VR, designers, architects, and users can explore the space of future projects. It has been suggested that in the future, training coaches should be involved in the implementation phase, creating dedicated VR environments for training and documentation purposes. Moreover, in article (Bellalouna, 2020) was presented the VR application allows the user to be fully immersed in the virtual factory environment, which is a significant improvement over conventional 2D/3D tools that have limited planning area display capabilities and lack intuitive operational features. This innovative VR-based approach has the potential to improve the quality and efficiency of the factory planning process. As a next step indicated to widely implement this application in the digital factory process of industry partners to gain valuable user feedback and continue to improve the approach to factory planning using VR.

The last and smallest cluster is the "Science and Virtual Reality Environments" cluster, consisting of two elements: "immersive learning" and "virtual-reality environment". This is an area where advanced VR technologies are used to deepen knowledge and enable interactive learning. Recently, the increasing demand for reliable, secure, effective and cost-effective digital applications has prompted various industries to explore the potential of immersive technologies, especially Immersive Virtual Reality (IVR) (Radhakrishnan et al., 2021). According to the literature review (Roldán et al., 2019) the use of virtual reality technology can be used for more advanced learning and exploration of virtual environments. Comparing the utilization of virtual and augmented reality in the industrial context becomes a compelling topic when considering the future of immersive training systems. Ulmer et al. (2020) presented an innovative VR environment that uses gamification and adaptability to learn industrial scenarios. This environment dynamically adapts to each exercise by loading appropriate assets and making corrections based on CAD models. The visual guidance system gradually increases the difficulty of tasks, and KPIs allow you to assess user performance and create effective work sequences transferred to real applications.

5. Summary

Bibliometric analysis of scientific works on the use of VR technology in manufacturing processes leads to the conclusions, which can be used by practitioners and researchers interested in this topic.

Bibliometric analysis showed that the number of publications on this topic is constantly growing, which suggests a growing interest in VR in production management. Especially in the years 2016-2022, there is a rapid increase in interest among scientists in the analyzed direction. Increased interest in research on the use of VR in production and production processes, proves the growing role of this technology in industry. Over the last 3 years, there has been an increase

in the number of scientific works devoted to the areas of education, immersive learning, training, digital factory, and artificial intelligence. Virtual reality can be used to train employees in a safe and interactive way. Research often focuses on training applications, which indicates the role of VR in improving employee competences and increasing safety. VR technology can open up new markets where enterprises can explore new areas of business. The trends reflect the drive to use VR as a tool for optimization, achieving industrial sustainability goals and shaping the future of manufacturing. Research into the use of VR technology can help enterprises optimize product design and production processes, which will save time and reduce costs. The study shows a clear trend related to interest in research and publications that combine virtual reality and artificial intelligence. This indicates that scientists are increasingly exploring the potential for synergies between these two areas. The combination of VR and AI technologies may be a promising tool for improving production processes and implementing innovations in industry. This is valuable information for both business managers and researchers interested in this field. The priorities activities in the future will be exploring how VR technology can be integrated with other advanced technologies such as artificial intelligence and the Internet of Things to further improvement manufacturing processes. An important aspect will also be conducting research on the use of VR for sustainable design of manufacturing processes and identifying ways to save raw materials, energy and minimize the impact on the environment.

The research results identified key and emerging seven areas that require further research and in-depth analysis. These areas are related to, among others sustainability, safety and training, artificial intelligence, Industry 4.0 and smart factories. Research in these areas may contribute to a better understanding of the role of VR in industry. As well as to develop more advanced solutions for the manufacturing industry. This work may encourage interdisciplinary research to fully understand the impact of VR on manufacturing. Research on the impact of VR in manufacturing is important both for the manufacturing industry itself and the broad field of VR technology.

The research limitations were related to using two most representative databases (Scopus and Web of Science) and choosing the scope of virtual reality technology with the manufacturing industry. In further work, the scope of the analysis can be extended to include works indexed in other databases (e.g. Elsevier, Emerald, EBSCO, Schematic Scholar).

The next research stages will be to further analyse mixed reality technology in terms of adaptation of techniques and technologies and digitalization of manufacturing enterprises.

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APPLICATION OF LEAN MANUFACTURING TOOLS IN THE AUTOMOTIVE INDUSTRY, A MULTIPLE CASE STUDY

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Purpose: This paper aims to investigate Lean Manufacturing tools application in automotive companies with a special attention to their early stages of introduction. The scope and methodology of Lean tools implementation are identified. Conditions of their successful operation in company's manufacturing systems are attempted to be determined.
Design/methodology/approach: The exploratory multiple case study method is employed in this study. It provides learnings through a real-life investigation in automotive multinational companies' plants. The qualitative data along with insights are gathered by following purposely designed research protocol applied to each investigated case, it consists of open interviews with managers, data and documents analysis along with observations in research objects.
Findings: It was found that investigated Lean tools in three companies operate effectively and bring a lot of benefits. Lean tools need to have a clear vision of how they would contribute to the company's improvement concept before starting their implementation. Appropriate pace of introduction along with carefully considered steps are of special importance, they need to be adjusted individually to a company specificity. Observed tools are typically changed towards better usability and productivity during theirs use. The responsible team has to be lunched when starting tools implementation, empowerment is necessary, supervisors and line managers should treat Lean tools initiatives with personal involvement. The study discovers that final implementation effect depends on preparation stage and employee engagement.
Research limitations/implications: The study possesses all the limitations typical for the qualitative research method. The conclusions are based on fragmentary view of the three business objects. Studied companies are located in one EU country, Poland. In other regions/countries, the view of Lean tools might differ.
Originality/value: The study provides an in-depth insight in Lean tools application and operation in automotive companies, the automotive industry is leading in Lean implementation. The observations, generalizations and concussions are unique in the literature, the study offers a research input to further studies, it also contributes to management practice.

Keywords: Lean tools, Lean implementation, automotive industry.

Category of the paper: research paper, case study.

1. Introduction

Lean tools implementation is a complex process that requires organizations to determine how to articulate and define Lean journey. Even highly knowledgeable and well-organized companies regularly struggle with it. Preparation stage entails not only setting the goals and choosing process to simplify. Crucial point is to define steps of the implementation and adjust the most suitable tool to the business need.

Lean Manufacturing is a philosophy and a mind-set that helps organizations to identify and eliminate waste and thereby increase the value of business processes. It includes various techniques, enablers and metrics, which find their application in current manufacturing sectors. (Ojha et al., 2014). The main idea behind continuous improvement is a systematic strategy to determine and remove waste activities through looking for opportunities to optimize processes (Taj, Morosan, 2011; Inan et al., 2021).

Various authors have documented quantitative benefits of Lean tools implementation such as increasing overall equipment effectiveness, production cost and defects reduction, improvement in production lead time and cycle time (Belekoukias et al., 2014; Belhadi et al., 2018, Elrhanimi et al., 2016) Researchers indicate also qualitative benefits such as effective communication, job satisfaction, team decision making, work standardization and employee morale (Aij, Teunissen, 2017; Fulleron et al., 2014).

The literature consensus is that the Lean philosophy requires a long-term view, respect for employees, level of patience, focus on processes and the ability to understand where waste happens in the company to use effective Lean tools. Various types of methods and techniques for improving processes have been proposed in the literature. Manuals and consulting industries can help managers and production workers understand how to implement these techniques successfully (Urban, Tochwin, 2022).

This research objectives to investigate of scope and methodology in practical Lean tools implementation in automotive companies. In multiple case studies analysis, researches verify how managers were preparing tools introductions, who are the main stakeholders involved and what are the conditions for successful implementation.

2. Literature review

Importance of process improvement is constantly growing. Any organization that striving to be competitive in the market must keep up with the rapidly changing environment and take full advantage of both continuous improvement tools and technological breakthroughs.

In literature many authors focus on Lean tools implementation in automotive industry. Researches confirm that that appropriate understanding business need and bottleneck inside the organization, effectively support process of choosing proper Lean tool and have positive impact on business results (Ojha, Venkatesh, 2022; Elrhanimi, Abbadi, 2021; Singh, Singh, 2020; Apafaian et al., 2019). The applicability of Lean initiatives has been proven also in other sectors in the literature by hundreds of successful implementations: pharmaceuticals (Sieckmann et al., 2018), metallurgy (Indrawati et al., 2019), shipbuilding (Sharma, Gandhi, 2017), hospital (Régis et al., 2019), banking (Gong, Janssen, 2015), furniture (Guner Goren, 2017) and also at universities (Balzer et al., 2016).

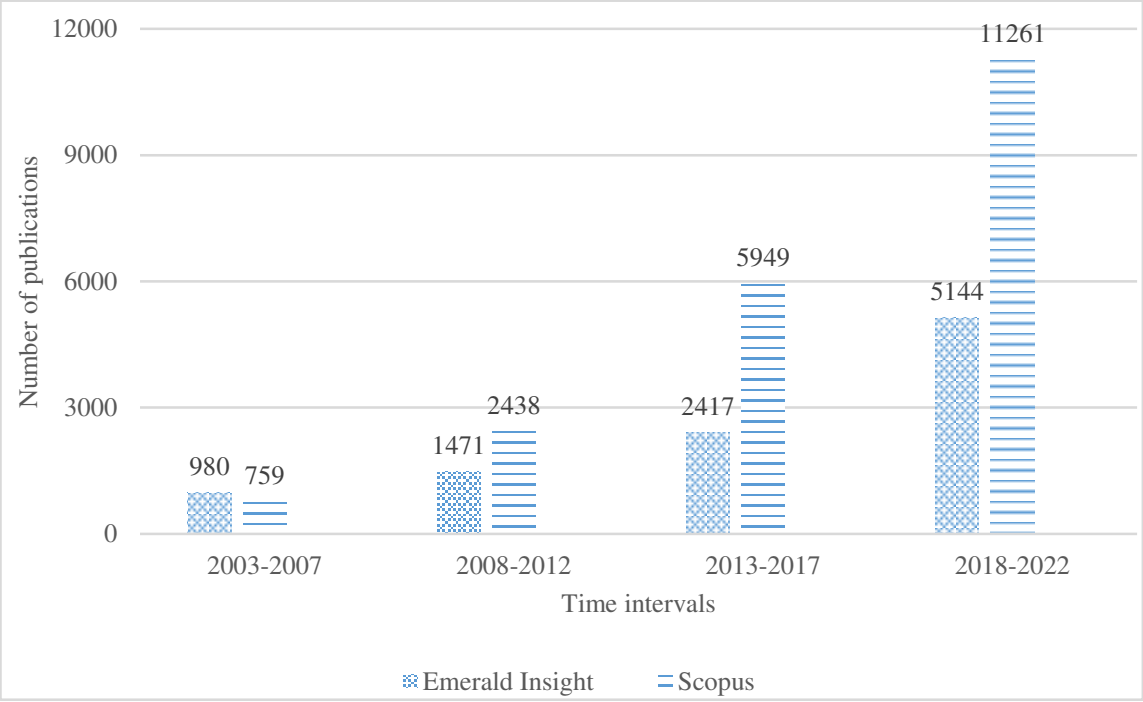

Figure 1. Number of publications in database Emerald Insight and Scopus related to the terms: Lean implementation, process improvement.

Source: own elaboration based on Emerald Insight and Scopus databases (7.04.2022).

Figure 1 introduces trend of rapid grow in popularity of Lean implementation and process improvement topics in literature. Data to prepare this figure was downloaded from 2 online databases: "Emerald Insight" and "Scopus". The scope of research in both of them was the same by using words: "Lean" and "Implementation" and "Process" and "Improvement". Year by year, number of publications dedicated to Lean methodology is still increasing, e.g. in Emerald Insight database between 2008 and 2012 1471 researches were published, between 2013 and 2017 it was 2417 publications and in years 2018-2022 5144 researches were published. In case of Scopus database level of increase was even higher: between 2008-2012 2439 researches were published, between 2013-2017 5949 publications and in years 2018-2022 11261 researches were published. About 80% of publications represents scientific articles, about 12% conference papers, about 5% book chapters and 3% other publications.

Another interesting aspect is rapidly increased number of case study publication focusing on practical Lean implementation. In Scopus database between 2000-2010 50 articles were published, between 2011-2020 number increased up to 474 articles and in years 2021-2022 123 articles were published based on case study methodology. In Emerald Insight database rapid increase is also visible. Between 2000-2010 72 articles were published, then between 2011-2020 number of case study articles increased to 180 and in years 2021-2022 123 articles were published based on case study methodology. Data confirmed that scope of this study is very important topic and research can provide for science new interesting results.

Majority available researches (Apafaian et al., 2019; Estorilio, Posso, 2010; Sahoo, 2020; Singh, Singh, 2020) focus on one tool implementation in company. In this publications main objective is to introduce how one particular tool supports business result in researched object. This is a crucial knowledge. Due to analysis of different case studies based on one tool, it is now possible to extract the most important factors during the implementation process.

In literature there are available publications focusing on different tools used in one company from automotive industry (Kim, 2015; Ojha, Venkatesh, 2022; Elrhanimi, Abbadi, 2021). It presents approach to implementation process in particular researched object. All authors define, that lean implementation without deeply understanding onsites is useless.

The contemporary researchers such as: Gupta et al. (2012), Jadhav et al. (2015), Swarnakar and Vinodh (2016), and Dresh (2018), have assessed various dimension of lean practices in auto-component manufacturing plants. Large automotive companies should not only introduce the potential advantages of lean within their own organization but also extend the approach to their components suppliers (Saho, 2020). Crucial aspect is understanding of the relationship between lean initiatives and operational performance in the context of automotive industry (Swarnakar, Vinodh, 2016; Singh, Singh, 2013).

In available literature, sequence of Lean tools implemented in automotive companies has not been researched. This paper provides specific knowledge of what should be determined and consulted in preparation stage. Conducting research in accordance with clearly defined criteria, facilitates the opportunity to carry out a comparative analysis and identify the main similarities and differences between the examined objects.

3. Research methodology

In this study, multiple case study methodology has been chosen to examine the practical Lean tools implementation and their daily operation in automotive companies. To conduct this investigation, crucial data was collected and analyzed using the following techniques: open interviews with the Lean Manager to understand in details the scope of implemented Lean tools, interviews with employees at different organizational levels (production, administration,

planning and logistics employees), analysis of the company's internal documents in the field of Lean tools, direct observations.

A sequence of queries had been elaborated to provide the accuracy and quality of the field investigation. Each of the queries open series of clarifying questions asked during interviews. The list of queries is presented below:

1) Which tools are practically and effectively implemented in research object?
2) How given tool is used and who was involved in the implementation; how the implementation process went through?
3) What benefits has the organization achieved after implementing this tool?
4) What were the crucial factors of given tool success during implementation and later use?

The scheme of each case examination was standardized with an appropriate open space to explorations of selected important issues. Investigations in companies were conducted in two steps. First, the interviews with representatives of the company's senior management (Lean Manager or related positions). The issues related to Lean maintenance and company development strategy, Lean tools implementation process and benefits, motivation for improvements, managers and other employees involvement and engagement were raised. The second step relied upon production area visits with Lean Manager. This step included observation of the production process, open-ended questions referred to practical issues of implemented Lean tools in a company, overview of the results presented on tables in production area, discussions of daily management practices with reference to used tools, individual interviews with employees devoted to their involvement in Lean tools implementation and everyday use.

Direct observation facilitated the researchers to collect and verify the information provided by respondents. Any unexpected activity being observed was then tested through discussion with individuals or group of employees at the research object to confirm the validity of the observation. Hence through this approach, as well as quantitative and qualitative data were simultaneously collected. Access to information is a crucial element to conduct effective case study research (Panizzolo et al., 2012; Lande et al., 2016). To conduct the evaluation of Lean implementation even better, deep analysis of the internal documentation was conducted.

Case study investigations were conducted in 3 automotive manufacturing plants in Poland. Owing to confidentiality reasons, the identity of the companies has been masked and a fictitious identity given as company A, company B, company C.

4. Lean tools applications – multiple case study

In Table 1 was introduced basic information about research objects. Study was conducted in one medium size company (Company A) and two large companies (Company B and C). Each company is characterized by the use of two or three main technologies and auxiliary technologies in the entire production process. Observed Lean tools mentioned in the table are operating on daily basis in the examined objects.

Table 1.
Research objects description

	Company A	Company B	Company C
Number of employees	100	450	700
Area of the production plant	6000 m2	10 000 m2	13 500 m2
Main technologies	1) Pressing 2) Pressure welding	1) Injection molding 2) Pressing	1) Electromagnetic coil 2) Injection molding 3) Thermoforming
Implemented Lean tools	1) Visual management 2) Regular board meeting 3) VSM 4) Kaizen suggestion system	1) 5S 2) One Piece Flow 3) VSM 4) SMED 5) Line balancing	1) Kaizen suggestion system 2) VSM 3) SMED 4) Internal improvement system

Company A

Research object was founded in 2012 as a small family production company located in Poland. The main areas of activity focus on the production of pressed steel and aluminum parts and the serial production of pressed body parts for customers in the automotive industry. In order to ensure the highest quality at an affordable price, the company uses the latest technologies of cutting, punching, deep drawing and welding. Production is mainly focused to produce for car concerns such as Mercedes, BMW, Audi and Ford. The company's machine park is equipped with presses of various pressure forces - from 400 T to 1000 T, as well as welding cells and welding devices.

The enterprise has been implementing Lean since the beginning of 2021. Tools such as Visual Management, Regular board meeting, Value Stream Mapping and Kaizen were implemented. To prepare for the implementation, an external company specializing in implementing continuous improvement practices in industrial enterprises was hired. Production manager emphasize that the most important period was preparation phase. Employees haven't had even basic knowledge about implementation process. Together with Lean specialist, main bottlenecks in research object was defined. After that, first ideas about precise Lean tools selection to adjust to business needs were discussed. The next step consists in selecting 14 representatives of various departments of the research facility to take part in comprehensive trainings entitled as Lean Belt. The main goal of this activity was to train employees about Lean

tools, important stages during implementation, key stakeholders and possible obstacles. The next element was to organize internal workshops to develop common approaches to implementation, define communication model and prepare plan how to share Lean knowledge with production workers (main stakeholders). Continuous improvement department supported particular departments in preparation, employee trainings and building engagement.

Company has started Lean journey 2 years ago and already is aware of its first benefits. For example, VSM implementation enabled to identify activities that did not provide added value, eliminate it and reduce stock between workstations by 60%.

Company B

The examined facility is an international concern with over 160 years of experience in the industry. The company specializes in the production of components for the interior of passenger cars and trucks. Key products include door trim systems, console, instrument panels and cockpit and aerated systems. Organization as a whole consists of more than 40 production plants in 15 countries with 13 technical, engineering and sales centers. Research were carried out at the production plant in Poland. Main customers of the company are car concerns such as Volvo, Audi, BMW and Mercedes. The machine park is equipped with e.g. in automatic machines for cutting fabrics and textiles, injection molding machines, laminating machines, CNC machines as well as sewing machines.

Lean tools have been implemented since the beginning of the production plant in 2016. Implemented tools are: 5S, One piece flow, VSM, SMED and Line balancing. Quality manager confirms that building continuous improvement culture is crucial point to achieve effective results. All employees should be involve in the changes. To support such activities, management board established three-persons team. Members represent production, quality and engineering departments. At first, they took part in external workshop to gain basic knowledge about Lean tools and also see examples of practical implementation. In next step, together with management board and selected representatives of particular departments, business needs were defined and an initial plan for the implementation of lean tools has been developed. Continuous improvement engineer defines that the most important factor during implementation is complete understanding of elaborated approach by all stakeholders. Lean project should have high priority and be the part of company's strategy.

First implemented tool was 5S. The main aim was to standardize workstations and show employees how small changes can help in the daily performance of individual tasks. It also helps to improve safety and reduce quality defects. In researched object, the most effective implementation was One piece flow project. It allowed to reduce stock in the whole production process from 1745 to 48 pieces. It also had a huge impact on reducing internal and external quality defects.

Company C

The examined production plant is part of an international concern. It is a leading manufacturer of spare parts in the automotive industry on the primary and secondary markets. The company specializes in design and production of sensors, coils and switches (e.g. pressure, fuel and oil levels, ABS systems and temperature). The company's main customers are automotive concerns such as Ford, Chrysler, Hyundai, Toyota and Volkswagen. The main production lines are equipped with plastic injection molding machines, primary and secondary winding machines as well as vacuum pouring lines with a system of integrated furnaces and testers. The company implements over 100 new finished products annually, which are designed from scratch, tested and then mass-produced in the research plant in Poland.

Continuous improvement has been implemented since 2009. Implemented tools consist of: Kaizen suggestion system, VSM, SMED and Internal improvement system. Lean Manager confirms that Lean tools have a positive impact on reducing waste, improving the quality of finished products and customer satisfaction. To coordinate implementation of particular initiatives, 2-persons team were established. Team members have worked in research object since the beginning of functionality and already implemented their own optimization ideas at the work stations. Production Manager emphasizes, that increasing the efficiency of processes requires the full involvement of employees and openness on change. In the beginning, these two employees were delegated to another production facility of the company where practical Lean solutions are already implemented. Experienced Manager conducted workshop and explained basic knowledge about Lean tools, crucial implementation steps and key success factors. In the next step, Lean department with the support of the management board and representatives of particular departments, developed a concept for implementing the first optimizations. The crucial point was to elaborate trainings for employees to make sure that knowledge inside organization is shared and to link Lean project with the business strategy.

In research object, high levels of engagement employees at all position was observed. Lean culture has been continuously developing since 14 years. It is worth adding that in 2022, the savings generated from all Lean initiatives undertaken in this company will amount to about 1 million PLN.

5. Discussion

Lean tools are designed to eliminate invaluable processes. Implementation is a transformational journey and needs to enable organizational development alongside process improvement. In research objects it was confirmed that the most important is the preliminary stage. Company should develop long-term strategy and define priorities. Customizing Lean tools to the organization's business needs its essential element.

In Table 2 sequence of Lean tools implementation in research objects is presented. Despite the fact, that all the researched companies operate in the same industry, the implementation process was different.

In company A, at the beginning of the Lean journey, visual management and regular board meeting were implemented. The main goal of this activities was to achieve work environment where everyone is aware of defined areas in plant, and knows where to find components needed in production process. Additionally, second objective was improving engagement of all employees in discussion about daily problems and ideas of how they can be solved. When positive effects were seen, company decided to implement Kaizen suggestion system to enable employees sharing ideas about potential improvements at work stations. To identify gaps in process research, object also decided to use VSM (Value Stream Mapping). This tool can help to understand what are value-added activities in process and collect realistic data about efficiency and flow.

Company B has started the implementation from 5S tool. The main goal of the implementation was to increase work safety at the workplace and the quality of products. The standardization of workstations also had a positive impact on ergonomics and order. Visualizations of each production lines were created to define how the equipment in a workplace should look like, and also created location for components and all needed units. Second chosen tool was One Piece Flow. Main objective of implementation was bottleneck identification in processes. To verify where are the main loses, company used VSM tool to develop visualization of current stage and future ideal state. After achieving positive results, researched object invested also in implementation of SMED and Line balancing tools. Starting with the most complex lines, they began to analyze all process steps to identify elements for improvement or complete elimination of worthless tasks.

Company C has decided to implement Kaizen suggestion system. First version of this tool was basic with simply form and rewards system. After few years, system wasn't effective and as a result, number of suggestions decreased rapidly. After that, company decided to developed new version of suggestion system with more complex approach and rewards system to motivate employees. To visualize process and identify losses company used VSM. This tool was used two times already. In 2016-2018 first visualizations were created, and more after two years to verify, that implemented solutions are still working effectively. Achieved positive results, encouraged the company to invest in SMED on the most complex lines (the highest number of changeovers). Finally, Lean teams elaborated "internal improvement system" tool. It is used by production team leaders, who are responsible for development of one improvement project per year. Ideas may concern safety, quality or saving the costs. Elaborated solutions are presented to management board and the most effective are implemented and awarded.

Table 2.
Lean tools implementation sequence in research objects

Year	2009	2010	2011-15	2016	2017	2018	2019	2020	2021	2022	2023
Company A									Visual Management		
									Regular board meeting		
										Kaizen suggestion system	
										VSM	
Company B				5S							
								One Piece Flow			
								VSM			
									SMED		
									Line balancing		
Company C	Kaizen suggestion system							Kaizen suggestion system			
				VSM					VSM		
									SMED		
									Internal improvement system		

In three research objects, sequence of Lean implementation were different. The whole process is multi-staged. At first, company needs to identify what should be improved, develop a concept with the timeline and elaborate the plan on how to involve employees in this change. In company A, the main identified loss was ineffective communication model between teams and it was a main reason to use visual management and regular board meetings. In company B, problem with maintaining orders and discipline at work stations were identified, and it was a reason to implement 5S. In company C, it has come in a natural way. Production employees have started to report their own ideas of how to simplify process on their work stations. Kaizen suggestion system was developed to allow employees sharing ideas in a more standardized way. It is a perfect example of how smart company should react on internal employee's needs.

Authors also observed main conditions for the successful using of Lean tools. In researched objects, continuous improvement implementation came from the company's development program. Crucial factor is a complete and correct understanding of Lean tools scope and understanding of how they should be used to achieve effective results. It is a reason why companies during each implementation invested in workshops, training and in sharing knowledge inside the organization. All employees should be aware of why company decided to implement such tools and what potential benefits can be achieved. The changes should occur

at an operational level (tool) and at a strategic level (Lean thinking) (Hines et al., 2004). Another essential step is to continuously develop Lean tools and adjust them to specific company's business needs.

Additionally:

- In company A the transformation process began from confirmation that all managers understood the organization's strategic directions, main goals and their own role in the business. Thanks to this, all employees are aware of their contribution to the identification and elimination of waste.
- In company B implementing Lean tools has a top priority. High-level managers are involved in all actions and actively participate in the preparation of the tool implementation plan and in the entire enforcement process.
- In company C there is a highly developed awareness of the main strategic assumptions among employees at all levels of the organization. Achieving this state required involvement of managers of all departments in providing information in an understandable way since the very beginning of the Lean tools implementation. Productions employees are engaged and know that their contribution to the development of the organization will be appreciated.

Researchers suggest that well organized preparation stage supports achieving assumed results (White et al.,2009; Thun et al. 2010). Appropriately developed action plan with timeline of implementation is a key. Plan should include: essential steps, human resources, working time and external support. The pace of change should be adjusted to the goals and development level of the organization.

Lean and Production Managers in researched objects, confirmed that continuous improvement is possible thanks to:

- Full engagement of management board by constantly looking for alternatives to increase company results and enhance employee's skills.
- The line management plays the trigger role and can be a possible issue in the primary importance of Lean tools successful use by the organizations.
- Elaboration of appropriate workshops and training materials to enhance all employees to changes and for them to be the part of it.

In conducted studies, authors refer to identified in literature Lean success factors. In research objects it was identified like conditions supporting implementation.

Table 3.
Lean success factors identified in literature and in researched objects

Lean Success Factors according to literature (Urban and Tochwin, 2022)	**Company A**	**Company B**	**Company C**
Commitment of top management	X	X	X
Training and education	X	X	X
Effective system of awards and recognitions	X		X
Concentration on production workers	X	X	
Cultural change		X	X
Data-based approach and link to business strategy			X
Lean project prioritization		X	
Precise selection of Lean tools	X		
Unidentified in research objects: Appropriate selection of the implementation team, Performance management system, Sufficient resources, Project management skills, Benchmarking system, Lean projects tracking and review, Realistic success criteria, Appropriate communication models			

Note. In table "X" means that authors identified given factor in the study.

Table 3 presents the Lean success factors identified in authors previous study. Systematic literature review was conducted (Urban, Tochwin, 2022). Authors asked Managers in research companies to indicate top 5 factors supporting implementation of Lean tools. It is interesting that Managers at all facilities confirmed that crucial elements are "commitment of top management" and "training and education". This two factors are strongly connected. Management board should understand the training needs and give opportunities and resources to organize workshops and share Lean approach among the whole organization. Company A and C also indicates that "effective system of awards and recognition" is very important. Employees should feel that their effort and ideas are appreciated, then their engagement will increase. It is worth to add that "concentration on production workers" was also identify as an important topic by Company A and B. Production processes on shop floor level are the most important ones, since their goal is to create finished goods without defects. Company B and C indicates that if Lean effect are well known by employees then the "cultural change" is visible. After that, it is possible for the employees to achieve results they had never imagined. One of production workers said that "there are tasks I can do now that I never thought I could do before". It is very important to understand why decisions about implementation any particular tools took place. Far too often, when employees talk about "Lean" all they have in mind is about cost savings and process improvements. Very often it is not a primary reason. It is about "cultural change" to deliver long term improvement.

6. Conclusions

This study investigates Lean tools implementation in three different automotive companies located in Poland. Research confirmed that effective results can be achieved if since the very beginning (early stage of introduction) employees are engaged in change. Lean transformation involves whole organization, all stakeholders should work with continuous improvement approach and use it in everyday activities. The vision of what would be achieved and how much is it crucial to company future success are indispensable.

Employees engagement has a huge impact on final results. It is a main reason why companies invested a lot of effort in trainings and workshops about Lean methodology. In researched companies, the strategic objectives and directions of development are understandable to all employees. Not only management, but also production line employees must to identify themselves with the designated development path of the organization. The key element is to create environment in which employees feel that they are part of the organization and have an impact on the implementation of the company's strategy. The role of line managers, the direct operators' supervisors looks to be of outstanding importance, their personal involvement as well.

The pace and sequence of Lean tools implementation is very important. They should be adjusted to identify business needs and company specificity. Process of tools implementation must be always open to modify scope of project to adjust to the current situation. Sometimes in preparation stage, it is difficult to identify all potential obstacles. Fast reaction gives the opportunity to get back on track as fast as possible. The key element is openness to employee's feedback.

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ASSESSMENT OF MANAGERIAL COMPETENCIES BY GENERATION Z

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Purpose: The aim of the text is to identify managerial competencies that are most and least desired by representatives of Generation Z. Additionally, the article sought to examine whether there are significant statistical differences in the evaluations of these competencies between women and men of this generation participating in the study.
Design/methodology/approach: The following research hypotheses were set: H1: There are specific managerial competencies that are particularly desired by representatives of Generation Z; H2: There are specific managerial competencies that are especially undesirable for representatives of Generation Z; H3: There are statistically significant differences in the assessments of managerial competencies between women and men of Generation Z. To verify hypotheses H1 and H2, basic statistical measures were used: arithmetic mean (M), median (Me), and standard deviation (SD). The Mann-Whitney U test was employed to verify hypothesis H3.
Findings: All competencies that were the subject of the study are highly rated by respondents, indicating a general consensus that these competencies are crucial for managers. The highest-rated competency is the clear definition of task structure, and the ability to manage crises effectively is also highly valued by respondents. Among competencies with lower ratings are such as creating an organized list of tasks that take into account the interdependencies between them or effectively motivating employees by using both rewards and punishments to achieve desired results. However, these competencies also achieved relatively high average values, emphasizing their significance. The Mann-Whitney U test showed no significant statistical differences in evaluations between women and men, confirming that both groups have similar expectations and opinions about the importance of various managerial competencies.
Research limitations/implications: The limitations of the text include the lack of representativeness of the study, resulting in the inability to generalize the findings. Future research directions may include: determining differences in the perception of managerial competencies stemming from diverse cultural traditions, examining whether respondents' expectations differ depending on the industry or sector they are employed in, and investigating whether specific personality traits influence expectations regarding managerial competencies.
Originality/value: The results can be significant for both the academic community and practitioners. This study enriches knowledge in the area of cohort theory, and the presented findings can assist in understanding Generation Z's expectations in the work environment. Additionally, the work provides a valuable contribution to literature in the field of human resource management, analyzing it through the lens of Generation Z.

Keywords: competencies, managerial competencies, generation Z.
Category of the paper: research paper.

1. Introduction

In the contemporary labor market, four generations of employees coexist, shaped by different social and economic events. These are the Traditionalists (born before 1945), the Baby Boomers (born between 1946 - 1964), Generation X (born between 1965-1979), Generation Y (born between 1980 and 1994), and Generation Z (born in 1995 or later) (Sidor-Rzadkowska, 2018, p. 88). It should be emphasized that researchers dealing with the issue of generational diversity use both different terminology and birth periods for individuals classified into particular groups (Jeruszka, Wolan-Nowakowska, 2020, pp. 34-35; Paszkiewicz, Wasiluk, 2022).

Generations are characterized by various value systems, professional goals, levels of engagement, and motivational preferences (Różańska-Bińczyk, 2022). Additionally, representatives of these generations differ in their understanding of development, loyalty, and dedication to the organization (Warwas, Wiktorowicz, Jawor-Joniewicz, 2018, p. 22).

The subject literature allows for the identification of several areas that constitute a particular interest for researchers of Generation Z. These include:

- Approach to Technology and Digital Media - Research focuses on the interactions of representatives of this generation with technology, social media, and the internet. Researchers strive to understand how these tools impact their social life, education, and mental health (Frąckiewicz, 2023).
- Education - Research concentrates on analyzing the ways in which Generation Z learns and prepares to enter the job market (Ruszaj, Błażejewski, 2021).
- Values, Attitudes, and Mental Health - Research in this area focuses on the values held by Generation Z, their attitudes towards social and political issues, and the mental health challenges they face. Researchers strive to understand the causes of their anxieties, stress, and other mental health issues (Michalak, Olejnik, 2023).
- Consumerism and Lifestyle - Research focuses on analyzing the shopping habits of Generation Z, their preferences towards brands and products, and their interest in sustainable development and ecology. Researchers strive to understand how their social and environmental awareness impacts their purchasing decisions and lifestyle (Sobura, 2023; Szymańska, 2022).

- Social Relationships - Research in this area concentrates on how Generation Z builds and maintains relationships with others, both in the real and digital worlds. Researchers' interest also focuses on their attitudes towards diversity, discrimination, and human rights (Marciniak, 2020).
- Job Market - Researchers' interest concentrates on the professional expectations, values in the workplace, and preferences regarding the work environment of Generation Z (Wajnbrener, Werczyńska, 2022; Jankowska, 2022; Kwiecińska et al., 2023).

This text focuses on the last of the mentioned areas. It should be noted that although generational differences in the workplace and their potential consequences have been a popular subject of discussion among organizational practitioners, researchers, and commentators for several decades (Pollak et al., 2015, p. 182), the Generation Z that is currently entering the job market presents new challenges and specific characteristics that are not yet fully recognized. It seems that further, in-depth research on this topic is necessary to effectively address the needs and expectations of this group. Authors emphasize the increasing role of manager-leaders in creating conditions for effective cooperation (Juchnowicz, 2014).

With the above in mind, the aim of the text was to identify managerial competencies that are most and least desired by representatives of Generation Z. The conducted analyses were aimed at answering the following questions:

RQ 1 – Which competencies are most desired in managers according to respondents?

RQ 2 – Which competencies are least desired in managers according to respondents?

RQ 3 – Are there statistically significant differences between the evaluations of women and men participating in the study?

The following research hypotheses were proposed:

H1: There are specific managerial competencies that are particularly desired by representatives of Generation Z.

H2: There are specific managerial competencies that are particularly undesired by representatives of Generation Z.

H3: There are statistically significant differences in the evaluations of managerial competencies between women and men from Generation Z.

The method applied in the study was primarily the analysis of secondary data – theoretical and research works, as well as quantitative research conducted by the author in 2022.

2. Review of the literature

Generation Z comprises over 32% of the global population (Miller, Lu, 2019). According to GUS data, nearly 2.5 million people aged 20-27 live in Poland. In the most optimistic assumption, they currently constitute no more than 10% of the working staff (Wasiluk,

Tomaszuk, 2022, pp. 61-62). Over time, their number and significance in the labor market will steadily increase. Projections predict that by 2028, Generation Z representatives will make up as much as 58% of the global workforce (Responsible Business Forum, 2022).

Generation Z consists of young individuals who are just starting their professional careers or have recently done so. It is said that they have more in common with their global generational cohort than with their own parents. Round-the-clock access to information, mainly due to the Internet, facilitates the dissemination of values and characteristics typical of this generation (Farrell, Phungsoonthorn, 2020). However, as M. Pawłowska (2022) notes, this is a very divided generation "in which it will be so clearly visible who "inherited from their parents": education, wealth, openness to the world, and a chance for professional success."

Although generational differences in the workplace and their potential consequences have been a popular subject of discussion among organization practitioners, researchers, and journalists for several decades (Pollak et.al., 2015, p. 182), the literature concerning Generation Z is still in the developmental phase (Dwivedula, Singh, Azaran, 2019; Chillakuri, 2020). An increasing number of studies suggest that members of Generation Z differ in some significant respects from the preceding millennials (Bencsik, Horváth-Csikós, Juhász, 2016; Bergler, 2020). However, it should be noted that many research findings on the characteristics of this generation are conflicting. For instance, B. Crouch (2015) and A. Bencsik, G. Horváth-Csikós, T. Juhász (2016) argue that representatives of Generation Z are very concerned with job stability and security, while according to L. Bernier (2015), they value job fit to their skills more than job security.

Generation Z presents unique challenges for organizations and managers (Chillakuri, 2020). They do not hesitate to express their desires and expect to be recognized and appreciated (Silva Sousa, Colauto, 2021). Unlike previous generations, they are very ambitious, eager to learn new things, and are not afraid to question established norms. They often wonder why climbing the professional hierarchy has to take so long (Wiktorowicz, 2016, p. 76; Lanier, 2017). Therefore, organizations should clearly define career paths for them from the outset of cooperation (Chillakuri, 2020).

Individuals from Generation Z place much more emphasis on work-life balance than their predecessors (Berge, Berge, 2019; Vilanova, 2019; Lima-Vargas, Cervantes-Aldana, Lima-Vargas, 2022). The workplace atmosphere is a key criterion for them when choosing an employer (Generation Z in the job market…, 2019). In studies conducted by C.S. Flippin (2017), it was observed that representatives of Generation Z attach great importance to "happiness", often ranking it above values such as health, family relationships and friendship, career development, financial stability, or spiritual life.

Researchers analyzing Generation Z express concerns that they might be individualists, people primarily focused on self-development and fulfilling their own ambitions. They are sometimes referred to as the generation lacking the "gene of loyalty" towards employers (Rogozińska-Pawełczyk et al., 2019, p. 21). Other experts highlight their strong egocentric

tendencies, having difficulty understanding the value of teamwork, compromise, or sharing (Leśniak, 2022, p. 69). Representatives of this generation quickly move from one task to the next, placing more emphasis on speed than accuracy. They struggle to focus on one thing and see it through. It's challenging to capture their attention so intensely that they aren't simultaneously doing something else (Grabiwoda, 2018, p. 51).

Considering that the oldest representatives of this generation are just entering the job market, it's difficult to definitively assess what kind of employees they will turn out to be and what place intra-organizational relationships or trust in superiors and colleagues will hold in their professional lives. As researchers emphasize, the new generation is shaping a new profile of the employee, consumer, and citizen (Cortés Quesada, Barceló Ugarte, Fuentes Cortina, 2022). For this reason, it is extremely important to continue research on this generation.

Despite the growing interest among researchers in the topic of Generation Z in the labor market, as reflected in numerous studies focusing on various aspects related to it (Kocot, Kwasek, 2023; Chiiakuri, 2020; Silva Sousa, Colauto, 2021; Rogozińska-Pawełczyk et al., 2019; Muster, 2020), the issue of how this generation perceives leadership and managerial competencies remains an open and insufficiently explored question. There is a lack of detailed studies concentrating exclusively on this subject matter. Therefore, addressing the issue of Generation Z's perception of managerial competencies in this text can significantly contribute to bridging the existing research gap, thus underscoring the importance of this matter.

3. Research methods

The analyses presented in this text are a part of a broader study conducted among representatives of Generation Z in 2022 (from January to December). Data were collected using two methods: paper-and-pencil interviewing (PAPI) and computer-assisted web interviewing (CAWI). The online survey was hosted on Google Drive. A link to the survey, along with a request for its completion, was disseminated primarily through social media. Respondents who completed the survey were asked to share it among their acquaintances. For the analyses conducted in this text, only the questionnaires filled out by individuals with an education in social sciences were used – a total of 394 people. Among this group of respondents, there were 232 women (59%) and 162 men (41%).

To determine the expected managerial competencies, a questionnaire developed by the team of A.K. Koźmiński, A.K. Baczyńska, and P. Korzyński (2018, pp. 274-275) was used. This questionnaire was employed in their previous research. Unlike the original studies, where participants described specific individuals, in this research, respondents referred to a hypothetical supervisor, indicating their desired competencies (Table 1).

Table 1.
The questionnaire used to measure managerial competencies

Question mark	Items
Mn 1	My supervisor should set and adhere to deadlines controlling the completion of assigned tasks.
Mn 2	In team activities, my supervisor should take into account employees' suggestions.
Mn 3	My supervisor should define the necessary resources to achieve goals.
Mn 4	My supervisor should adjust plans and implement corrective actions if goals are not met.
Mn 5	My supervisor should offer help and support on their own initiative.
Mn 6	My supervisor should operate efficiently in emergency situations.
Mn 7	My supervisor should create an organized task list considering the interdependence between them.
Mn 8	My supervisor should respond to feedback regarding the team's task execution methods – they should foster cooperation and information exchange.
Mn 9	My supervisor should optimally allocate tasks to employees.
Mn 10	My supervisor should efficiently, meaning effectively and skillfully, monitor the achieved results against the planned goals.
Mn 11	My supervisor should encourage employees to take the initiative and actions.
Mn 12	My supervisor should assign responsibility for tasks, e.g., determining who has the right to make decisions and to what extent.
Mn 13	My supervisor should optimally plan the time for task execution, ensuring timely goal achievement.
Mn 14	My supervisor should skillfully motivate employees, using both rewards and punishments, to achieve the intended results.
Mn 15	My supervisor should clearly define the structure of tasks so that everyone knows what, how, and when to do.

Source: based on (Baczyńska, Koźmiński, Korzyński, 2018, pp. 274-275).

The responses obtained from the respondents were coded and subjected to statistical analysis using the Statistica 14.0 software.

The reliability of the adopted measurement scale was assessed using Cronbach's α coefficient, which was 0.91. Therefore, it can be considered to be of a very good level.

To verify hypotheses H1 and H2, basic statistical measures were used: mean (M), median (Me), and standard deviation (SD). The Mann-Whitney U test was used to verify hypothesis H3.

4. Analysis

For all respondents, the average values for all statements are high, suggesting that respondents uniformly recognize these competencies as important for managers. It's worth noting that there are no items that were rated as insignificant or of little importance. The highest-rated item is Mn 15, concerning the clear definition of the task structure ($M = 4.41$, $Me = 5$). This indicates that transparency and clarity in terms of duties and expectations are key to effective management. Statement Mn 6, pertaining to efficient action in emergency situations, received one of the highest average scores ($M = 4.37$, $Me = 5$). This shows that the ability to manage crises effectively is highly valued by respondents.

Table 2.
Basic descriptive statistics of the studied variables and the results of the Mann-Whitney U test

Items	Total respondents			Women			Men			*U* Mann-Whitney Test		
	M	***Me***	***SD***	***M***	***Me***	***SD***	***M***	***Me***	***SD***	***U***	***Z***	***p***
Mn 1	4,22	4,00	0,88	4,25	4,00	0,91	4,17	4,00	0,84	17333,50	1,42	0,19
Mn 2	4,23	4,00	0,86	4,26	4,00	0,84	4,18	4,00	0,88	17952,50	0,81	0,45
Mn 3	4,15	4,00	0,86	4,17	4,00	0,87	4,12	4,00	0,85	18110,00	0,66	0,54
Mn 4	4,27	4,00	0,82	4,28	4,50	0,84	4,27	4,00	0,79	18378,00	0,40	0,71
Mn 5	4,12	4,00	0,95	4,17	4,00	0,94	4,04	4,00	0,97	17340,50	1,39	0,19
Mn 6	4,37	5,00	0,78	4,34	5,00	0,79	4,40	5,00	0,77	18196,00	-0,59	0,59
Mn 7	3,94	4,00	0,94	3,91	4,00	0,93	3,98	4,00	0,96	17897,00	-0,85	0,42
Mn 8	4,21	4,00	0,87	4,20	4,00	0,89	4,23	4,00	0,84	18616,00	-0,17	0,87
Mn 9	4,18	4,00	0,86	4,15	4,00	0,86	4,22	4,00	0,86	17919,00	-0,84	0,43
Mn 10	4,27	4,00	0,81	4,27	4,00	0,79	4,28	4,00	0,84	18456,00	-0,33	0,76
Mn 11	4,15	4,00	0,87	4,20	4,00	0,82	4,08	4,00	0,93	17714,50	1,04	0,33
Mn 12	4,09	4,00	0,93	4,03	4,00	0,95	4,18	4,00	0,90	17164,50	-1,55	0,14
Mn 13	4,22	4,00	0,89	4,22	4,00	0,90	4,22	4,00	0,88	18684,00	0,10	0,92
Mn 14	4,03	4,00	1,00	3,99	4,00	1,03	4,09	4,00	0,95	17917,00	-0,83	0,43
Mn 15	4,41	5,00	0,86	4,45	5,00	0,85	4,36	5,00	0,89	17652,00	1,17	0,31

M - mean, *Me* - median, *SD* - standard deviation, *U* - Mann-Whitney U statistic, *Z* - statistic that results from the normalization of U, *p* – probability.

Source: own study.

The lowest ratings were given to the statements: "My supervisor should create an organized list of tasks taking into account the interdependencies between them" (Mn 7 – $M = 3.94$), "My supervisor should effectively motivate employees, using both rewards and penalties, to achieve intended results" (Mn 14 – $M = 4.03$), and "My supervisor should assign responsibility for tasks, specifying who decides and to what extent" (Mn 12 – $M = 4.09$). However, even these competencies with lower ratings have relatively high average values (all close to 4 on a 5-point scale), emphasizing their importance.

The standard deviation ranges from 0.78 to 1.00, indicating a relatively small dispersion of ratings around the mean. Indicators with lower values (e.g., Mn 6 – $SD = 0.78$) suggest that respondents' views on a particular item were more consistent and uniform. For these competencies, most respondents had similar expectations or opinions. An indicator equal to 1 indicates slightly greater dispersion of ratings, which may suggest differences in expectations towards managers.

In both groups (women and men), similar trends in competency assessment can be observed, with higher values for the same competencies. In some cases, such as Mn 5 ("My supervisor should provide assistance and support on their own initiative") and Mn 11 ("My supervisor should encourage employees to take initiative, actions"), women scored slightly higher average values than men (respectively 4.17 vs. 4.04 and 4.20 vs. 4.08). This may suggest that women have slightly higher expectations regarding certain competencies. Conversely, for other competencies, such as Mn 6 ("My supervisor should act efficiently in emergency situations") and Mn 9 ("My supervisor should optimally allocate tasks to employees"), men scored slightly higher average values than women (respectively 4.40 vs. 4.34 and 4.22 vs. 4.15), indicating a different tendency.

In the female group, the highest average rating was achieved by competency Mn 15 - "My supervisor should clearly define the task structure so that everyone knows what, how, and when they should do" (M=4.45), while among men the highest average was for item Mn 6 - "My supervisor should act efficiently in emergency situations" (M = 4.40). For certain competencies, such as Mn 14 ("My supervisor should skillfully motivate employees, using both rewards and punishments, thereby achieving the intended results"), women had a slightly higher standard deviation than men, indicating a greater dispersion of answers among women. Although in many cases the standard deviation values are similar for both genders, there are some differences. Women have a slightly higher standard deviation (Mn 5 "My supervisor should provide assistance and support on their own initiative" – M = 0.94, Mn 14 "My supervisor should skillfully motivate employees, using both rewards and punishments, thereby achieving the intended results" – M = 1.03) compared to men (Mn 5 – M = 0.97, Mn 14 – M = 0.95), suggesting a greater dispersion of ratings among women in these areas.

Considering the above analyses, it should be concluded that hypothesis H1 and H2 have been positively verified.

The Mann-Whitney U test was conducted to check if the observed differences in the assessments of women and men are statistically significant. The results indicate no significant differences between the compared groups. All p-values are higher than 0.05. Z-values are generally low and close to zero, further indicating a lack of significant differences between the assessments of the studied women and men. U values are consistent for all items, confirming that there are no significant differences between the samples. It should therefore be assumed that hypothesis H3 has been negatively verified.

5. Discussion

All competencies subjected to the study received high ratings from the respondents, which indicates a common belief in their significance for the role of a manager. The competency "clear definition of task structure" (Mn 15) enjoys the highest average rating, emphasizing the importance of transparency and clarity in defining duties and expectations as key elements of effective management. Meanwhile, the "ability to manage crises effectively" (Mn 6) also gained recognition among the respondents, highlighting its essential role in a manager's work. Therefore, it should be acknowledged that hypothesis H1 has been positively verified.

Lower positions in the ranking include competencies such as "creating an organized list of tasks, taking into account the interdependencies between them" (Mn 7) and "effective motivation of employees, using both rewards and punishments to achieve intended results" (Mn 14). Nevertheless, these competencies also received relatively high average ratings, once again underlining their significance in the context of management. The standard deviation of

the results ranges from 0.78 to 1.00, indicating relatively low variability of ratings around the mean value. This, in turn, suggests that the responses provided by the respondents were characterized by considerable consistency and unanimity. Therefore, it should be acknowledged that hypothesis H2 has been negatively verified.

The analysis of responses from women and men showed that both groups have similar trends in competency assessment. The observed differences are small and pertain to specific competencies, such as Mn 5 and Mn 11 for women, and Mn 6 and Mn 9 for men. Women had a slightly greater dispersion of ratings for some competencies, indicating greater differences in their expectations and opinions. The Mann-Whitney U test did not reveal any statistically significant differences in the ratings of women and men, confirming that both groups have similar expectations and opinions about the importance of different managerial competencies. Therefore, it should be acknowledged that hypothesis H3 has been negatively verified.

The results obtained in the analyses conducted in this text are consistent with the observations of other researchers, including the studies of J. Fratričova and Z. Kirchmayer (2018). These authors in their studies on the motivation of Generation Z noted that the main barriers to motivation are the monotonous nature of work, an overload of duties, and a lack of a sense of purpose in tasks performed. On the other hand, the key motivating factors turned out to be the opportunity for career development and continuous learning. In the research presented in this text, respondents rated the competence "My supervisor should effectively motivate employees, using both rewards and punishments, to achieve the intended results" the lowest. This observed approach points to the need for a new management style that more reflects the values and priorities of Generation Z. Guided by these observations, it can be postulated that traditional methods of motivation, such as simple reward and punishment systems, may no longer be as effective as they once were. Instead, Generation Z, raised in a technologically advanced and rapidly changing environment, is looking for a deeper meaning in work, as well as opportunities for self-realization and improvement. Management should therefore consider how to better adapt their management methods to the needs of this young generation. It seems that the key to effective motivation is to create a work environment that offers challenges, the possibility of continuous development, and a sense of belonging and purpose. Only then can we expect full commitment and loyalty from Generation Z employees.

The high expectations of respondents regarding the abilities of supervisors to act effectively in crisis situations prove that as a conscious generation, they are sensitive to various threats - both physical and digital. They therefore expect that managers will be capable of protecting both themselves and the entire organization. Additionally, research suggests that Generation Z places great importance on their own development (Iorgulescu, 2016), and crisis situations can be a source of valuable experiences for them.

T. Wiedmer (2015) emphasizes that Generation Z values autonomy in work. They do not want to be dependent on colleagues or team members, so representatives of this generation prefer to have a full understanding of their scope of duties. According to H. Bresman and

V. Rao (2018), members of Generation Z expect a positive attitude and clearly defined goals from their superiors. This might explain why one of the most sought-after competencies is: "The supervisor should clearly define the task structure, so everyone knows what, how, and when they have to perform their duties". Moreover, Generation Z deeply cares about a balance between professional and personal life. G. Morahan's (2019) research shows that more than 60% of respondents value this balance more than career development prospects. Gen Z employees do not want to waste time on unnecessary activities or poorly organized tasks (Chillakuri, 2020). Understanding the task structure and clear objectives has profound significance for Generation Z. For this group, raised in a world of instant information and constant access to knowledge, ambiguities in duties can lead to frustration. Clear guidelines from superiors help them manage their time and resources better, resulting in higher productivity and job satisfaction. Additionally, for a generation accustomed to using digital tools for project and task management, clarity in responsibilities is key to effective teamwork. With clearly defined tasks, Gen Z members can focus on what truly matters, instead of wasting time guessing what is expected of them. As a result, such clarity allows them to achieve better results and derive greater satisfaction from their work.

Taking into account the above considerations, directions for further research can be identified, which may pertain to the following areas. It would be worth considering any potential differences in the perception of managerial competencies that might arise from various cultural traditions. It would be significant to check whether respondents' expectations differ depending on the industry or sector in which they are employed. Such a study would have the potential to provide valuable data on specific competencies desired in different sectors of the job market. It would also be worth considering examining whether specific personality traits influence expectations regarding managerial competencies. This would help understand how different personality types evaluate and respond to different management styles.

6. Summary

The study focused on the assessment of managerial competencies by Generation Z respondents. The average ratings for all competencies were high, indicating that the respondents consider these skills crucial for effective management. The highest-rated competency was the manager's ability to clearly define the task structure, highlighting the importance of transparency and clarity in communication. The ability to manage effectively in crisis situations was also highly rated, demonstrating the significance of this skill in the eyes of the respondents. Some competencies, such as task planning considering interdependencies, effective employee motivation, and assigning responsibility, received slightly lower ratings, although still relatively

high. No statistically significant differences were found between the ratings of women and men, indicating consistency in the perception of managerial competencies regardless of gender.

In conclusion, it is worth noting some limitations of the text, such as the lack of representativeness of the study, which prevents generalization of the results. Nevertheless, it should be emphasized that the obtained results may have significant implications for both the academic community and practitioners. The conducted research enriches the existing understanding of cohort theories, offering valuable insights into the expectations of Generation Z in the workplace. Additionally, this work contributes to the literature in the field of human resource management, providing a unique perspective of analysis focused on Generation Z.

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SELECTED ASPECTS OF SPECIAL EDUCATION IN POLAND FOR SUSTAINABLE REGIONAL DEVELOPMENT – STATISTICAL ANALYSIS

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Purpose: The main purpose of the paper is to draw attention to the need of implementing one of the factors of equitable development, that is to remove barriers of social exclusion faced by people with disabilities and provide them with access to high standard education.
Design/methodology/approach: The study used quantitative statistical methods (cointegration, dynamics measures, linear dependence) to determine changes and dependencies in the population, and in the education system in Poland.
Findings: The results of the study showed that the convergent dynamics of change (population) cannot be confirmed by a long-term interrelation. However, the year-by-year increasing number of institutions confirms the high dependence on special institutions in the regions, indicating two most advanced regions in special education in Poland.
Research limitations/implications: The research conducted in the article was based on general data on the number of children and facilities providing education with special educational needs. Further exploration is required to learn about the special needs of students resulting from their degree of disability in particular areas of the country, in order to direct regional development towards fully equitable development.
Practical implications: Recognising the local educational needs of children, especially those requiring greater personal educational involvement, is a source of knowledge for entrepreneurs. In a region of increased activity by people with disabilities, there is a greater demand for investments aimed at improving the qualifications of special education experts and entrepreneurs providing specialized equipment for learning and rehabilitation. Such activities have a real impact on improving the economic situation of the region.
Originality/value: The paper refers to the increased government involvement in the field of inclusive education and general trends in adapting or creating places "friendly to people with disabilities".

Keywords: education, disability, equitable development, region.

Category of the paper: Research paper.

1. Introduction

Sustainable development assumes balance in broadly understood consumption, taking into account the environment, climate and nature surrounding us. The general idea is to take care of the Earth's resources in such a way that there will be enough for everyone, in particular for future generations (UN, 1987; Kamble et al., 2018; Ren et al., 2022). Therefore, it is important that education in this field be complete, and that the development aspect begins at the regional level. The goal of sustainability concept in education is to support learning culture that values diversity and creativity. Such education should also enable students themselves to participate in sustainable development (Sterling, Orr, 2001). Thanks to this approach education can be described as sustainable. This issue is defined by Lin and co-authors (Lin et al., 2023). They describe sustainable education as a learning process that emphasizes personalization and student centeredness in a way to develop the skills needed by this social group. The modern technology, which accompanies the young generation on daily basis is a determinant in the approach to achieving sustainable education. Incorporation of modern information technologies, such as intelligent teaching systems (ITS) (Carbonell, 1970) and technology-enhanced learning (TEL) (Deng, Benckendorf, 2020) are the starting point for achieving high-quality education. Irina Bokova, Director-General, UNESCO: "The benefits of education permeate all walks of life right from the moment of birth. If we are to eradicate poverty and hunger, improve health, protect our planet and build more inclusive, resilient and peaceful societies, then every individual must be empowered with access to quality lifelong learning, with special attention to opportunities for girls and women. The evidence is unequivocal: education saves lives and transforms lives; it is the bedrock of sustainability. This is why we must work together across all development areas to make it a universal right" (UNESCO, 2023).

Building a sustainable future depends on education, which is one of the key areas of the 17 global goals, the so-called Sustainable Development Goals (SDG). The 2030 Agenda for Sustainable Development is a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. The basic assumption of the goals with their 169 associated targets is to observe human rights, including equal treatment of all social groups regardless of their views. The Agenda therefore undertakes not to leave anyone out, including people with disabilities (or other socially disadvantaged groups). It recognizes disability as a cross-cutting issue which must be taken into account in achieving all SDGs (UN, 2015). There are areas such as standard of living, appropriately paid work, participation in education or also in social life, in which disabled people constitute a particularly socially privileged group. The 2030 Agenda can be a guide for countries and local communities to help achieve development in disability integration. According to the provision in the preamble of the Convention on the Rights of Persons with Disabilities (CRPD, 2007), disability is an evolving concept, and defines persons with disabilities as those who have 'long-term

physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others. In 1980, the World Health Organization (WHO) published the International Classification of Impairments, Disabilities and Handicaps (ICIDH, abbreviated as ICF - International Classification of Functioning), which, after five years of detailed research and international consultations, was approved for international use by the fifty-fourth WHO Assembly on 22 May 2001 (resolution WHA54. 21). Classification is a description of a process that provides the means to create maps of various structures and fields. The importance of the interrelations between individual components is presented in Figure 1.

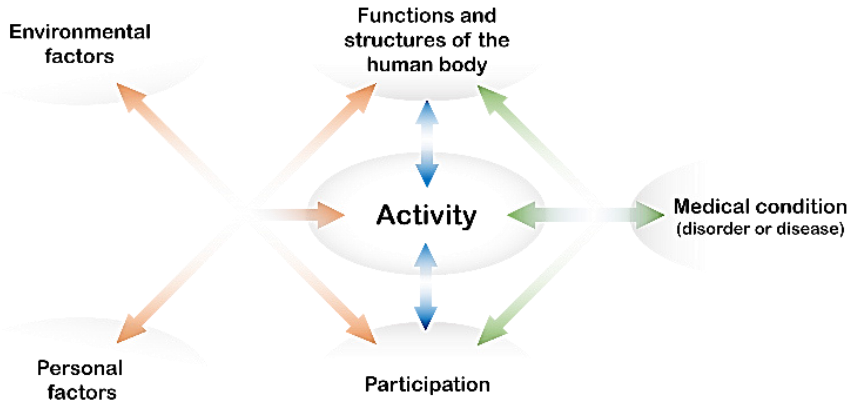

Figure 1. Interrelations between ICF components.

Source: Own work based on (WHO, 2001).

This interactive and evolutionary process constitutes a multidimensional approach to the classification of functioning and disabilities. It provides "building blocks" for users who want to explore various aspects of this process or create models (WHO, 2001).

The issue of disability covered by the SDG goals is to be resolved by achieving the following targets (UN, 2015):

- SDG 4.5: eliminate gender disparities in education, ensure equal access to all levels of education and vocational training for the most vulnerable group, including people with disabilities, indigenous peoples, and children in vulnerable situations.
- SDG 4.A: create new and improve existing education facilities that are child (boys and girls), disability and provide safe, non-violent, inclusive and effective learning environments for all.
- SDG 8.5: ensure full and productive employment and decent work for all women and men, including for young people and persons with disabilities, equal pay for work of equal value.
- SDG 8.6: substantially reduce the proportion of youth not in employment, or not participating in education and training.

- SDG 10.2: empower and promote the social, economic and political inclusion of all, regardless of age, gender, disability, race, ethnicity, nationality, religion or economic or other status.
- SDG 11.2: provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, especially by developing public transport. Particular attention should be paid to the needs of vulnerable situations, women, children, persons with disabilities and older people.
- SDG 11.7: provide easy and universal access to safe, inclusive and accessible, green and public spaces, especially for women and children, older people and persons with disabilities.

People with disabilities are the largest minority group in the world. They are much more likely to become the victims of violence than other people. According to data published by the UN Information Centre in Warsaw: a) incidences of violence occur almost 4 times more often against children with disabilities and 1.5 times more often against adults compared to able-bodied coevals; b) adults with mental illnesses are almost 4 times more at risk of being the victims violence; c) stigmatization, discrimination and ignorance as well as the lack of support for their caregivers increases the risk of violence against people with disabilities; d) one in seven persons worldwide has a disability, hundred million of them are children; e) 80% of people with disabilities live in developing countries, and 50% of them cannot afford health care (UNIC WARSAW, 2017).

2. Literature review

Special education was for the first time described in Public Law 94-142, 94th Congress, Education for All Handicapped Children Act of 1975: "SEC. 4. (a) Section 602 of the Act (20 U.S.C. 1402) is amended— (...) (4) by adding at the end thereof the following new paragraphs: "(16)The term 'special education' means specially designed instruction, at no cost to parents or guardians, to meet the unique needs of a handicapped child, including classroom instruction, instruction in physical education, home instruction, and instruction in hospitals and institutions." (…) "(18) The term 'free appropriate public education' means special education and related services which (A) have been provided at public expense, under public supervision and direction, and without charge, (B) meet the standards of the State educational agency, (C) include an appropriate preschool, elementary, or secondary school education in the State involved, and (D) are provided in conformity with the individualized education program required under section 614(a)" (Public Law 94-142, 1975).

In Poland, the right to education is guaranteed by the Constitution of the Republic of Poland, ascertained by Article 70, which states, among others, that education to 18 years of age shall be compulsory and free of charge in public institutions and that public authorities have the obligation to ensure universal and equal access to education, along with maintaining the autonomy of higher education institutions on the principles set out therein (Constitution of the Republic of Poland, 1997). The right to education in Poland is also assured in the Education Law Act of December 14, 2016, which upholds the principles contained in the Constitution of the Republic of Poland, the Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights and the Convention on the Rights of the Child. Article 2 of this Act describes the components of the education system, including schools and special departments as well as counselling centres and institutions. In turn Article 4 sections 2 and 3 define correspondingly a special unit as the one intended for pupils/students with a certificate of need for special education, referring to Article 127 describing this form of education: "Special education covers children and adolescents with disabilities, socially maladjusted and at risk of social exclusion, requiring special organization of learning and work methods". Sections 3 and 4 of this article describe correspondingly the individual educational and therapeutic programme and the organization of education and upbringing meeting the needs of special education, (Journal of Law 2023, items 900, 1672 and 1718).

The phrase "people with special needs" has an inclusive nature since it refers to people with behavioural, cognitive, sensory, academic and social problems, as well as gifted people (Küçükalkan et al., 2023). Rodriguez and Garro-Gil (2015) distinguish four main stages of the development of special education:

- Exclusion – pertained to people with disabilities or special needs who were eliminated from all social contexts such as family, school, community.
- Segregation – segregated education took place in special schools and classrooms. Its purpose was to relieve public schools of the burden of educating students who were unable to meet the curriculum requirements, thus hampered teaching and educational work. At this stage, learning difficulties were attributed to intellectual impairment of an individual student. Special schools and classes were to provide conditions that mainstream schools could not ensure. The advantages of segregated education are smaller class sizes, specialized education of staff and a much better position of such a child in informal structures of coevals (Serafin, 2009).
- Integration – at this stage public schools were obliged to create a new space for students with special needs, so that they could meet other students without any mental impairments. This space included regular classrooms, special education classrooms, and additional services (Franklin, 1996). The concept and practice of integration assumed that the conditions of education in a mainstream school could be transformed in a way that would create teaching-learning space suitable also for children with disabilities (Sochacka, 2012).

- Inclusion – from the very beginning, social structures and educational facilities such as classrooms, schools, communities and socio-educational activities are designed with students with special needs in mind (Rodriguez, Garro-Gil, 2015). The idea of inclusive education is holistic, focusing on the entire class of pupils/students, enabling effective learning for all children in the classroom. In the education process, the student adapts to the curriculum requirements and the pace of teaching, while the teacher adapts the organization of learning, teaching methods and the given student's needs. This solution enables students to cope and achieve success to the best of their abilities (Szumski, 2006).

Birkan (2002) draws attention to the situation when families learn that their children have an increased risk of abnormal development, most often at their age of 0-6. In such a difficult situation for the family, an early education programme can help. Its aim is to develop healthy patterns of interaction between children with disabilities and other members of the family. It consists of providing parents with information about children's traits, communication methods and their basic needs, which enable the family to make best possible progress and changes in the child's development. Ysseldyke, Algozzine and Thurlow, (2000), point out the lack of sufficient research on children with disabilities aged 0-3. It is important to provide children with special education from their earliest age. This will make it possible for them to establish social contacts like normally developing children, which will help them to determine their place in society. Research on this age group was conducted by researchers from Turkey who compared special education for young pupils in four countries: Turkey, Hungary, Italy and Romania. The overall results showed that these countries have an inclusive education system. Hungary additionally uses integrated education, while Turkey uses an individualized curriculum (Demirok, Haksiz, 2015). Casale, Golann, LeMaster, (2021), provided interesting information about special education. They checked the level of legal knowledge of school principals and deputy principals in the United States regarding special education. In the United States, the Individuals with Disabilities Education Act (IDEA) sets out many detailed policies and procedures that, if not understood and followed, can result in strained relationships with families and an inability to resolve educational problems. The results indicate a rather average level of knowledge of school management staff, as principals answered approximately 60% of the questions regarding the law on special education.

In 2009, in Poland, the Team for Special Educational Needs, established by the Ministry of National Education (MEN, 2010), began its activities which purpose was to indicate the direction of changes in the field of inclusive education. The work was continued by the Team for developing a model for educating students with special educational needs established in 2017 by the Minister of National Education (MEN, 2017). After public consultations, the model set down the most important direction of changes. At a conference under the heading “Planned changes based on the education for all model” (21 October 2021), the developed legal and financial solutions, based on the education for all model, were discussed (MEiN, 2021).

The direction of change in the education of pupils with special educational needs refers, first of all, to the implementation of solutions for inter-ministerial and comprehensive support provided under the National Support System for children, pupils and families, which covers communes, counties, all the way up to the level of ministries. The second aspect of changes is the introduction of a new model of support for child development and family support (WWR), covering children from their birth to the primary school. Another change focuses on how to assess the needs of children and pupils and how to plan, provide and evaluate the effectiveness of the support provided. The implementation of a biopsychosocial approach and the use of the International Classification of Functioning, Disability and Health (ICF) will make it possible to use functional assessment. The last changes are about the implementation of the pilot model of Specialized Centres Supporting Inclusive Education (SCWEW), which is intended to regulate schools and special institutions capacities to play a new role and undertake tasks in supporting kindergartens as well as mainstream and integrated schools. The changes also concern teachers, namely the standards for employing specialists in kindergartens and mainstream schools, including integrated schools and those with integration divisions as well as enlarging current possibilities for improvement along with the professional development of teachers and supervision specialists. (Jachimczak, Podgórska-Jachnik, 2023).

3. Statistical material and method

The goal of the research process was to determine the interrelation the relationship between the variables defined as:

- Number of children/adolescents of the specified age:
  A_1: 3-6 years old.
  A_2: 6 years old.
  A_3: 7-14 years old.
  A_4: 15-19 years old.
  A_5: 15-20 years old.
- Number of children/adolescents with special educational needs in specified facilities:
  B_1: number of children with disabilities in nursery schools.
  J_2: number of children with disabilities in the pre-primary sections in primary schools.
  D_3: number of children in special primary schools.
  F_4: number of adolescents in special general secondary schools.
  G_5: number of adolescents in special stage I and II sectoral vocational schools and in special basic vocational schools.
  H_5: number of adolescents in special technical schools and in special specialised general secondary schools.

- Number of facilities educating children/adolescents with special educational needs – overall:

  I_{B1}: number of nursery schools teaching children with disabilities.

  II_{J2}: number of pre-primary sections in primary schools teaching children with disabilities.

  III_{D3}: number of special primary schools.

  IV_{F4}: number of special general secondary schools.

  V_{G5}: number of special stage I and II sectoral vocational schools and special basic vocational schools.

  VI_{H5}: number of special technical schools and special specialised general secondary schools.

- Number of facilities educating children/adolescents with special educational needs – in individual voivodeship and overall in Poland.

  PL: Poland.

  $PL_{DŚ}$: Dolnośląskie Voivodship:

  $PL_{DŚ(B)}$: number of special nursery schools.

  $PL_{DŚ(J)}$: number of special pre-primary sections in primary schools.

  $PL_{DŚ(D)}$: number of special primary schools.

  $PL_{DŚ(F)}$: number of special general secondary schools.

  $PL_{DŚ(G)}$: number of special stage I and II sectoral vocational schools, special basic vocational schools and special job-training schools.

  $PL_{DŚ(H)}$: number of special technical schools and special specialised general secondary schools.

  PL_{KP}: Kujawsko-Pomorskie Voivodship[1].

  PL_{LB}: Lubelskie Voivodship.

  PL_{LS}: Lubuskie Voivodship.

  $PL_{ŁD}$: Łódzkie Voivodship.

  PL_{MP}: Małopolskie Voivodship.

  PL_{MZ}: Mazowieckie Voivodship.

  PL_{OP}: Opolskie Voivodship.

  PL_{PK}: Podkarpackie Voivodship.

  PL_{PD}: Podlaskie Voivodship.

  PL_{PM}: Pomorskie Voivodship.

  $PL_{ŚL}$: Śląskie Voivodship.

  $PL_{ŚK}$: Świętokrzyskie Voivodship.

  PL_{WM}: Warmińsko-Mazurskie Voivodship.

  PL_{WP}: Wielkopolskie Voivodship.

  PL_{ZP}: Zachodniopomorskie Voivodship.

[1] the number of special facilities for each voivodship, similarly to the number of special facilities in the Dolnośląskie Voivodship.

In the quantitative study the tools used were the ones applied for time series analysis. Time series cointegration was used to determine the dependence and nature of the long-term interrelation between variables characterizing the population; index methods to determine the pace and intensity of changes in all studied variables and the study of correlation determining the strength of interrelations between variables divided by voivodeships.

Data for the analysis were obtained from Statistics Poland, using the Local Data Bank tool and an annual publication from the series: Information and studies, studies on education and upbringing for a given school year (Polish: Informacje i opracowania, opracowania na temat oświaty i wychowania dla danego roku szkolnego). Due to the diverse data collection process, the respective years were 2000-2021 (population, facilities); 2010-2021 (facilities by voivodeships). The subject of the study is the territory of Poland in general and in particular voivodeships.

3.1. Cointegration of time series

According to Welfle (2003), the state of long-term equilibrium, is the state to which the system tends after being thrown out of balance. It will be achieved after a finite time has elapsed, provided that it is not subjected to the action of external forces.

$$Y_t = \alpha_0 + \alpha_1 X_t + \varepsilon_t \tag{1}$$

The basic feature of apparent regression (Strahl et al., 2004) is the unrelatedness of non-stationary variables as to cause and effect, which may create the apparent statistically significant interrelation when a model is constructed on their basis. The phenomenon of apparent regression is a factor conditioning the occurrence of an interrelation between the value of empirical statistics (autocorrelation test using the Durbin-Watson statistics) and the determination coefficient, called the "rule of thumb".

$$DW < R^2 \tag{2}$$

Unit root test – The Dickey-Fuller test [2], for a unit root checks the stationarity of a time series, i.e. the degree of its integration. D.A. Dickey and W. Fuller's (Kosicka et al., 2015) null hypothesis test assumes that in the autoregressive equation the parameter is zero.

$$Y_t = \beta_1 Y_{t-1} + \varepsilon_t \tag{3}$$

The intercept is used when the estimates of structural parameters in the models differ significantly.

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \varepsilon_t \tag{4}$$

An integrated series of d degree is defined by Cheremz and Deadman (1997) as a non-stationary series, made stationary by calculating its increments d times. The stationarity of the Yt variable means that it is integrated to zero degree, while a series whose first (or higher) increments are constant, i.e. integrated to first (or higher) degree, is a non-stationary series.

[2] In the case of models with autocorrelation of the random component, the ADF test (extended Dickey-Fuller test) should be used.

$$Y_t \sim I(d)\ Y_t \sim I(0)\ Y_t \sim I(1)\ Y_t \sim I(2)\ \ldots \quad (5)$$

Cointegration testing should be done for at least two variables that indicate the existence of a long-term interrelation. According to Engle and Granger (1987) time series of two variables are cointegrated of *d, b* degree ($d \geq b > 0$), when both series are integrated of $d(Y_t, X_t \sim I(d)$ degree and there is a linear combination of these variables integrated of *d-b*.

$$Y_t, X_t \sim CI(d, b) \quad (6)$$

Error correction models (ECM) for cointegrated time series apply to models for variable increments. They are supplemented with the so-called an adjustment component that expresses the long-term equilibrium (interdependence) between non-stationary variables. The form of models for which ECM is a vector of residuals of the long-term equilibrium model (Strahl et al., 2004).

$$\Delta Y_t = \gamma_0 + \gamma_1 \Delta X_t + \gamma_2 ECM_{t-1} + \eta_t \quad (7)$$

or

$$\Delta Y_t = \gamma_0 + \gamma_1 \Delta X_t + \gamma_2 (Y_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) + \eta_t \quad (8)$$

3.2. Indexes

The direction and intensity of changes that take place in the studied phenomenon over a specific time are described by dynamics measures (Nowak, 2001). Two types of measures: on a fixed base (single-base) and mobile (chain based), characterize the level of the period that was adopted as the base.

Single-base dynamics measures assess the level of changes in the phenomenon that occurred in subsequent periods (x_t), compared to the designated period, while chain dynamics measures assess changes in the level of the phenomenon which take place in the subsequent analysed periods (x_{t-1}). The dual characteristics of the measures informs about increments (a, b) and indices (c, d), respectively, divided into: a) absolute (nominated quantity, showing by how many units the level of the phenomenon has changed in the examined period, in relation to the level of the phenomenon in the period recognized as basic), b) relative (percentage difference showing changes in the examined period compared to the basic period) and c) individual (presents the percentage difference in the phenomenon from the basic period, which is part of the level of the phenomenon in the current period), d) aggregate (enabling the analysis of interrelated phenomena using value, price and quantity).

Single-based (x_1) dla $t = 1, 2, \ldots, n$ and chain based (x_{t-1}) dla $t = 2, \ldots, n$:

- Absolute increment

$$\Delta x_{1t} = x_t - x_1 \text{ and } \Delta x_t = x_t - x_{t-1} \quad (9)$$

- Relative increment

$$d_{1t} = \frac{x_t - x_1}{x_1} \text{ and } d_t = \frac{x_t - x_{t-1}}{x_{t-1}} \quad (10)$$

- Individual index

$$i_{1t} = \frac{x_t}{x_1} \text{ and } i_t = \frac{x_t}{x_{t-1}} \quad (11)$$

The medium-period pace of change of the phenomenon over time enables the analysis of the entire time span of the examined phenomenon.

$$\overline{T_n} = (\overline{\iota_G} - 1) \cdot 100\% = \left(\sqrt[n-1]{\frac{x_n}{x_1}} - 1 \right) \cdot 100\% \tag{12}$$

3.3. Correlation

The strength and linear interrelation between two variables is expressed by the correlation coefficient (Czaja, Preweda, 2000). The linear interdependence between variable Y (depended variable) and variable X (explanatory variable) is the assumed value within $-1 \leq r_{XY} \leq 1$. Values approaching one indicate a strong connection between the variables, while its absence is signalled in the case of values close to zero. The coefficient also indicates the direction of the dependence, a positive correlation means that an increase in the value of one variable is accompanied by an increase in the value of the other variable, while a negative correlation informs us that an increase in the value of one variable means a decrease in the other variable. In order to examine the interrelation between variables Y and X (its statistical significance), the correlation coefficient test is used. The study is based on the value read from the T-Student's statistical table (T*) for the adopted level of significance (α) and degrees of freedom, and comparing it with the calculated statistics. This test enables you to verify the alternative hypothesis on a significant correlation against the null hypothesis of its insignificance:

$$r_{XY} = \frac{cov(X,Y)}{S_X \cdot S_Y} \tag{13}$$

where:

$$cov(X,Y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}) \tag{14}$$

S_X, S_Y - standard deviation of the X and Y variable

4. Results and Conclusions

The time series analysis on the state of long-period equilibrium between variables describing the size of the population according to age groups (variables A_1 to A_5) to the corresponding population of children with disabilities and those learning in special units (variables B_1 to H_5) is presented in Table 1.

Table 1.
Cointegration of time series of variables of the studied populations

Relationship of variables	State of long-period equilibrium	
	Model	**Apparent Regression**
$A_1 : B_1$	$\widehat{A_{1t}} = 1{,}722{,}444.75 + 116{,}225.41B_{1t}$	$DW > R^2$
$A_2 : J_2$	$\widehat{A_{2t}} = 392{,}881.53 + 17{,}657.96J_{2t}$	$DW > R^2$
$A_3 : D_3$	$\widehat{A_{3t}} = 2{,}227{,}385.37 + 189{,}300.7D_{3t}$	$DW < R^2$
$A_4 : F_4$	$\widehat{A_{4t}} = 2{,}961{,}546.99 + 332{,}030.33F_{4t}$	$DW > R^2$
$A_5 : G_5$	$\widehat{A_{5t}} = 1{,}247{,}393.41 + 175{,}144.61G_{5t}$	$DW > R^2$
$A_5 : H_5$	$\widehat{A_{5t}} = 1{,}184{,}225.48 + 63{,}364.92H_{5t}$	$DW < R^2$
The degree of integration of individual variables		
$A_{1t} \sim I(0)$ $A_{2t} \sim I(0)$ $A_{3t} \sim I(0)$ $A_{4t} \sim I(0)$ $A_{5t} \sim I(0)$	$B_{1t} \sim I(1)$ $J_{2t} \sim I(1)$ $D_{3t} \sim I(0)$ $F_{4t} \sim I(1)$ $G_{5t} \sim I(0)$ $H_{5t} \sim I(1)$	

Source: own work.

Since the degree of integration of the variable describing the population (A) is a stationary series and the basic assumption on the degree of integration of the variables is not met (there is no *d-b* interrelation), further steps regarding the cointegration of two variables and the EMC model were not carried out. Thus, it can be concluded that in Poland there is no long-period interrelation between the number of children attending special facilities and the population of same age.

The dynamics of changes in the studied variables are shown in Table 2. To illustrate the entire study, the medium-period pace of change was used, and to show its cross-section, the initial period (2001/2000), the middle period (2012/2000 and 2012/2011) and the last analysed year (2022/2000 and 2022/2021) were selected. The base year was the first period, i.e. 2000. The analysis of dynamics measures included variables describing the population (A_1 do A_5), the number of children with disabilities in special schools (B_1 do H_5) and the number of special facilities (I_{B1} do VI_{H5}).

Table 2.
Direction and pace of changes in selected variables

Variable	Single-base absolute (relative) increments			$\overline{T_n}$
	X_2 do X_1	X_{12} do X_1	X_{22} do X_1	
A_1	-429,596 (-16.78%)	-1,123,645 (-43.89%)	-1,052,760 (-41.12%)	-2.49%
A_2	-25,368 (-5.46%)	-94,570 (-20.36%)	-76,962 (-16.57%)	-0.86%
A_3	-152,959 (-3.47%)	-1,413,767 (-32.09%)	-1,142,443 (-25.93%)	-1.42%
A_4	-24,966 (-0.75%)	-1,027,646 (-30.75%)	-1,563,475 (-46.78%)	-2.96%
A_5	-36,254 (-0.91%)	-1,141,293 (-28.61%)	-1,851,000 (-46.40%)	-2.93%
total	***-669,143 (-4.53%)***	***-4,800,921 (-32.52%)***	***-5,686,640 (-38.52%)***	***-2.29%***

Cont. table 2.

B_1	1,001 (14.80%)	1,328 (19.64%)	26,788 (396.10%)	7.93%
J_2	-257 (-21.78%)	309 (26.19%)	4,042 (342.54%)	7.34%
D_3	-7,377 (-12.42%)	-34,938 (-58.82%)	-12,611 (-21.23%)	-1.13%
F_4	500 (41.74%)	970 (80.97%)	1,710 (142.74%)	4.31%
G_5	1,335 (4.54%)	-14,486 (-49.25%)	-16,636 (-56.56%)	-3.89%
H_5	104 (6.74%)	-332(-21.53%)	-627 (-40.66%)	-2.45%
total	***-4,694 (-4.72%)***	***-47,149 (-47.39%)***	***2,666 (2.68%)***	***0.13%***
I_{B1}	-232 (-2.66%)	75 (0.86%)	4,481 (51.31%)	1.99%
II_{J2}	-650 (-6.40%)	-1,104 (-10.87%)	-2,547 (-25.09%)	-1.37%
III_{D3}	-21 (-2.62%)	-21 (-2.62%)	152 (18.98%)	0.83%
IV_{F4}	3 (12.50%)	80 (333.33%)	86 (358.33%)	7.52%
V_{G5}	19 (5.96%)	56 (17.55%)	76 (23.82%)	1.02%
VI_{H6}	2 (5.88%)	19 (55.88%)	2 (5.88%)	0.27%
total	***-879 (-4,38%)***	***-895 (-4.46%)***	***2,250 (11.21%)***	***0.51%***
Variable	**Absolute chain increments**		**Chain indexes**	
	X_{12} do X_{11}	**X_{22} do X_{21}**	**X_{12} do X_{11}**	**X_{22} do X_{21}**
A_1	20,768	-1,974	101.47%	99.87%
A_2	11,611	-3,001	103.24%	99.23%
A_3	-68,651	15,114	97.76%	100.47%
A_4	-109,616	15,962	95.48%	100.91%
A_5	-122,788	6,144	95.87%	100.29%
total	***-268,676***	***32,245***	***97.37%***	***100.36%***
B_1	789	11,590	110.81%	152.78%
J_2	88	2,026	106.28%	163.39%
D_3	-199	-313	99.19%	99.34%
F_4	345	287	118.92%	110.95%
G_5	-642	441	95.88%	103.58%
H_5	-32	-56	97.42%	94.23%
total	***349***	***13,975***	***100.67%***	***115.85%***
I_{B1}	367	303	104.35%	102.35%
II_{J2}	45	-203	100.50%	97.40%
III_{D3}	3	-3	100.39%	99.69%
IV_{F4}	20	-1	123.81%	99.10%
V_{G5}	1	8	100.27%	102.07%
VI_{H6}	0	0	100.00%	100.00%
total	***436***	***104***	***102.33%***	***100.47%***

Source: own work.

The data from the second table clearly show a downward trend in the population growth of children and adolescents. The average year-to-year decrease of the population under study (A_1-A_5) was at the level of 2.3%. A detailed analysis of the dynamics until 2014 showed an increase in the number of preschool-age children, since this trend gradually slowed down reaching a positive value in 2012, which then dropped to negative values in 2017. Population decreases relative to the base year were on average at the level of one million people, while the chain equivalent for decreases of population was approximately 120 thousand people and 30-50 thousand for increases. A noticeable change in the trend concerning school-age children occurred in 2014. The pace of decreases slowed down and the population of adolescents over 15 years old began to gradually increase but did not reach positive values. In the case of children with disabilities, the key year was 2010, when the declining population trends turned into increasing ones. They did not last throughout the entire period under study, but for the group of preschool children they came to an average annual increase of over 7%. Special vocational schools also recorded growth, but their dynamics cannot be defined as

a trend. The highest number in both populations concerns school children, while the increase in the number of preschool children with disabilities is directly proportional to its overall population. The number of children attending special vocational schools and secondary schools has been negatively increasing year by year. The analysis of the dynamics of the number of facilities showed an almost 90% structural share of facilities teaching preschool children compared to the total number. The year-to-year decrease by 1.37% in the number of pre-school units in schools is related to an increase in the number of kindergartens for children with disabilities by almost 2%. Other facilities, despite the decreasing population, recorded annual increases. The highest values in relation to the base year were noted in vocational and special trade schools, they increased by approx. 250-300%.

The last research procedure carried out under this study was to examine the level of linear dependence. Table 3 shows the direction and importance of the ratio of the total number of facilities educating children with disabilities to their equivalents, divided by individual Polish voivodeships.

Table 3.
Correlation of variables determining the number of facilities educating children with special educational needs

Facilities in Poland by age group in individual regions	**Facilities in Poland by age group**					
	$PL_{(B)}$	**$PL_{(J)}$**	**$PL_{(D)}$**	**$PL_{(F)}$**	**$PL_{(G)}$**	**$PL_{(H)}$**
$PL_{DŚ}$	0.990	0.988	0.949	0.901	0.781	-0.016
PL_{KP}	0.911	***0.693***	0.950	0.714	0.891	-0.299
PL_{LB}	0.936	0.973	0.939	0.849	0.812	***-0.012***
PL_{LS}	***0.804***	0.969	0.661	***0.374***	0.738	0.375
$PL_{ŁD}$	0.960	0.958	0.834	0.925	0.894	0.375
PL_{MP}	0.915	0.963	0.990	0.807	0.909	0.478
PL_{MZ}	0.984	0.993	0.996	0.857	0.860	0.704
PL_{OP}	0.958	0.960	***0.670***	0.876	0.941	-0.299
PL_{PK}	0.990	0.977	0.953	0.832	0.895	0.264
PL_{PD}	0.968	0.986	0.979	0.907	***0.656***	-0.299
PL_{PM}	0.876	0.986	0.897	0.835	0.954	0.375
$PL_{ŚL}$	0.990	0.998	0.977	0.959	0.990	0.820
$PL_{ŚK}$	0.970	0.985	0.958	0.762	***0.655***	-0.375
PL_{WM}	0.959	0.984	0.970	0.940	0.778	0.640
PL_{WP}	0.991	0.978	0.981	0.946	0.760	0.299
PL_{ZP}	0.982	0.989	0.991	0.930	0.825	0.640
	Lowest correlation between voivodeships					
$PL_{LS\text{-}KP}$	0.592					
$PL_{ŁD\text{-}KP}$		0.540				
$PL_{LS\text{-}LB}$			0.397			
$PL_{MP\text{-}LS}$				1.308E-17		
$PL_{PD\text{-}LS}$					0.061	
$PL_{LB\text{-}PL}$						-0.012

Source: own work.

The table above shows the decreasing impact of subsequent groups of facilities on the total number of units attended by children with special educational needs. The division into voivodeships demonstrates that the Masovian and Silesian voivodeships are those in which all types of facilities show a correlation in the range of 0.99-0.64, i.e. at a very high level. What's more, the study of dependencies between voivodeships did not indicate such high results. The first group of facilities (for children up to the age of 6) has the lowest correlation of 0.6-0.7, which occurs between most voivodeships and the Lubusz or Kuyavian-Pomeranian Voivodeship. The lowest correlation values are in the group of vocationally profiled secondary schools and special technical schools, from -0.243 to -0.529.

To sum it all up, the obtained results confirm the general trend of a decreasing population of newborn children and an increased number of children with certificates of disability, which has been present in Poland for years. The growth/decrease interrelation between the population of children and their coevals with disabilities, visible in the dynamics research, does not, however, translate into a state of long-period equilibrium. These conclusions result from the fact that x children with disabilities are part of the total population. Nonetheless, it cannot be said that a trend change in one group will cause the same or opposite result in another group. The increased number of decisions confirming disability results from the easier access to specialists and diagnostic facilities, and also due to actions taken by the Polish government (teams appointed by MEN/MEiN), parents have become more aware of this problem. A good direction is the trend of an increasing number of special facilities, observed in the dynamics study. Bearing in mind the decreasing number of children, we can assume that there will be a sufficient number of places in these facilities. According to the results of the analysis presented as part of the 2020 Substantive Report on inclusive education in Poland, one of the problems reported by the survey respondents were (Podgórska-Jachnik, 2021) regional differences in the profile of activities having psychological and pedagogical support. Their uneven use resulted in the provision of support in the Masovian Voivodeship (with Warsaw as its capital) for almost ¼ of cases. It is therefore important that support for children requiring special education is considered countrywide through the prism of local needs. The study of correlations in regions discussed this paper, indicated the Masovian and Silesian voivodeships as dominant in Poland. Their strong interdependencies regarding subsequent groups of special facilities show the right direction to meet the needs of children and adolescent with disabilities throughout the country. This interrelation is additionally confirmed by the highest number of such facilities in these regions. Therefore, sustainable development of a region demands that special attention be paid to the needs of the community examined in the paper. The annual increase in the number of such facilities, which stands out compared to other voivodeships, should also be a signal for the local governments as intermediary institutions, e.g. in contacts with social economy entities. The growing number of facilities will enable various educational approaches, thus adapt the offer to the requirements of future employers, and contribute to region's development. Ultimately, such actions will improve the

unemployment situation, which at the end of the first quarter of 2023 presented itself as follows: 48.8% (rate of long-term unemployed people out of the total number registered), of which 12.3% were people under 25 years old. The creation of local social and educational policy strategies should therefore be implemented in cooperation with the local government, which, knowing and implementing projects to meet the needs of children with disabilities, will enable the real development of inclusive education.

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FACTORS INFLUENCING THE COMPETITIVENESS OF POLISH ENTERPRISES FROM THE CONSUMER'S PERSPECTIVE

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Purpose: To identify the key factors of enterprise competitiveness from the consumer's perspective. Two research hypotheses are proposed: **H1:** consumer satisfaction is an important factor of enterprise competitiveness; **H2:** the consumer's age has a significant effect on the choice of enterprise competitiveness factors. The notion and essence of competitiveness are discussed. The dimensions of competitiveness, that is, competitive position and competitive potential of an enterprise, as well as the instruments of competition are set out in detail.
Design/methodology/approach: The theoretical section follows a detailed review of leading literature on the subject. In the empirical part, descriptive statistics, i.e., the measures of position (arithmetic mean, median) and of dispersion (standard deviation, the coefficient of variance) and the non-parametric Kruskal-Wallis test are used to verify the hypotheses.
Findings: The paper contains the results of a survey of 236 respondents living in Poland. The tools of descriptive analysis serve to demonstrate the consumer's behaviour is a major factor of enterprise competitiveness in the consumers' opinion. The Kruskal-Wallis test, on the other hand, serves to determine whether the factor distribution of enterprise competitive position, competitive potential, and the instruments of competition are identical for the variable category of the respondent's age. The age is proved to be a variable differentiating the choice of enterprise competitiveness factors in all its dimensions.
Practical implications: The results may be of use to entrepreneurs as a guide to the selection of competitiveness factors in line with consumers' opinions.
Originality/value: The paper includes some original results of research into a group of respondents living in Poland with regard to their assessment of competitiveness factors utilised by enterprises.

Keywords: competitiveness, enterprise, competitive potential, competitive position, instruments of competition.

Category of the paper: research paper.

1. Introduction

Competitiveness is a key factor of success for any enterprise. In today's global and dynamic business environment, enterprises must continue adapting and developing to maintain their market positions. There are a number of factors influencing enterprise competitiveness. A correct choice and understanding of these factors is necessary for effective management and preparation of a strategy that will allow an enterprise to gain and preserve its competitive advantage. This is for this reason that consumers' opinion about which competitiveness factors employed by enterprises matter most to consumers is so important. The purpose of this article is therefore to identify the factors of enterprise competitiveness from the consumer's perspective.

The knowledge of rules followed by people when making their purchase decisions plays a crucial role in planning effective enterprise actions. The extent of understanding consumers' purchasing behaviour may determine which enterprises will survive in the market and which will attain a competitive advantage.

Consumers' opinions can provide important information about what an enterprise does well and what it can change to improve its competitive position in the market. If an enterprise is in possession of information which factors customers pay particular attention to when making their shopping decisions, it can modify its strategy to better meet consumer expectations and compete in the market more effectively.

2. The role of consumer in forming the factors of enterprise competitiveness – literature review

Competitiveness is the object of many theoretical studies and empirical analyses. The term itself is vaguely defined and multifaceted (Porter, 1994), relative (Balkytė, Tvaronavičienė, 2010), and implies the need for comparisons with other entities (Berger, 2010).

Competitiveness can be analysed at the level of:

- Country – in this case, it means an economy's ability to provide a population with high living standards and high employment in a sustainable manner. These issues have been studied by e.g., Fyliuk et al., 2019; Haller, 2020; Androniceanu et al., 2020.
- Region – this means improving living standards of a given region's inhabitants. A region is more competitive if businesses there are more productive than those in other regions. The subject matter has been researched by e.g., Vetráková, Smerek, 2019; Higgins et al., 2013, Berger, 2011.

– Enterprise – in this case, it denotes actions taken by enterprises to preserve their existing 'good' competitive position in the market compared to competitors. The subject matter has been studied by e.g., Konstantinidis et el., 2022; Wolak-Tuzimek et al., 2021; Doncheva, 2020.

Some authors decompose enterprise competitiveness into its components. According to M.J. Stankiewicz (2005, p. 89), competitiveness consists of four subsystems: competitive potential, competitive advantage, instruments of competition, and competitive position. M. Gorynia (2010, p. 77), on the other hand, suggests describing enterprise competitiveness by means of three dimensions (variable groups): competitive position in future, competitive potential, and strategy (instruments) of competition. Competitive potential is seen as a bundle of abilities, possibilities, capacities, and productiveness (of someone like an employee or something like machinery, equipment or technology) (Sobolewski, Narojczyk, 2018, p. 38), all tangible and intangible resources of an enterprise necessary for functioning in the scene of market competition (Stankiewicz, 2005, p. 89). It should address both internal elements in an entity and its business environment. It's commonly identified with resources, competences and unique skills available to a specific firm (Wolak-Tuzimek, 2022, p. 714).

A. Janiak and others (2017, p.5) believe competitive advantage is limited in time and conditioned by actions taken by competitors and changes in an industry structure. This is the result of using the competitive potential of an enterprise (considering environment conditions) to allow for an effective generation of an attractive market offer and effective instruments of competition (Stankiewicz, 2005, p. 89). It's founded on the utilisation of: resources, potential, quality, reputation, corporate culture, brand, know-how, innovation and creativity, unique technology, time and speed, successful strategy implementation, the capability for learning and knowledge management, and organisational slack. It should be noted enterprises increasingly address some parts of Corporate Social Responsibility in their strategies in order to achieve competitive advantage (Maráková et al., 2021, p. 111).

The instruments of competition can be defined as means an enterprise creates consciously to attract clients to their current or projected (future) offers (Stankiewicz, 2005, p. 89), as the methods of finding consumers and creating goodwill, such as quality, product pricing, or a flexible adjustment of products to consumers (Jabłońska-Porzuczek, Smoluk-Sikorska, 2016, p. 103). A suitable use of competition instruments gives rise to a competitive position stronger than of competitors.

The competitive position of an enterprise at a given time is a result of the position in a previous period, its competitive potential available in a current period, and a present strategy of competition (Dzikowska, Gorynia, 2012, p. 24).

The competitive position of an enterprise in the market economy is decided by the way it is perceived by its workers, partners, consumers, local authorities and communities, whose needs and expectations are increasingly reflected in the long-term strategies of development.

An analysis of links among the dimensions of competitiveness indicates that the achievement of a desired competitive position is conditioned by the competitive advantage that is in place, which is in turn dependent on the competitive potential that is available to an enterprise. An entity's resources and skills influence the preparation of a product range that is to be evaluated by the market and that allows for a competitive advantage. The instruments of competition should be chosen following a detailed analysis of an enterprise's competitive potential and the environment in which it operates. Only after applying the appropriate instruments of competition can a certain competitive position be acquired (Duda et al., 2021, p. 142).

The literature offers some theories that uphold the significance of consumers' opinions as a factor influencing how an enterprise builds its competitive advantage:

1. Customer Value Theory - The competitiveness of an enterprise depends on the value supplied to customers. The customer value is the difference between the benefits a customer derives from a product or service and the costs of its acquisition. Enterprises focussing on enhancing the value for customers more than their competitors attain competitive advantage (Woodruff, 1997; Woodside et al., 2008).
2. Customer Satisfaction Theory - It regards customer satisfaction as the key factor influencing enterprise competitiveness. Customers satisfied with products or services tend to return to a given enterprise and recommend it to others. Thus, enterprises effectively managing customer satisfaction can gain competitive advantage (Anderson, 1994; Atila, Fisun, 2008).
3. Customer Engagement Theory - Enterprise competitiveness depends on the degree of customer engagement with a brand and products/ services. Engaged customers are loyal, buy more often, and are more eager to recommend an enterprise. Enterprises which effectively engage their customers through interactions, communication, and relationship building can achieve competitive advantage (Brodie, 2011; Vivek et al., 2012).
4. Customer Experience Theory - The theory stresses the importance of creating positive and valuable experiences for customers. They frequently value enterprises on foot of their associated experiences, which include any contacts and interactions. Enterprises providing positive experiences to their customers can attain competitive advantage (Verhoef et al., 2009; Meyer, Schwager, 2007).
5. Customer Advocacy Theory - It assumes enterprise competitiveness depends on the ability to generate positive customer recommendations. A firm supports customer interests while customers support the firm buying its products and helping adapt its product range to consumer requirements (Reichheld, 2003; Urban, 2005).

6. Customer Trust Theory - In line with its assumptions, customer trust is the key factor influencing enterprise competitiveness. Customers tend to choose enterprises they trust to supply promised products and services and to care for their interests. Enterprises that build and maintain customer trust with their honesty, transparency, and consistent actions can achieve competitive advantage (Moorman et al., 1992; Isaeva et al., 2020).
7. Customer Relationship Theory - It assumes long-term and lasting customer relationships are crucial to enterprise competitiveness. The creation and preservation of strong bonds with customers, founded on mutual understanding, trust and collaboration, can lead to customer loyalty and competitive advantage (Morgan, Hunt, 1994; Rajarshi et al., 2016).
8. Customer Satisfaction-Loyalty Theory - According to this theory, enterprise competitiveness depends on the ability to generate customer loyalty by satisfying the needs and expectations of customers. Satisfied customers are more willing to return their custom, which can produce a long-term competitive advantage (Fornell, Larcker, 1981; Khadka, Maharjan, 2017).

All these theories highlight the role of consumer in creating competitive advantage and a focus on customer value creation, building of relationships, generating trust, and providing positive experiences. The enterprises which effectively address these factors from the consumer's perspective stand a greater chance of becoming successful in the market. The research hypothesis **H1** has been formulated, therefore: consumer satisfaction is an important factor of enterprise competitiveness.

Consumer behaviour may depend on a range of factors. Consumer age is one, since people of various ages have different needs, preferences and values, which affects the structure of demand. In line with the lifestyle theory (Wells, Tigert, 1971), consumers from diverse age groups have different lifestyles that affect their shopping preferences and the choices of products or services. In addition, consumer age is addressed when creating marketing strategies targeted at specific age groups, which also influences the shopping behaviour of customers in the particular age groups. Hypothesis **H2** has been proposed, therefore: the consumer's age has a significant effect on the choice of enterprise competitiveness factors.

3. Methods

Correctly filled survey questionnaires are analysed, including part one, the formal characteristics of respondents, and part two, questions on the evaluation of competitiveness factors that enterprises utilise in consumers' opinions. The sample is selected at random, the survey was conducted via the Google Forms platform in June-August 2022.

The research hypotheses are verified with the results for 236 respondents living in Poland.

As far as the sample's characteristics are concerned, women (60.2% of the respondents) and university educated individuals (49.2%) prevailed. The residents of cities with populations of up to 100 000 (22.1%) and from 301 000 to 500 000 (13.1%) dominated. Respondents aged 31-40 (31.8%) formed the largest and those aged 26-30 the smallest grouping (8.0%). The details of the respondents' age structure are laid down in Figure 1.

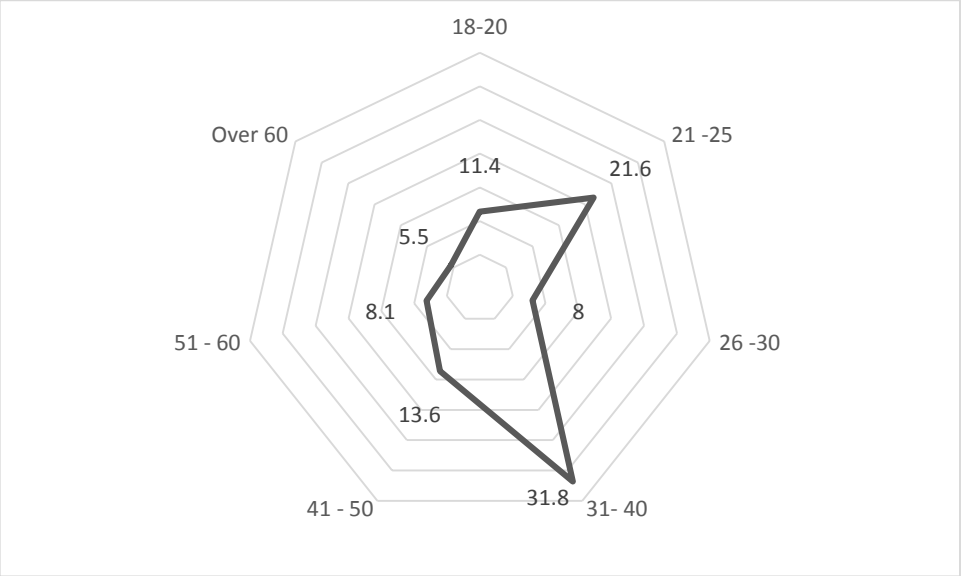

Figure 1. The age structure of the study sample.

Source: The author's own research.

The respondents were asked to attribute significance to the particular factors of enterprise competitiveness. Their responses were recorded on 10-point ordinal scales, with 1 denoting a low significance and 10 high significance. Table 1 lists the factors of enterprise competitiveness (observable variables) surveyed.

If the table was borrowed from a publication, the source should be provided underneath. You should not insert tables as figures, but as Microsoft Word tables. The text must contain a reference to a given table (Table 1).

Table 1.
The variables forming the database

Variable symbol	Name of observable variable
Variables defining the competitive position of enterprises	
V1	Market share
V2	Financial position
V3	Recognition of enterprise and its products in the market
V4	Customer satisfaction

Cont. table 1.

Variables defining the competitive potential of enterprises	
V5	Financial liquidity of enterprise
V6	Profitability of enterprise
V7	Equity level in enterprise
V8	Customer loyalty
V9	Method of distribution
V10	Integrated IT system
V11	Quality of managerial staff
V12	Creativity of workers
V13	Condition of plant and machinery
V14	Research and development activities
V15	Technical standard of products+
V16	New technology
V17	Creation of strong product brand
V18	Standard of servicing
Variables defining the instruments of competition	
V19	Quality of product/ service
V20	Quality of servicing
V21	Product brand
V22	Advertising
V23	Public relations
V24	Image of enterprise
V25	Highly qualified staff
V26	Product pricing
V27	Innovativeness of products
V28	Size of product range
V29	Matching of product structure to structure of consumer demand
V30	Implementation of Corporate Social Responsibility

Source: Source: The author's own research.

Non-parametric methods apply to variables measured with ordinal scales (Gaca, 2016, p. 32). The Kruskal-Wallis test (1952) is used to verify the research hypotheses, therefore. This non-parametric test serves to verify statistical hypotheses concerning the diversity of individual dimensions between groups. This is equivalent to a one-factor variance analysis (ANOVA). The following is required for the Kruskal-Wallis test to apply (Kruskal, 1952, p. 525):

- Variables are measured along an ordinal (interval) scale.
- Groups studied are independent.
- Normal distribution.

The assumptions were fulfilled, therefore, the Kruskal-Wallis test was applied in line with the formula below (Donocik et al., 2013, p. 35):

$$H = \frac{12}{\mathrm{n}(\mathrm{n}+1)}\left(\sum_{j=1}^{k}\frac{R_j^{\,2}}{n_j}\right) - 3(n+1) \tag{1}$$

where:

$n = n_1 + n_2 + \ldots + n_j$,

$(n_1, \ldots, n_j)$ – the strengths of successive samples,

R_j – the rank-sum in the *j*-th sample.

The Kruskal-Wallis test's zero hypothesis assumes the samples come from populations of the same distributions, whereas the alternative hypothesis says they come from different distributions.

Thus:

H0: $\theta 1 = \theta 2, \ldots, \theta k$

(the variable distribution is the same as or similar to the alternative hypothesis, given the comparative variable considered), since

H1: not all θj are equal ($j = 1, 2, \ldots, k$)

(the variable distributions for at least two codes of the grouping factor are different)

where:

$\theta 1, \theta 2, ..., \theta k$, – the medians of the variable studied in the populations the samples are withdrawn from.

p, based on the test statistics, is comparable to the significance level α (PQStat Software, 2018):

if $p \leq \alpha \Rightarrow$ H0 is rejected and H1 is accepted,

if $p > \alpha \Rightarrow$, there are grounds for rejecting H0.

Accepting H0 implies the levels of a factor examined have no significant effect on results observed. Rejecting H0 implies the levels of a factor examined have a significant effect on results observed. The factor differentiates the results in the circumstances (Skrzypek, 2013).

Descriptive statistics are used as well, ordering the data for ease of analysis and interpretation. On applying the measures of position (arithmetic mean, median) and of dispersion, the way the data are arranged and differ from each other is presented.

4. Results

The measures of position (arithmetic mean, median) applied indicate around what values the distribution of variables concentrates. The analysis of descriptive statistics implies the arithmetic mean is lowest for variables V7 (6.64) and V1 (6.78). This means customers attach a minimum importance to the equity level in enterprises and to the market share. On the other hand, the arithmetic mean is maximum for V4, V20, V26. It's in the range <8.37;8.43>. This means customers attach the greatest weight to customer satisfaction, quality of servicing, and product pricing. The median, or the central value, for these variables reached a maximum of 8, proof of a normal relationship between the arithmetic mean and the median for these variables.

Both standard deviation and the coefficient of variance are the measures of dispersion that serve to examine the degree of differentiation of variable values. They served to determine whether the values the respondents assigned to the variables differ significantly from one another.

The low standard deviation in the range <1.02;1,62> for all the variables studied is evidence of the homogeneity and stability of the data analysed. For customer satisfaction, it is 1.18, with a coefficient of variance of 13.97%, proof of a low dispersion of the responses. The coefficient of variance is highest for market share (23.89%) and equity level in enterprises (23.85%). This implies the consumers surveyed supplied the most diverse answers relative to these two variables.

This analysis implies consumers appreciated customer satisfaction the most, with a low diversity and dispersion of responses that concentrated around the mean, which corroborates the **hypothesis H1**: consumer satisfaction is an important factor of enterprise competitiveness.

Table 2.
The results of descriptive statistics

Variable symbol	Measures of position		Measures of dispersion	
	Arithmetic mean	Median	Standard deviation	Coefficient of variance (%)
V1	6.78	7	1.62	23.89
V2	6.96	7	1.55	22.26
V3	8.04	8	1.02	12.66
V4	8.43	8	1.18	13.97
V5	6.94	7	1.60	23.00
V6	6.84	7	1.51	22.05
V7	6.64	7	1.58	23.85
V8	8.03	8	1.1	13.68
V9	8.15	8	1.14	14.01
V10	6.92	7	1.62	23.39
V11	8.31	8	1.04	12.57
V12	8.01	8	1.13	14.11
V13	6.94	7	1.55	22.31
V14	7.03	7	1.61	22.85
V15	7.35	7	1.40	18.99
V16	7.48	8	1.47	19.63
V17	7.55	7	1.39	18.46
V18	7.89	8	1.10	13.93
V19	8.28	8	1.18	14.26
V20	8.41	8	1.10	13.05
V21	7.39	7	1.48	20.05
V22	8.03	8	1.08	13.43
V23	7.38	7	1.46	19.72
V24	7.81	8	1.46	18.69
V25	7.95	8	1.38	17.33
V26	8.37	8	1.11	13.30
V27	8.01	8	1.03	12.88
V28	7.62	8	1.42	18.67
V29	7.49	7	1.46	19.49
V30	7.33	7	1.57	21.47

Source: The author's own research.

The results developed by means of *Statistica* software served to analyse the observed level of significance *p*. Its value represents the declining reliability of the result and helps to assess the probability of a result assuming H0 is true. *p* should be greater than the set level of $\alpha = 0.05$.

Two hypotheses were posited:

H0: The distributions of competitiveness factors (for its particular dimensions, i.e., the competitive position and potential of enterprise, the instruments of competition) are the same for the variable category of respondent age.

H1: The distributions of competitiveness factors (for its particular dimensions, i.e., the competitive position and potential of enterprise, the instruments of competition) are not the same for the variable category of respondent age.

H0 should be rejected and H1 accepted if $p \leq \alpha$. Where $p > \alpha$, there are no reasons for rejecting H0. The results of Kruskal-Wallis test are included in Table 3.

Table 3.
Test results for the values of enterprise competitiveness factors by the respondents' age

No.	Zero hypothesis	Test	Significance *(p)*	Decision
1	The distribution of enterprise competitiveness factors is the same for the variable category of respondent age.	Kruskal-Wallis test	0.000	Reject the zero hypothesis
2	The distribution of enterprise competitive potential factors is the same for the variable category of respondent age.		0.001	Reject the zero hypothesis
3	The distribution of competition instrument factors is the same for the variable category of respondent age.		0.000	Reject the zero hypothesis

Source: The author's own research.

The analysis of probabilities for the particular boundary values shown in Table 1 implies the zero hypothesis should be rejected for the factors determining the competitive position, competitive potential, and the instruments of competition. This means the respondent's age in the population surveyed is a variable differentiating the selection of enterprise competitiveness factors in all the dimensions, which corroborates the validity of the research **hypothesis H2**: the consumer's age has a significant effect on the choice of enterprise competitiveness factors.

5. Discussion

The literature review shows most authors focus on examining competitiveness factors from the viewpoint of enterprises (e.g., Maráková et al., 2021; Cao et al., 2022; Flak, Głód, 2022), with few studies perceiving these factors from the customer's perspective (including Mende et al., 2015; Chen et al., 2021; Le, 2022).

My results are in line with or similar to those reported by other authors. N. Isaeva and others (2020) see customer trust as a major factor with a positive influence on the development of service enterprises. Research demonstrates service sectors benefit from customer trust, which has a positive impact on engagement, loyalty, sales efficiency, cooperation, and successful exchange. The results obtained by I.A. Ripa (2022) confirm the creation of long-term partner relationships and supply of customised offers that satisfy the needs of key clients are the essence of customer relationship management. A trust-based relationship emerges between a firm and key clients. Positive relationships with key customers and an improved understanding of their needs lead to suitable strategies of customer relationship management, which results in a competitive advantage in the market. R. Ahlawat's study of the hotel industry (2022) indicates customers' trust and loyalty have an immediate effect on the development of budget and luxury hotels in the UK. Factors like customer service, cleanliness, room quality, quality to price ratio, food quality, and family friendliness influence the levels of customer trust and loyalty and, indirectly, hotels' competitiveness in the market.

Technological innovation and stable customer relationships are some important factors of sustainable enterprise development. Y. Chen et al. (2021) have studied the connection between stable customer relationships and technological innovation. Empirical research has proved stable customer relationships greatly promote technological innovation in enterprises, which helps them gain competitive advantage. In addition, a comparison of sample big enterprises, state enterprises, mature enterprises, and low capital consuming enterprises shows stable customer relationships can substantially promote technological innovation in small enterprises, non-state enterprises, young enterprises, and high capital consuming enterprises. These results affirm stable customer relationships influence enterprises' technological innovation and continuing competitive advantage.

The literature also offers some research into the impact of age on customers' shopping behaviour. E.J. Tomaszewska and U. Ryciuk (2018) have proved some statistically significant differences in shopping for certain product and service ranges depending on the age of e-consumers in Poland, Lithuania, and Latvia. Friends' opinions, advertising, social media, and company image are the principal factors influencing the decisions of consumers aged below 25, with ranges sold and loyalty programmes counting most for those aged 25 and above.

The results generated by M. Slabá (2019) demonstrate age is one of the factors influencing consumers' shopping behaviour and attitudes to price, the prime factor of enterprise competitiveness.

The top age group of 64+ consumers were most sensitive to pricing. ANOVA shows the price is a factor influencing the shopping decisions of the age brackets 16-24 and 55-64 as well. The results of chi-square test additionally show the preferences for branded and unbranded goods are also dependent on the consumer's age.

The knowledge of the consumer's behaviour improves the chances of market success (Stankevich, 2017) and helps in understanding what consumers appreciate the most (Islam, Chowdhury, 2018), which produces an enterprise's competitive advantage.

Consumers address a variety of aspects when making their shopping decisions. Lacey et al. (2009) claim several factors like information that helps to eliminate hesitation when deciding to buy, that is, price, quality, product availability or brand knowledge, influence the shopping decisions of consumers (Chan, Raharja, 2021).

6. Conclusion

Consumers' assessment is of paramount importance to enterprise success in the contemporary, competitive market. What consumers think about products, services and their characteristics is a key factor influencing a company's image and competitive position in the market.

Consumers' opinions influence a number of aspects of enterprise operations, including marketing strategies, the development of products and services, and the building of competitive advantage.

Contemporary enterprises pay increasing attention to consumers' opinions, which furnish valuable guides to the improvement of products, services, and customer support. The analysis of these opinions helps to identify areas for improvement and adjust offers to changing consumer needs. My results, therefore, according to which consumer satisfaction, quality of service, and product prices allow enterprises to gain competitive advantage in the market, uphold the hypothesis H1 that consumer satisfaction is an important factor of enterprise competitiveness.

It should be noted, though, consumers' opinions may vary a lot depending on many factors, both economic and not. A consumer's age may have a significant influence on the selection of enterprise competitiveness factors. Diverse age groups have varied preferences, needs, and expectations of products and services. The young are commonly more attached to technology and are thus more likely to point to innovative technological solutions or state-of-the-art methods of customer service as the factors of competitive advantage. The younger generation is also more aware of sustainable development and social values, therefore, enterprises are able to compete by promoting their commitment to social responsibility and actions for the environment. Older generations, on the other hand, prefer trust, loyalty, and a high quality of service. The analysis of my results implies the consumer's age affects the choice of competitiveness factors employed by enterprises, which corroborates the research hypothesis H2.

It can be said in general that, as the market becomes more competitive, consumers' opinions influence long-term success of companies. Therefore, entrepreneurs should consider these opinions in their marketing strategies, as what consumers think about products and services has an immediate impact on a firm's reputation, customers' trust and loyalty and, above all, their shopping decisions. Enterprises should actively manage consumers' opinions and build lasting customer relationships. Such an approach should bring benefits in both improved competitiveness and a positive influence on business profitability and development.

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WHY DO EMPLOYEES CHANGE THE JOB? INSIGHTS ON EMPLOYEES` NEEDS AND EXPECTATIONS BASED ON INTERNATIONAL EVIDENCE

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Purpose: The main objective of the study is to identify the current motivations and expectations of employees who are searching for new job opportunities. The theoretical objective is to expand the understanding of motivations to change the job. The practical objective is to assist managers in retaining employees and creating a better workplace.
Design/methodology/approach: Data were collected based on the online questionnaire with open-ended questions. In total 647 respondents participated in this study. Responses were gathered in 2023 from five countries: Portugal (112), Poland (139), Palestine (130), Brazil (109), and Mexico (157). Answers were analyzed using NVivo software.
Findings: Empirical findings revealed seven reasons to apply for a new job post: career development, financial motivation, work environment and culture, ambition, leadership and management, work-life balance, and relocation. Moreover, in the explored countries professional development, management skills and leadership were identified as the most significant employees` expectations in relation to future employers. Other expectations are following: behavioral values, empathy, teamwork, collaboration, work environment, financial compensation, security, stability, autonomy and flexibility in a new workplace.
Research implications: The study provides insights into the motives that cause employees to change jobs. As theoretical implications, revealed insights can be valuable in developing management theories. For managers recommendations were formulated to better understand and react on personal needs of employees to create opportunities for financial and personal development within the organization.
Originality/value: The value of this study lies in the used method (open-ended questionnaires) that allowed to discover insights about current employees` needs. Findings may inspire researchers to develop theory and managers to redesign the personal strategy.

Keywords: employees; management; motivation; change the job, retain employees.

Category of the paper: research paper.

1. Introduction

Previous research show that employees with proper qualifications and motivations significantly contribute in achieving the goals of organizations, and based on employees` knowledge, skills and competences, organizations build a competitive advantage (Horzela, Ambrochowicz, 2019; Kuzior, Sobotka, 2019; Grzeszczyk, 2020). Therefore, employees are essential to gain success within organizations. Consequently, it is crucial to attract, develop, motivate, and retain employees in organizations. However, remote work popularized during and after COVID-19 created a new approach to leading and managing organizations (Montenero, Cazorzi, 2022).

Pandemic time significantly affected management and organizations, that have to look for resilience and opportunities simultaneously take into account increasing uncertainty (Zadeh, 2022). According to the researchers, human behaviors patterns in organizations have changed after COVID-19 time (Machaczka, Stopa, 2022) and one of the most significant changes is that employees are more open to work remotely and they started to change their jobs more often than they did in the past.

Therefore, it can be valuable to extent the knowledge about employees` motives of changing jobs. Expectations and needs of employers and employees have changed. It is possible to see enterprises` needs based on many job post platforms or directly on enterprises' websites. However, current employees' needs and expectations require the examination. For managers, there is limited knowledge on how to attract candidates and retain employees to manage the organization's needs and meet employees' expectations.

Organizations are facing employee turnover and researchers as well as business practices are searching for the motives of changing new job by employees. Therefore, taking into account the dynamic changes in the labor market, the need to develop theories and support organizations, following research questions were formulated:

RQ1: Why do employees decide to apply for a new job post?

RQ2: What do employees expect from their future employers?

The main objective of this study is to identify the current motivations of employees in different countries. The first research objective is to identify the reasons employees look for new jobs. The second research objective is to identify what employees look for in new jobs. Presented studies are originality taking into account not only the international dimension and collecting data during real recruitment processes, but also using the method based on the open-ended questions, what provides the opportunity to discover insights that are not anticipated.

The structure of the paper includes an introduction, literature review, research methodology with characteristics of the research sample. Next the results and discussions are described. The final part is the conclusion, limitations and future research directions.

2. Literature background

Recent studies underline the significance of new generations of employees who frequently consider the question “Should I stay or should I go?” (Lu et al., 2023) it has been an issue because recently demand for workers in response to continual growth in the global economy has been increased (Zwardoń-Kuchciak, Lipińcka-Grobelny, 2020) and human resources management in 4.0 industry has become more demanding (Piwowar-Sulej, 2020). Moreover, due to the COVID-19 pandemic, the employees' desire to leave their current jobs increased. Therefore, dealing with management and turnover became an urgent challenge for organizations and managers (Bokuchava, Javakhishvili, 2022; Bruyneel et al., 2023; Christianson et al., 2023; Wen-Long et al., 2022).

According to existing research literature work expectations were identified as significant reasons for job change and turnover intentions: “Work expectations regarding future work experiences as one important mechanism explaining why and how individuals (...) are less inclined to remain with their organizations. These findings suggest a process whereby systematic improvement or decrement in prior work experiences (...) shapes employees' expectations for future work experiences, which in turn influence their inclination to stay at or leave their organization” (Chen et al., 2011).

Recent studies suggest show different predictors of changing job. Some researchers underlined the role of organizational learning culture, that has a significant impact on employee turnover intentions and job performance. According to empirical studies, employees who experience a higher learning culture have a lower level of turnover intention and better job performance (Lin, Huang, 2021).

In another study, there was an analysis of the impact of psychological contract breaches on organizational distrust and turnover intention. Based on empirical research was confirmed that psychological contract breaches impact organizational distrust and organizational distraction directly influences turnover intention (Abdalla, et al., 2021). In other studies, the adaptation to frequency changes was considered with the role of job crafting and personal needs (Chen, Tang, 2021).

Furthermore, interesting research was conducted to increase knowledge about employee well-being and job change intention (Lee, et al. 2020) taking into account change jobs across organizations (external) and within the same organization (internal). Moreover, in one of the newest studies in the medical sector, the attention was focused on the work environment and the association between burnout and intention to leave the profession (Bruyneel et al., 2023). In another study conducted in this sector, key findings claimed that work-related burnout and compassion fatigue are significant contributors to the intention to leave the profession. Additionally, it was reported that personal financial incentives are a reason for staying on the job despite being burnout (Christianson et al., 2023).

Searching for the answer to what makes employees want to leave their job was considered recently also in the public sector. According to meta-analyses (Hur, Abner, 2023) the relationship between individual demographic variables, work environment characteristics, job characteristics, HRM practices, work motivation and work attitudes, and factors related to the external environment and turnover intention showed that individual demographic predictors have a negligible effect on turn-over intention highlighting the need to find variables in a work environment and organizations (Hur, Abner, 2023).

Taking into account work environment and organizations, also leadership was identified as a significant variable that affected the frequency of changes and turnover intention of employees (Babalola et al., 2016). In another study, relations between work-life balance, satisfaction and intention to leave were investigated (Holland et al., 2019). One of the newest studies revealed that workload is the most significant direct predictor of turnover intention (Jasiński, Derbis, 2022).

These findings from previous research confirmed that this topic is a very pressing issue in this changing and turbulent world. In conclusion, according to the literature review reasons for turnover, burnout, financial rea-sons, well-being, organizational distrust, work environment, leadership, and workload were identified as significant in relation to the intention to leave and look for new jobs.

A few studies were focused not only on changing the job but also on the intention to leave the profession (Christianson et al., 2023). It shows that this is a complex phenomenon. Moreover, due to COVID-19 which accelerated the dynamics of changes, this topic has become a more urgent challenge for enterprises. "The employee stability of organizations is an essential situational variable in enterprise strategic decision-making processes, which can promote the stable development of enterprises" (Lu et al., 2023). Therefore, this study is focused on deepening knowledge about current needs and expectations of employees who are looking for a new job.

3. Research methodology

The theoretical part of this study was prepared based on the literature review. Special attention was focused on the newest primary articles from renowned journals indexed in the *Web of Science* and *Scopus* databases, articles published by the *Academy of Management* and articles published by specialized research journals in the field of international entrepreneurship.

As a result of this review, the problematization methodology described in the *Academy of Management Review* was used. Problematization methodology is recommended to generate re-search questions and challenge previous assumptions to develop research and enrich theory

(Al-vesson, Sandberg, 2011). Based on this methodology two research questions were formulated to conduct the empirical research.

Several approaches were evaluated to select the most appropriate empirical approach and tool for this study. Ultimately, an open-ended questionnaire was employed due to its effectiveness. Open-ended questions provide more varied and textured information than closed-ended questions and can provide insights that are not anticipated. Those new and open answers are considered as the source of insight for the researchers. Summarizing this approach has been chosen because of significantly of building and developing theory (Bratnicka-Myśliwiec et al., 2018)

Respondents` answers were collected using an online questionnaire. Five researchers in five different countries (Portugal, Poland, Palestine, Brazil, and Mexico) collected the database within the same timeframe, beginning in January 2023 and closing in May 2023. After collecting the data, the researchers imported the answers into an Excel file to prepare them for analysis. The methodology assumption was to provide a comparable sample size from each country. In this study answers from 647 respondents were collected. To ensure the relevance of the results, the respondents in this study were actively seeking jobs in real recruitment processes. Table 1 presents the characteristics of the sample.

Table 1.
Statistical data about the research sample

Respondents	**Portugal 17,31%**	**Poland 21,48%**	**Palestine 20,09%**	**Brazil 16,85%**	**Mexico 24,27%**	**In total**	**In %**
Gender							
Male	33	50	53	46	63	245	37,87%
Female	47	89	77	62	88	363	56,11%
No answer	32	0	0	1	6	39	6,03%
Age							
18-19	3	1	0	1	0	5	0,77%
20-24	63	15	40	5	5	128	19,78%
25-29	16	30	34	22	12	114	17,62%
30-34	10	25	18	23	18	94	14,53%
35-39	4	30	17	17	29	97	14,99%
40-44	7	19	6	16	46	94	14,53%
45-49	2	11	10	5	26	54	8,35%
50-54	4	5	1	9	6	25	3,86%
55-59	3	1	3	6	9	22	3,40%
60 or more	0	0	1	1	6	8	1,24%
No answer	0	2	0	4	0	6	0,93%
Education							
High School	26	15	7	4	2	54	8,35%
Bachelor degree	62	32	59	85	108	346	53,48%
Master of Art	22	90	51	19	47	229	35,39%
Doctoral degree	2	0	13	0	0	15	2,32%
No answer	0	2	0	1	0	3	0,46%
In total	112	139	130	109	157	647	

Source: own study.

According to the characteristics presented in Table 1, respondents from five countries participated in this research – 112 from Portugal, 139 from Poland, 130 from Palestine, 109 from Brazil and 157 from Mexico. Most of the respondents were female (56,11%), while men made up (37,87%). Few respondents preferred not to answer the question about gender (6,03%). The age structure of this sample is evenly distributed. The majority of respondents are between 20 till 49 years old (89,80%). More than half of the respondents graduated with a Bachelor's degree (53%) or Master's studies (35,39%).

The answers from each country were translated from their respective languages into English and imported into a single Excel file. Data such as country, gender, and education level were con-verted to numerical values. The coded responses were imported into IBM® SPSS® Imago PRO software (version 9) for statistical analysis presented in Table 1.

Data were analysed using IBM® SPSS® Text Analytics for Surveys and NVIVO (version 14) for qualitative data. NVIVO (version 14) provides a meaningful analysis of responses to open-ended questions. The analysis procedure involved importing the survey, identifying open-ended and closed-ended questions, creating cases for survey respondents, and creating case attributes for closed-ended questions.

To guarantee complete and systematic identification and the coding of themes, the coding process for open-ended responses involved multiple researchers. To find trends and subjects, keywords and text research searches were used, and categories were generated accordingly. This methodical technique allowed for precise and consistent answer coding.

4. Results

The first part of the quality analysis was the coding process for all the respondents` answers to the question "Why do you apply for a job post?" As a result of the coding process, seven main reasons (topics) have been identified as critical. These are presented in Table 2.

Table 2.
Motivations to apply for a new job post - Topic codebook

No.	Topic	Code	Description	Keywords
1	Career Development	why1_ career_dev	Exploring opportunities to improve skills, knowledge, and professional development to pursue new challenges and achieve upward mobility	Career, growth, professional, development, skills-building, competency, advancement, new challenges, promotion, upward mobility, position, growth, progress, satisfaction, learning, knowledge, training, evolve, competence
2	Financial Motivation	why2_ financial	Assessing Financial Incentives such as Job Security, Pay, Benefits, and Retirement	Salary, financial, money, income, benefits, retirement, economic, pay, remuneration, compensation, wage, job security, stability

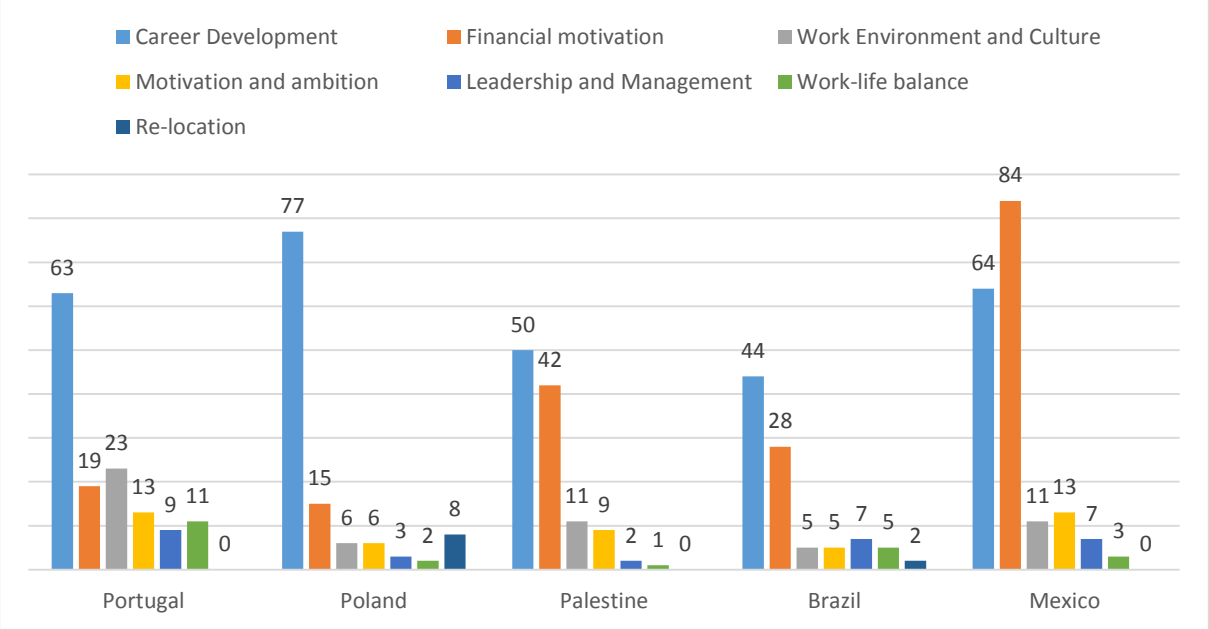
Cont. table 2.

3	Work Environment and Culture	why3_ work_env	Assessing Workplace Culture Evaluating Respectful Collaboration and Working Conditions	Culture, environment, respectful, reception, collaboration, working conditions, atmosphere
4	Motivation and ambition	Why4_ motiv_amb	Exploring the motivation and ambition behind seeking a new job for personal and professional growth, gaining new experiences, and contributing to society	Motivation, ambition, community, contribution, society, giving back, social impact, personal, self-improvement
5	Leadership and Management	Why5_ leader_mngt	Opportunities with good leadership, understanding management, and potential for career advancement and recognition	Leadership, appreciation, recognition, understanding,
6	Work-life balance	Why6_ work_lif	Understanding factors that affect work-life balance, including commute, stress, and flexibility	Work-life, balance, commute, peaceful, stress, relocation, flexibility OR family
7	Re-Location	Why7_ relocation	Relocateon	Relocation

Source: own study using Nvivo Analysis 2023.

Seven main motivations to apply for a new job post were identified, as presented in Table 2. Based on the qualitative analysis of the respondents' answers content the reasons for looking for a new job under into seven categories: career development, financial motivations, work environment and culture, motivation and ambition, leadership and management, work-life balance, and relocation.

Figure 1 presents the results of comparative analyses on motivators among respondents from Portugal, Poland, Palestine, Brazil, and Mexico.



Note: Respondents might mention more than one topic in their answers. Therefore, the number of mentions for each topic should be interpreted as a count of how many times each topic was mentioned, rather than the number of respondents.

Figure 1. Motivators indicated by respondents (RQ1).

Source: own elaboration.

As was presented in Figure 1, career development is a significant motivator indicated frequently by respondents regardless of the country. It is the most important motivator to change the job in Portugal, Poland, Palestine, and Brazil. In Mexico career development was indicated very often, but more frequently financial motivation encourages respondents to change jobs. In Mexico, Brazil, and Palestine those two topics were described the most as reasons to change the workplace.

Moreover, topics covered in Portugal included work environment and culture, motivation and ambition, work-life balance, leadership and management. In Poland, a unique motivator related to relocation was identified, which is not as popular in other countries. The main topics addressed in Palestine apart from a career development and financial compensation included also motivation, ambition and work environment. Brazil prioritizes career development and financial compensation, while leadership, management, work environment, and work-life balance are secondary motivators. Mexico, shares some similarities with Palestine and emphasis on ambition, culture and work environment.

Overall, all the countries included in this study had similar main reasons for looking for new jobs including career development and financial compensation. The main difference among those countries lies in their workforce desires and issues. In addition to career development and financial motivations, employees in Portugal, Palestine, and Mexico value a good work environment, organizational culture, and opportunities for motivation and ambition. Poland stands out in the desire for relocation, what is quite unique in this international picture. Brazil slightly prioritizes leadership and management. Based on the results of comparative analyses following proposition was formulated:

Proposition 1: Career development and financial reason are the most often motivators indicated by respondents regardless the country. It would be valuable for enterprises to create opportunities to career development inside the organization to retain employees. Moreover, the control of the level of compensation can significantly reduce the probability of change the job. The future research focus on this topic could examine deeper what exactly does it mean "career development" and which ways of career development would be the most interesting for employees.

The second part of analyses refers to the codification process of respondents` answers to the question "What do you expect to your future employers?" As a result of the coding process ten main expectations were identified as significant. They are presented in Table 3.

Table 3.
Expectations to future employers - Topic codebook

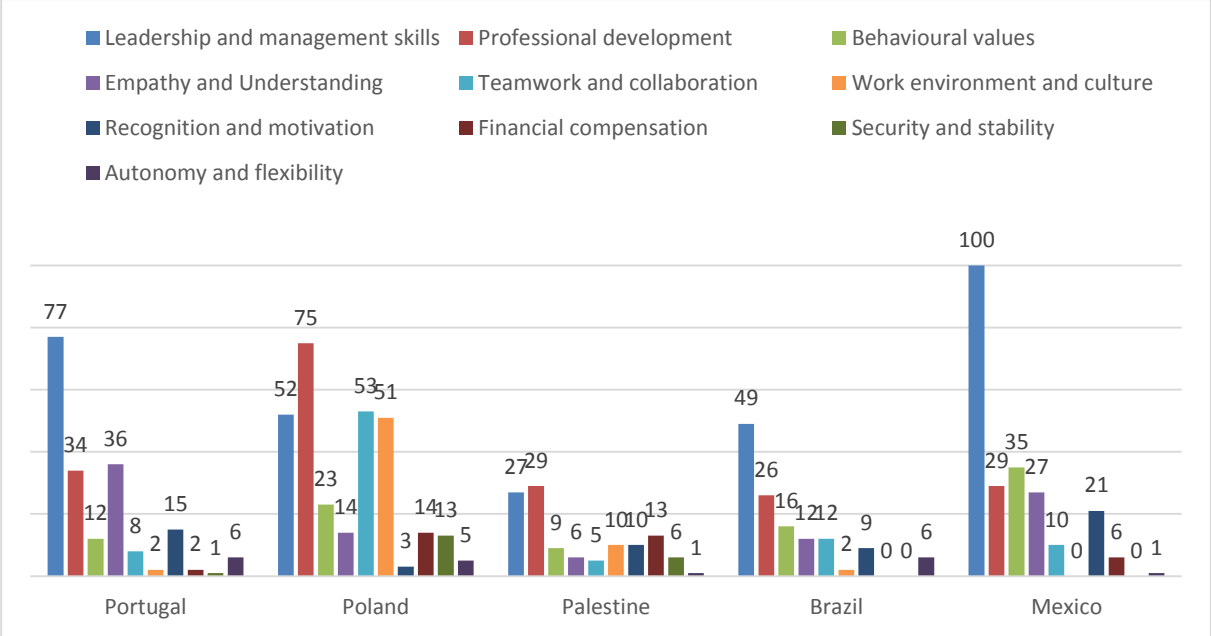
No.	Topic	Code	Description	Keywords
1	Leadership and management skills	What1_leader_mngt	Effective leadership and management skills with clear communication, empathy, and supportive mentorship	Leadership, competence, guidance, delegate, rules, structures, organized, clear, instructions, objectives, clarity, communication, empathy, listening, feedback, support, assistance, mentor, help, competence, decision, opinion
2	Professional development	What2_ profesional_dev	Expectations for growth opportunities, career development, and learning through training, promotion, and experience	growth, development, training, promotion, entrepreneurship, experience, responsibilities, career, opportunities, improvement, knowledge, learning, competence
3	Behavioural values	What3_ behvav_val	Expectations of respect, kindness, humanism, and fairness from the employer	Respect, kindness, dignity, humanism, patience, fairness, non-judgmental
4	Empathy and understanding	What4_ empath_und	A workplace with a culture of empathy and understanding towards employees' needs and concerns	Empathy, understanding, life balance, well-being, health, stress, family
5	Teamwork and collaboration	What5_ team_col	The expectation of cooperative teamwork, trust, and support for a collegial and cohesive work environment	Cooperation, teamwork, collegial, rivalry, together, group work, cooperation, trust, cooperative, cohesive
6	Work environment and culture	What6_ work_env	A positive work environment and culture that values diversity and fosters collaboration	Atmosphere, environment, culture
7	Recognition and motivation	What7_ recognition_mot	Expecting recognition for work and motivation to drive commitment	Recognition, motivation
8	Financial compensation	What8_ financial	Providing economic compensation, remuneration, salary, and financial benefits	Remuneration, salary, money, income, economic, financial, compensation
9	Security and stability	What9_ security_stab	Expectation for a secure and stable job with permanent employment	Stability, permanent, secure
10	Autonomy and flexibility	What10_ auto_flex	Flexibility in work arrangements with options for remote, hybrid work and autonomy in decision-making	Remote, hybrid, flexibility, autonomy

Source: own study using Nvivo Analysis 2023.

As was presented in Table 3, identified expectations to future employers are related to following topics: leadership and management skills, professional development, behavioral values, empathy and understanding, teamwork and collaboration, work environment and culture, recognition and motivation, financial compensation, security and stability, autonomy and flexibility.

The results of the comparative analyses were presented in Figure 2. Firstly, general findings will be presented based on the total numbers of indications of every identified expectation. In general, employees` expectations are mainly focused on two topics. Primarily, employees

expect leadership and management skills (305 indications in total) and professional development (193 indications in total). Furthermore, employees are looking for at a new workplace behavioral values (95 indicators) empathy and understanding (95 indicators OR responses) and the possibility to collaborate in a team (88 indications). Work environment and culture were linked to several indications (65) as well as recognition and motivation (58). Some respondents noticed also financial compensation (35 indications), security and stability (20 indications) and autonomy and flexibility (19 indications).



Note: Respondents might mention more than one topic in their answers. Therefore, the number of mentions for each topic should be interpreted as a count of how many times each topic was mentioned, rather than the number of respondents.

Figure 2. Expectations indicated by respondents (RQ2).

Source: own elaboration.

Figure 2 allows for the comparison of results between countries. In Portugal, employees expect to find leadership and management skills in their new enterprises. Moreover, many of them are looking for empathy, understanding and professional development. The expectation related to professional development is prominently visible in Poland. In addition to it, polish employees expect leadership, the possibility to work in a team, collaboration, good work environment and organizational culture. Respondents from Palestine expected that the enterprise will provide opportunities for career development and growth, leadership and management skills in the organization. In the second line, respondents are motivated by financial compensation, work environment, culture and recognition. Brazilians apart from leadership and management skills in a new work place are looking for professional development, behavioral values, empathy, understanding, and possibility to collaborate. The highest number of indications among respondents from Mexico significantly was related to leadership and management skills. Moreover, they explicitly expect behavioral values, professional development, empathy, understanding, motivation and recognition. Based on the results of this comparative study the following proposition can be formulated:

Proposition 2: Understanding the different employees' expectations can be valuable for enterprises to attract and retain employees. Based on insights it is possible to claim that respondents of this study expect from their future employers the most: leadership, management skills and opportunity for personal development. Countries like Portugal, Mexico, and Brazil highlight the most the importance of leadership and management skills, while countries like Poland and Palestine prioritize professional development and growth. Those insights can be an inspiration to dedicate more attention to improve leadership and management skills e.g., by trainings, educational programs, coaching or mentoring to improve those skills. Part of employees could be also included in this educational program to have an opportunity for personal development. It is worth to notice that expectation of "better salary" was not at the top of main employees' expectations. Rather, employees expect from a new organisation empathy, understanding, work and collaboration, so it is crucial to pay attention to shaping work environment and organisational culture.

5. Discussion and conclusions

The aim of this study was to identify motivations and expectations of employees who apply for a new job post. To achieve this aim, the research using an open-ended questionnaire were realized. Based on answers from 647 respondents from Portugal, Poland, Palestine, Brazil and Mexico, the study found that career advancement and financial incentives were the primary motivations for changing jobs. Moreover, leadership, management skills and personal development were identified as the most desirable expectations for employees looking for new job opportunities.

The study contributes to the existing literature on management and entrepreneurship, especially focused on relation between employees and enterprises. Findings can be valuable to develop and redesign motivation theories and organizational behaviors research. They could have theoretical contribution also in social exchange theory, which suggests that employees' motivation to remain with an enterprise is based on a reciprocal exchange of resources and benefits. The practical implications can be implemented by enterprises through redesign personal strategy by providing career advancement opportunities, improving leadership and management skills, and fostering a positive work environment and culture. Enterprises interested in understanding motivators and employees` expectations can also refer to similarities and differences across different cultural con-texts.

Despite the effort that has been put into designing this research, this study has some limitations. First, the study was conducted based on respondents from only five different countries. Therefore, there is not enough evidence for the generalization of results. Second, answers were collected using native languages and translated into English, which can create linguistic ambiguities. The third limitation was the software used to analyze the open-ended questions. There was no evidence to prove that other software would be consistent with the current NVivo software and yield the same results.

Future research can be extended in a few directions. Firstly, future research can investigate how cultural differences impact employees' perceptions of professional development opportunities. Secondly, it would be valuable to explore what exactly "professional development" means for employees and what ways of career development enterprises can implement. Moreover, interesting insight was related to leadership and management skills that employees expect from future employers. It is surprising how significantly respondents mentioned them, therefore leadership and management skills as urgent topics are recommended to explore in future research.

Frequent employee turnover caused by leaving the enterprises reduces team cohesion, makes employees feel unstable, and causes additional costs in organization (Lu et al., 2023). Accordingly, understanding employees' motivations and expectations can help enterprises reduce turnover rates and improve team cohesion and stability. Therefore, the authors hope insights about current employees' motivations and expectations will enrich the knowledge on this topic and assist organizations that face challenges in a changing and dynamic world.

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