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FOREWORD

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

The papers presented in the number concentrate on many topics connected with organization and management. There are in the number papers about: service management, environmental management, financial management, sustainability, ethical aspects of management, lean management, green economy, impact of COVID-19 pandemic on management, information management, human resource management, supply chain management, quality management, leadership, Industry 4.0, Smart City, production management, public management and business analytics.

Radosław Wolniak

MULTICRITERIA EVALUATION OF COMPETITIVENESS OF CONTAINER TERMINALS IN THE BALTIC SEA REGION

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Purpose: After the outbreak of the covid-19 pandemic and Russo-Ukrainian war, the situation in the Baltic Sea Region (BSR) changed, especially regarding maritime container terminals. The aim of the article is to identify major Baltic container terminals and to perform a multicriteria analysis of their competitiveness. The analysis will be carried out before (2019) and after (2022) the turmoil on the market in question.

Design/methodology/approach: The study uses the Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE II) with subjective criteria weights, as well as the entropy method with objective criteria weights.

Findings: The obtained results show that two Polish maritime container terminals, DCT Gdańsk and GCT Gdynia, as well as Finnish Vuossari can be assessed as the most competitive both in 2019 and 2022. At the same time, in the analyzed years, the lowest positions in the rankings were maintained by Swedish GCT Gävle and Västhamnen, Finnish Euroports Finland as well as Latvian BCT Riga.

Research limitations/implications: Limited data availability influenced the choice of criteria used in the study. Moreover, website data sources used in the study may result in the inaccuracy of our calculations. Finally, the subjectivity involved in the selection of chosen criteria and some of their weights could lead to different competitiveness assessment results of maritime container terminals in the BSR.

Practical implications: Our findings should be of interest to terminal operators and managers planning their strategy for next years, especially if they want to maintain their competitive advantage in the region after the lifting of sanctions imposed on Russian ports.

Originality/value: This is the first paper to compare the multicriteria rankings of competitiveness before and after the turmoil on the BSR container market, especially as industry reports and research on the BSR usually consider the annual results achieved by individual ports, ignoring the efficiency of the terminals that comprise them.

Keywords: maritime container terminals, multicriteria analysis, Baltic Sea Region, competitiveness.

Category of the paper: research paper.

1. Introduction

The covid-19 pandemic has clearly affected the maritime transport of containers. In 2020, world seaports handled 2.8% twenty-foot equivalent units (TEU) less than in 2019 (UNCTAD, 2021). Yet, this reduction proved moderate compared to other shipping market segments and total seaborne trade (Notteboom, 2021). Despite the obstruction of the Suez Canal, the shortage of containers on the global market and the high freight rates, already in 2021, the global maritime container market quickly made up for the losses incurred a year earlier.

The recent market situation is much more complicated in the Baltic Sea Region (BSR). Following the global trend, in 2021, the Top 10 Baltic container ports increased the volume of container turnover by 4.56% y/y and handled 9.2 million TEU (Synak, Ołdakowski, 2020; Ziajka, Rozmarynowska-Mrozek, 2021). Yet, after the Russian aggression on the Ukraine in the beginning of 2022, the geopolitical local tension, and a considerable decrease of calls by container carriers to the ports of Russia triggered significant declines in container throughput of Russian ports. The most extensive drops were recorded in the second quarter of the year, when all Russian Baltic ports handled 61.2% TEU less than in the corresponding period of 2021 (Ziajka, Rozmarynowska-Mrozek, 2022).

Considering all the above, the competitiveness between Baltic seaports has recently increased. Thus, for the purposes of this article we decided to identify the leading Baltic maritime container terminals and to determine their competitive position in relation to their biggest competitors in the BSR. To this end, we used the Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE II) multicriteria analysis with subjective criteria weights and the entropy method with objective criteria weights which will be described in more details in Section 3. Then, we compared the obtained results with the multicriteria rankings of competitiveness for 2019, that is before the turmoil on the BSR container market. It will certainly fill the existing research gap and add to the literature, especially as industry reports and research on the BSR usually consider the annual results achieved by individual ports, ignoring the efficiency of the terminals that comprise them.

The rest of the paper is organized as follows. Section 2 summarizes a literature review of the multicriteria analysis of seaports' competitiveness. Section 3 explains the methods applied in this study. The results are presented in Section 4 while Section 5 presents conclusions and research opportunities.

2. Literature review

Many articles discuss different aspects of seaport competitiveness. Most relevant for this paper are recent studies using different multicriteria methods. For example, Teng, Huang and Huang (2004) tried to clarify the characteristics of a port's competitiveness using Grey Relational Analysis (GRA) model by taking eight East Asian container ports for identification. Guy and Urli (2006), in turn, assessed how port preference is affected by changes in criteria weight and evaluation. Madeira et al. (2012) used factor analysis to reduce the number of criteria necessary in the ordering of container terminals of major Brazilian ports. Then, Lee et al. (2014) attempted to find the factors that reflect strategic investments in terms of port policy and used the Analytic Hierarchy Process (AHP) method to compare eight major container ports throughout five continents. Dyck and Ismael (2015) also used the AHP method, but to evaluate the competitiveness of major ports in the West African region. Acer and Yanginlar (2017), on the other hand, analyzed the performance of 20 container ports operating in Turkey with the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method, using non-financial data from 2015.

More recently, authors started to implement fuzzy Multicriteria Decision Making (MCDM) methods for the evaluation of ports' and shipping industry's competitiveness. Wang et al. (2018) evaluated and ranked the key developmental factors of Shanghai's cruise tourism industry by using an interval-valued fuzzy number method. Then, Liu et al. (2020) used the fuzzy AHP to calculate the weight of the evaluation criteria layer and the concept of fuzzy TOPSIS to create an evaluation method suitable for container carriers to choose the most attractive port. Pamucar and Faruk Görçün (2022), in turn, proposed a fuzzy integrated MCDM approach consisting of the Fuzzy Level Based Weight Assessment (LBWA) and fuzzy Combined Compromise Solution with Bonferroni (CoCoSo'B) techniques. Thus, they evaluated the European container ports and proved that these methods can be implemented to solve the highly complex decision-making problems faced in the maritime industry. Finally, some researchers have recently started to propose their own novel multiple criteria sorting methods. For example, Qin et al. (2022) introduced the ORESTE-SORT method for sorting port group competitiveness and performed sensitivity analysis and comparative analysis with the ELECTRE-SORT method to determine their method effectiveness.

At the same time, only a few authors have yet discussed the competitiveness of maritime container terminals in the BSR. Bartosiewicz (2020) examined the competitiveness of the most important maritime container terminals in Poland and Russia using a strategic group mapping, as well as the AHP and PROMETHEE II methods. Bartosiewicz and Szterlik (2021) performed the multicriteria PROMETHEE II analysis to identify small Baltic container terminals which are in the area of strategic benefits for the analyzed market. Bartosiewicz and Jadczyk (2023), in turn, performed the AHP multicriteria analysis with subjective criteria weights and objective

criteria weights to evaluate the competitive advantages of major maritime container terminals in the BSR in 2021. In this context, this study adds to the literature as it identifies major Baltic container terminals in 2019 and 2022, as well as determines their competitive position in the BSR before and after the covid-19 pandemic and Russian aggression on Ukraine.

3. Methods

Similarly to Zhang and Wu (2023), this study follows a four-step process for evaluating competitiveness of the maritime container terminals in the BSR, as depicted in Fig. 1. The first step is to collect information for the assessment from multisource website data. The next phase defines the seven assessment criteria: length of the quay, number of RTGs, number of STS cranes, number of shortsea shipping connections, maximum depth at the quay and the distance from the nearest motorways, expressways/national roads, as well as national railway stations. The third stage aims to assign weights to the proposed assessment criteria. The fourth phase uses PROMETHEE II and entropy methods to analytically assess competitiveness of maritime container terminals in the BSR.

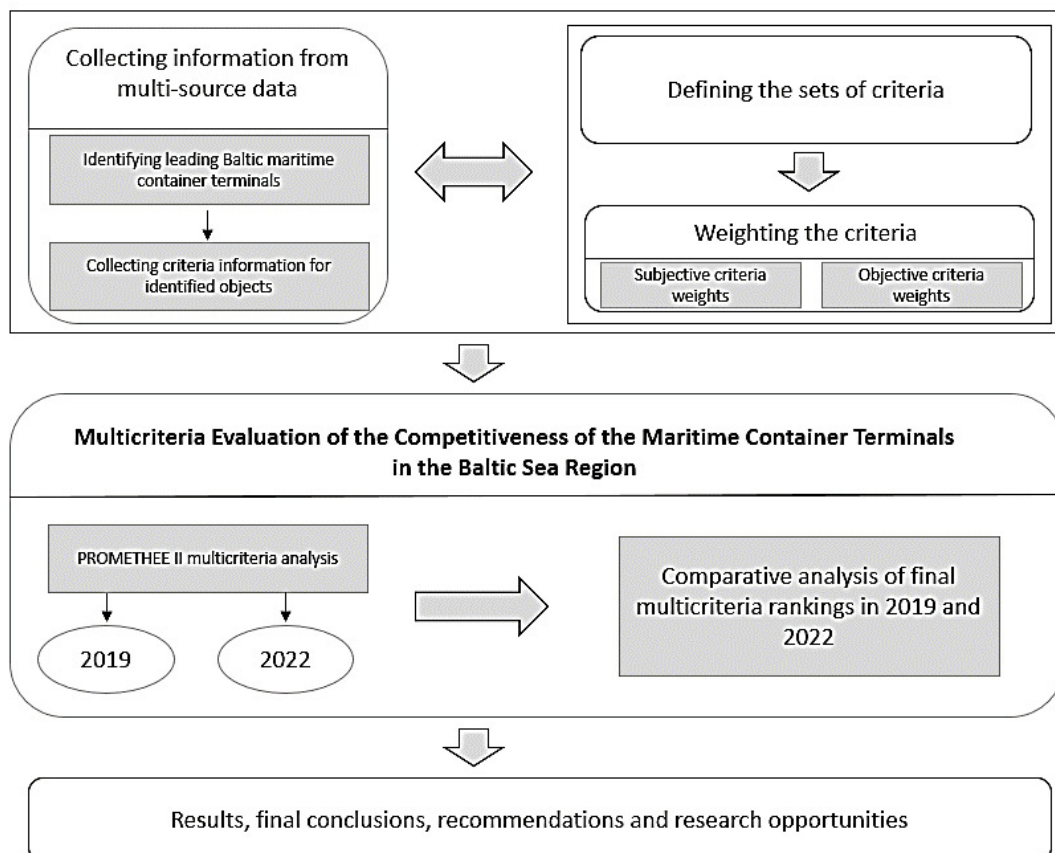


Figure 1. Proposed framework for multicriteria analysis of maritime container terminals in the BSR.

Source: own study.

3.1. Data and general problem description

The BSR consists of eight European Union countries (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden) and Russia. At the beginning of 2022, there were above fifty maritime container terminals in the described region. Our study considers only those Baltic container terminals whose maximum annual transshipment capacity was over 150,000 TEUs (the major terminals). This means that the number of studied terminals was different in 2019 and 2022 (Table 1). In our multicriteria analysis for 2022 we excluded Russian terminals and included newly built terminal in Stockholm. We had to exclude Russian terminals because, although they are still operating in 2022, their annual TEU turnover is greatly disturbed by the introduced sanctions. For example, container throughput of two biggest St Petersburg's container terminals (FCT, PLP) decreased by about 58% in the second quarter of 2022 comparing to the same period of 2021 (Bruno, 2022). In other words, in 2022, Russian terminals could be no longer included to the group of major terminals with annual turnover over 150,000 TEU. Table 1 below lists terminals chosen for our study. They are ordered alphabetically as registered in 2019 and 2022. Figure 2, in turn, presents the location of all analyzed objects.

Table 1.

Major Baltic container terminals chosen for the study (2019 and 2022)

| 2019 | | 2022 | |
|------------------|--------------------------------|------------------|--------------------------------|
| symbol | terminal (country) | symbol | terminal (country) |
| CT ₁ | APMT Aarhus (DK) | CT ₁ | APMT Aarhus (DK) |
| CT ₂ | APMT Gothenburg (S) | CT ₂ | APMT Gothenburg (S) |
| CT ₃ | BCT Riga (LV) | CT ₃ | BCT Riga (LV) |
| CT ₄ | BCT Gdynia (PL) | CT ₄ | BCT Gdynia (PL) |
| CT ₅ | Bronka (RUS) | CT ₅ | DCT Gdańsk (PL) |
| CT ₆ | DCT Gdańsk (PL) | CT ₆ | Euroports Finland (FIN, Rauma) |
| CT ₇ | Euroports Finland (FIN, Rauma) | CT ₇ | GCT Gävle (S) |
| CT ₈ | FCT (RUS, St Petersburg) | CT ₈ | GCT Gdynia (PL) |
| CT ₉ | GCT Gävle (S) | CT ₉ | HPS Stockholm (S) |
| CT ₁₀ | GCT Gdynia (PL) | CT ₁₀ | KCT Klaipeda (LT) |
| CT ₁₁ | KCT Klaipeda (LT) | CT ₁₁ | Klaipedos Smelte (LT) |
| CT ₁₂ | Klaipedos Smelte (LT) | CT ₁₂ | Mussalo CT (FIN, HaminaKotka) |
| CT ₁₃ | Mussalo CT (FIN, HaminaKotka) | CT ₁₃ | MCT (E, Tallin) |
| CT ₁₄ | MCT (E, Tallin) | CT ₁₄ | Västhämn (S, Helsingborg) |
| CT ₁₅ | PLP (RUS, St Petersburg) | CT ₁₅ | Vuosaari (FIN, Helsinki) |
| CT ₁₆ | CTSP (RUS, St Petersburg) | | |
| CT ₁₇ | Västhämn (S, Helsingborg) | | |
| CT ₁₈ | Vuosaari (FIN, Helsinki) | | |

Note. Denmark (DK), Estonia (EE), Finland (FIN), Latvia (LV), Lithuania (LT), Poland (PL), Russia (RUS), Sweden (S).

Source: own study.



Figure 2. Location of major maritime container terminals in the BSR.

Source: own study.

Such factors as technical infrastructure, the work organization of the terminal, the use of advanced information technologies or the provision of comprehensive logistic services influence the competitiveness of a maritime container terminal. This study includes five infrastructural, two superstructural and one service factors. More specifically, the multicriteria PROMETHEE II analysis uses the length of the quay (c_1), the number of RTG, Rubber Tyred Gantry (c_2) and STS, Ship to Shore (c_3) cranes, the number of shortsea shipping connections (c_4), the maximum depth at the quay (c_5) and the distance from the nearest motorways, expressways/national roads (c_6), as well as national railway stations (c_7). For five factors data was obtained from the websites of individual terminals or various types of collective studies. The distance from motorways and expressways/national roads, as well as national railway stations, in turn, was calculated using navigation programs and digital maps. Table 2 lists the proposed criteria with explanation for multicriteria analysis of competitiveness of major

maritime container terminals in the BSR. Table 3, in turn, presents the data used in the study. Data for 2022 is given in bracket if any change occurred comparing to 2019.

Table 2.

The proposed criteria with explanation for multicriteria analysis of competitiveness of major maritime container terminals in the BSR

| Criterion | Criterion name | Explanation | Units |
|----------------|--|--|-------|
| c ₁ | length of the quay | the length of berths at which container ships anchor | m |
| c ₂ | number of RTGs | the total number of Rubber-Tyred Gantry cranes (RTG) | item |
| c ₃ | number of STS | the total number of Ship to Shore cranes (STS) | item |
| c ₄ | number of shortsea shipping connections | the number of shortsea shipping regular (linear) connections | item |
| c ₅ | maximum depth at the quay | the maximum depth at berths at which container ships anchor | m |
| c ₆ | distance from the nearest motorways, expressways/ national roads | distance from the nearest motorways, expressways/ national roads measured in the straight line | m |
| c ₇ | distance from the nearest railway stations | distance from the nearest railway stations measured in the straight line | m |

Source: own study.

Table 3.

Data for major Baltic container terminals and seven criteria for 2019 (2022)

| Terminal | c ₁ | c ₂ | c ₃ | c ₄ | c ₅ | c ₆ | c ₇ |
|-------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| APMT Aarhus (DK) | 1,300 | 0 | 8 | 15 (9) | 14 (15) | 4,500 | 6,700 |
| APMT Gothenburg (S) | 1,800 | 0 | 10 | 10 (9) | 16 | 1,900 | 10,300 |
| BCT Riga (LV) | 450 | 6 (4) | 4 (5) | 9 (4) | 12.5 | 8,500 | 5,600 |
| BCT Gdynia (PL) | 800 | 20 (18) | 8 (6) | 9 (6) | 12.7 | 4,100 | 3,100 |
| Bronka (RUS) | 1,220 | 8 (10) | 4 | 8 (4) | 14.4 | 1,500 | 5,500 |
| DCT Gdańsk (PL) | 1,300 | 35 (40) | 11 (14) | 8 (9) | 16.5 (17) | 2,600 | 10,400 |
| Euroports Finland (FIN) | 160 | 0 | 3 (2) | 8 (5) | 12 | 900 | 2,100 |
| FCT (RUS) | 780 | 12 | 7 | 12 | 11 | 2,600 | 3,000 |
| GCT Gävle (S) | 328 (680) | 0 (6) | 2 (3) | 2 (4) | 10.1 (12.5) | 8,400 | 7,900 |
| GCT Gdynia (PL) | 620 | 14 | 6 | 15 (17) | 13.5 | 3,300 | 2,700 |
| HPS Stockholm (S) | (450) | (0) | (2) | (3) | (16.5) | (2,400) | (4,800) |
| KCT Klaipeda (LT) | 820 | 7 (13) | 2 (4) | 14 (5) | 10 (13.4) | 4,800 | 9,800 |
| Klaipedos Smelte (LT) | 1,088 | 7 (12) | 3 (5) | 5 (4) | 14 (13.4) | 1,100 | 6,800 |
| Mussalo CT (FIN) | 1,850 | 0 | 7 (9) | 8 (4) | 15.3 | 4,800 | 6,700 |
| MCT (E) | 1,094 (1,096) | 6 | 3 | 10 (6) | 14.5 | 1,000 | 16,100 |
| PLP (RUS) | 2,201 (2,071) | 20 (26) | 10 (7) | 13 (12) | 11 | 3,700 | 4,000 |
| CTSP (RUS) | 787.2 | 19 | 4 | 3 | 11.4 | 4,000 | 4,600 |
| Västhämen (S) | 700 (770) | 0 | 4 (3) | 8 (11) | 13.5 (13) | 1,600 | 3,900 |
| Vuosaari (FIN) | 2,500 | 0 | 10 (8) | 11 (14) | 13 | 600 | 16,500 |

Source: own study.

As we may notice, except for two Russian terminals (FCT, CTSP), at least one criterion has changed for all analyzed terminals in 2022 comparing to 2019. At the same time, criteria c_6 and c_7 have not changed at all. It stems from the fact that the geographical location of analyzed terminals has not changed throughout the analyzed period and at the same time no new road or rail infrastructure was built. Moreover, the number of shortsea shipping connections (c_4) have changed the most frequently while the length of the quay (c_1) and the maximum depth at the quay (c_5) – the least. Surprisingly, in three cases these indicators decreased in 2022 when comparing to 2019 (c_1 for PLP, and c_5 for Klaipėdos Smelte and Västhamnen). The difference seems insignificant, though, and may simply be the difference in the way data is presented on the website.

3.2. PROMETHEE II algorithm

In operations research literature, quantitative decision support methods are divided into single-criteria and multicriteria. This is very often a result of the decision problem's nature. In many situations decision-making requires the consideration of at least several decision options, each of which is influenced by several factors that determine its acceptability. Further, multicriteria analysis methods can be divided into methods based on utility function or methods based on superiority relationships. The latter implement a 'bottom-up' approach. We construct an overall superiority relationship between objects based on partial relationships (constructed for each criterion separately). The representative of this group of methods is the PROMETHEE II algorithm. The method is presented below in few steps.

Step 1: The objects must be compared in pairs for each criterion separately, which amounts to counting the following differences:

$$d^k(O_{[i]}, O_{[j]}) = O_{[i]}^k - O_{[j]}^k \quad (1)$$

where $O_{[i]}^k, O_{[j]}^k$ denote the ratings of objects i and j for criterion k ($i, j = 1, \dots, M; k = 1, \dots, K$).

Step 2: Based on the calculated differences in step 1, so-called pairwise object comparison preferences are created according to a given criterion. This boils down to applying one of the preference functions, the values of which are in the interval $[0, 1]$. The preferences for stimulants and destimulants may be calculated as follows, respectively:

$$P^k(O_{[i]}, O_{[j]}) = F^k\{d^k(O_{[i]}, O_{[j]})\} \quad (2)$$

$$P^k(O_{[i]}, O_{[j]}) = F^k\{-d^k(O_{[i]}, O_{[j]})\} \quad (3)$$

Each preference function has the important property that if $P^k(O_{[i]}, O_{[j]}) > 0$ then $P^k(O_{[j]}, O_{[i]}) = 0$.

Step 3: When all criteria are considered, calculate aggregated preference indices for each pair of objects $O_{[i]}$ and $O_{[j]}$. This procedure is performed using the formulas:

$$\Pi(O_{[i]}, O_{[j]}) = \sum_{k=1}^K w_k P^k(O_{[i]}, O_{[j]}) \quad (4)$$

$$\Pi(O_{[j]}, O_{[i]}) = \sum_{k=1}^K w_k P^k(O_{[j]}, O_{[i]}) \quad (5)$$

This index indicates the extent to which, overall, in terms of all criteria, object $O_{[i]}$ is preferred over object $O_{[j]}$ or object $O_{[j]}$ over object $O_{[i]}$.

Step 4: Calculation of preference flows for each object. First, calculations of positive flows $\Phi^+(O_{[i]})$ and negative flows $\Phi^-(O_{[i]})$ are performed:

$$\Phi^+(O_{[i]}) = \frac{1}{m-1} \sum_{O_{[j]} \in O} \Pi(O_{[i]}, O_{[j]}) \quad (6)$$

$$\Phi^-(O_{[i]}) = \frac{1}{m-1} \sum_{O_{[j]} \in O} \Pi(O_{[j]}, O_{[i]}) \quad (7)$$

Positive preference flow should be interpreted as the degree to which object $O_{[i]}$ is superior to all other objects, while negative flow tells which object $O_{[i]}$ is superior to all other objects.

Step 5: In the last step, calculation of net preference flows $\Phi(O_{[i]})$ is performed according to the formula:

$$\Phi(O_{[i]}) = \Phi^+(O_{[i]}) - \Phi^-(O_{[i]}) \quad (8)$$

The values of the net preference flows of the offers are in the range $[-1, 1]$, and their sum is 0. Based on the net preference values, the final ranking of the sites can be constructed by arranging them in descending order of the indicator's value.

In the PROMETHEE II algorithm presented here, step 2 is particularly noteworthy, in which a preference calculation must be performed using appropriate top-down functions. Of the proposed functions, the Gaussian function was used, which is expressed by the formula:

$$P^k(O_{[i]}, O_{[j]}) = 1 - \exp\left(-\frac{d^k(O_{[i]}, O_{[j]})^2}{2\sigma^2}\right) \quad (9)$$

where σ^2 denotes the variance of the scores for the k -th criterion.

The Gaussian function has quite a few advantages over the other functions in the PROMETHEE II method. The preference index reacts approximately linearly for medium values of the preference function, rendering almost proportional relationships for different pairs of objects. In contrast, the preference indices are close to each other within very large values of the preference function. The same is true for minimal differences – here, the preference indices are close to each other.

3.3. Criteria weights

In multicriteria analyses, criteria are given weights to express their importance. These can be adopted arbitrarily using, for example, expert judgements or determined in a more objective way using specific numerical procedures.

Determining the weights of criteria by experts can be done using an ordinal scale, e.g., from 1 to 10, where the least important weight takes the value of 1, and the most important – value of 10. Since the weights are very often the numbers from the range (0,1), their ranking values should be then normalized.

Another way of determining the weights is to use the Saaty scale known in the multicriteria AHP method (Trzaskalik, 2009; Kobryń, 2014). A pairwise comparison matrix \mathbf{P} between all weights must be created. The property of matrix \mathbf{P} is cohesion of its elements $[p_{i,i}]$ which means

that each element is equivalent to itself ($p_{i,i} = 1$) and the evaluation value of element i respect to element j is the reciprocal of the evaluation value of element i respect to element j ($p_{i,i} = 1/p_{i,i}$). The general form of the matrix \mathbf{P} is shown below:

$$\mathbf{P} = \begin{bmatrix} 1 & p_{1,2} & \dots & p_{1,n} \\ \frac{1}{p_{1,2}} & 1 & \dots & p_{2,n} \\ \dots & \dots & \dots & \dots \\ \frac{1}{p_{1,n}} & \frac{1}{p_{2,n}} & \dots & 1 \end{bmatrix} \quad (10)$$

The elements p_{ij} of matrix \mathbf{P} are set based on a relative grading scale defined by Saaty (2004). The comparison between variants can be made descriptively, to which is assigned an integer value from the set $\{1,9\}$. The value of p_{ij} expresses a rank of the relationship between the compared variants, where $p_{ij} = 1$ means the same significance (equivalence) between variant i and j , $p_{ij} = 5$ means that variant i is strongly preferred to variant j , and finally $p_{ij} = 9$ means that variant i is absolutely preferred to variant j . In the next step, normalized matrix $\hat{\mathbf{P}}$ should be calculated, where its elements \hat{p}_{ij} equal:

$$\hat{p}_{ij} = \frac{p_{ij}}{\sum_{i=1}^n p_{ij}} \quad (11)$$

Final weights are determined respectively according to formula:

$$\omega_v = \frac{\hat{p}_{ij}}{\sum_{i=1}^n \sum_{j=1}^n \hat{p}_{ij}} \quad (12)$$

It is worth noting here that verification of compliance of the ratings resulting from pairwise comparisons should be performed. This compliance is a consistency of ratings in which the transitivity relation is preserved: if $a > b$ and $b > c$ then $a > c$.

Another method of determining objective weights is based on entropy, the so-called Shannon entropy method, which is taken from information theory (Shannon, 1948). Entropy determines the degree of disorder in a set. It allows the significance of individual criteria to be determined from the divergence of the values of each criterion. The Shannon method consists of several steps (Al-Aomar, 2010). Given a matrix $\mathbf{Q}_{[N \times K]}$, which elements correspond to values of Table 3, first matrix $\mathbf{M}_{[N \times K]}$ must be created with elements $m_{ij} = q_{ij}$ for stimulants and $m_{ij} = 1/q_{ij}$ for destimulants. Next, matrix \mathbf{M} must be normalized according to the formula (11) to obtain matrix $\hat{\mathbf{M}}$. Based on elements \hat{m}_{ij} of the matrix $\hat{\mathbf{M}}$, in the next step the degree of the internal divergence of evaluations d_j is calculated for each criterion separately:

$$d_j = 1 + \frac{1}{\ln N} \sum_{i=1}^N \hat{m}_{ij} \ln \hat{m}_{ij} \quad (13)$$

In the last step, values d_j are used to determine final weights w_j for the individual criteria, what is shown below:

$$d_j = 1 + \frac{1}{\ln N} \sum_{i=1}^N \hat{m}_{ij} \ln \hat{m}_{ij} \quad (14)$$

$$w_j = \frac{d_j}{\sum_{j=1}^K d_j} \quad (15)$$

It is also worth noting, that it is possible to correct the subjective weights with the weights obtained by the entropy method:

$$\bar{w}_j = \frac{w_j w_j^{[s]}}{\sum_{j=1}^K w_j w_j^{[s]}} \tag{16}$$

where $w_j^{[s]}$ denotes a subjective weight of criterion j obtained, i.e., according to the Saaty’s scale.

4. Results

The assumed weight values are of key importance for the final rankings. Therefore, our intention was to build three rankings of the competitiveness of seaports separately for 2019 and 2022. In the first stage, three sets of scales were generated. The first set consists of subjective weights obtained in accordance with the procedure of the AHP method based on the constructed matrix of pairwise comparisons shown below (Table 4). The elements p_{ij} of the matrix represent the decision maker’s preferences regarding the significance of criterion i in relation to criterion j .

Table 4.
A pairwise comparison matrix between all weights

| Criterion | c1 | c2 | c3 | c4 | c5 | c6 | c7 |
|-----------|-----|----|-----|-----|-----|-----|-----|
| c1 | 1 | 5 | 4 | 1 | 2 | 3 | 3 |
| c2 | 1/5 | 1 | 1/2 | 1/5 | 1/4 | 1/3 | 1/3 |
| c3 | 1/4 | 2 | 1 | 1/4 | 1/3 | 1/2 | 1/2 |
| c4 | 1 | 5 | 4 | 1 | 2 | 3 | 3 |
| c5 | 1/2 | 4 | 3 | 1/2 | 1 | 2 | 2 |
| c6 | 1/3 | 3 | 2 | 1/3 | 1/2 | 1 | 1 |
| c7 | 1/3 | 3 | 2 | 1/3 | 1/2 | 1 | 1 |

Source: own study.

The second set of weights is independent of the decision maker. In this case, the Shannon entropy method was used, which is based only on a set of input data. Finally, the third set of weights is a combination of the first two. The weights obtained by the AHP method were corrected by the weights generated by the entropy method. The table below (Table 5) presents a summary of all sets of scales used in further calculations.

Table 5.
Sets of scales used in further calculations

| Criterion | c1 | c2 | c3 | c4 | c5 | c6 | c7 |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|
| Saaty’s scale weights | 0.267 | 0.041 | 0.061 | 0.267 | 0.165 | 0.100 | 0.100 |
| Entropy weights | 0.100 | 0.470 | 0.085 | 0.066 | 0.005 | 0.173 | 0.101 |
| Corrected weights | 0.276 | 0.197 | 0.054 | 0.182 | 0.009 | 0.178 | 0.104 |

Source: own study.

When changing the set of weights from subjective to entropy and corrected weights, the weight of the number of RTGs (c_2) increased significantly from 0.041 to 0.470 (ten times) and 0.197 (five times), respectively. On the other hand, there is also a significant decrease in the weight of the maximum water depth at the quay (c_5) from 0.165 to 0.005 and 0.009, respectively. The other five weights also changed their values. Three of them (c_1 , c_4 and c_6) changed their values in the range of 15-20 pp, while changes in the values of two weights (c_3 and c_7) can be considered small or insignificant.

In the second stage of calculations, rankings of maritime container terminals' competitiveness were generated for 2019 and 2022 separately. Tables 6 and 7 present PROMETHEE II results.

Table 6.

Final rankings of maritime container terminals' competitiveness in the BSR (2019)

| Terminal | Saaty's scale weights | | Entropy weights | | Corrected weights | |
|-------------------------|-----------------------|---------|-----------------|---------|-------------------|---------|
| | No. | Φ | No. | Φ | No. | Φ |
| APMT Aarhus (DK) | 4 | 0.2288 | 12 | -0.1149 | 7 | 0.0665 |
| APMT Gothenburg (S) | 2 | 0.2673 | 10 | -0.0486 | 5 | 0.1267 |
| BCT Riga (LV) | 16 | -0.2422 | 17 | -0.3039 | 17 | -0.3192 |
| BCT Gdynia (PL) | 11 | -0.0210 | 3 | 0.2307 | 9 | 0.0536 |
| Bronka (RUS) | 8 | 0.0599 | 7 | 0.0774 | 8 | 0.0654 |
| DCT Gdańsk (PL) | 5 | 0.1690 | 1 | 0.4947 | 2 | 0.2223 |
| Euroports Finland (FIN) | 15 | -0.1920 | 16 | -0.1527 | 16 | -0.1620 |
| FCT (RUS) | 9 | 0.0140 | 5 | 0.1532 | 6 | 0.0985 |
| GCT Gävle (S) | 18 | -0.5879 | 18 | -0.4700 | 18 | -0.5426 |
| GCT Gdynia (PL) | 7 | 0.1584 | 4 | 0.1813 | 4 | 0.1289 |
| KCT Klaipeda (LT) | 14 | -0.1067 | 14 | -0.1452 | 13 | -0.0830 |
| Klaipėdos Smeltė (LT) | 13 | -0.0932 | 9 | -0.0362 | 12 | -0.0626 |
| Mussalo CT (FIN) | 6 | 0.1590 | 15 | -0.1470 | 10 | 0.0206 |
| MCT (E) | 10 | -0.0109 | 11 | -0.1055 | 11 | -0.0551 |
| PLP (RUS) | 1 | 0.3103 | 2 | 0.4167 | 1 | 0.4294 |
| CTSP (RUS) | 17 | -0.3020 | 6 | 0.1389 | 15 | -0.1097 |
| Västhämn (S) | 12 | -0.0642 | 13 | -0.1429 | 14 | -0.0977 |
| Vuosaari (FIN) | 3 | 0.2533 | 8 | -0.0261 | 3 | 0.2198 |

Source: own study.

As shown in the obtained rankings for 2019, the Russian terminal Pertolesport (PLP) received the highest positions (1, 2 and 1). The Polish terminal DCT Gdańsk may also be ranked high (positions 5, 1 and 2). The Finnish Vuosaari also scored highly, while Swedish terminal GCT Gävle, the Latvian BCT Riga and the Finnish Euroports recorded the lowest positions (between 15 and 18) regardless of the value of the criteria weights.

Due to different sets of the adopted criteria weights, the positions of individual terminals in the rankings are subject to change. Still, these changes are minor or even imperceptible for some terminals. A certain stability of the position in the obtained rankings is characterized by the following terminals: BCT Riga (LV), Bronka (RUS), Euroports Finland (FIN), GCT Gävle (S), KCT Kleipeda (LT), MCT (E), PLP (RUS) and Västhämn (S).

The net preference flows Φ enable distinguishing two groups of terminals in each of the rankings: dominant (positive Φ values) and dominated (negative Φ values). In 2019, considering all three rankings, the group of dominant terminals includes always five of them: Bronka (RUS), DCT Gdańsk (PL), FCT (RUS), GCT Gdynia (PL), PLP (RUS). The group of dominated terminals includes always seven of them: BCT Riga (LV), Euroports Finland (FIN), GCT Gävle (S), KCT Kleipeda (LT), Kleipedos Smelte (LT), MCT (E) and Västhamnen (S).

Table 7.

Final rankings of maritime container terminals' competitiveness in the BSR (2022)

| Terminal | Saaty's scale weights | | Entropy weights | | Corrected weights | |
|-------------------------|-----------------------|---------|-----------------|---------|-------------------|---------|
| | No. | Φ | No. | Φ | No. | Φ |
| APMT Aarhus (DK) | 4 | 0.2086 | 9 | -0.0695 | 7 | 0.0894 |
| APMT Gothenburg (S) | 2 | 0.2711 | 7 | -0.0073 | 5 | 0.1414 |
| BCT Riga (LV) | 14 | -0.3715 | 15 | -0.2800 | 15 | -0.3723 |
| BCT Gdynia (PL) | 12 | -0.1485 | 3 | 0.1863 | 10 | -0.0185 |
| DCT Gdańsk (PL) | 3 | 0.2650 | 1 | 0.5544 | 2 | 0.2880 |
| Euroports Finland (FIN) | 13 | -0.2806 | 12 | -0.1316 | 12 | -0.1903 |
| GCT Gävle (S) | 15 | -0.3730 | 14 | -0.2743 | 14 | -0.3598 |
| GCT Gdynia (PL) | 5 | 0.1738 | 2 | 0.2059 | 3 | 0.1718 |
| HPS Stockholm (S) | 10 | -0.1327 | 13 | -0.1828 | 13 | -0.2316 |
| KCT Klaipeda (LT) | 11 | -0.1484 | 6 | 0.0097 | 11 | -0.0753 |
| Klaipedos Smelte (LT) | 8 | 0.0273 | 4 | 0.1705 | 4 | 0.1527 |
| Mussalo CT (FIN) | 7 | 0.0875 | 11 | -0.1014 | 8 | -0.0068 |
| MCT (E) | 6 | 0.1112 | 8 | -0.0149 | 6 | 0.1285 |
| Västhamnen (S) | 9 | -0.0017 | 10 | -0.0787 | 9 | -0.0080 |
| Vuosaari (FIN) | 1 | 0.3120 | 5 | 0.0135 | 1 | 0.2908 |

Source: own study.

In 2022, we omitted all Russian terminals and included one newly opened Swedish terminal, HPS Stockholm. The obtained results show the strengthening of the high positions in the rankings of the Polish terminal DCT Gdańsk (positions 3, 1 and 2) and the Finnish Vuosaari (positions 1, 5 and 1). The second Polish terminal, GCT Gdynia (positions 5, 2 and 3) joined the top-rated terminals. Like in 2019, three terminals: BCT Riga (LV), Euroports Finland (FIN), GCT Gävle (S) and additionally the Swedish HPS Stockholm took the lowest positions in this ranking (between 12 and 15).

As for the stability of positions in individual rankings in 2022, BCT Riga (LV), DCT Gdańsk (PL), Euroports Finland (FIN), GCT Gävle (S), MCT (E), and Västhamnen (S) occupied relatively similar places in rankings, irrespective of the sets of evaluating criteria weights. For 2022, two Polish terminals, DCT Gdańsk and GCT Gdynia, as well as the Lithuanian Kleipedos Smelte and the Finnish Vuosaari are the dominant ones. Five terminals: BCT Riga (LV), Euroports Finland (FIN), GCT Gävle (S), HPS Stockholm (S), and Västhamnen (S) belong to the dominated group.

Due to the different sets of terminals analyzed in 2019 and 2022, it is difficult to clearly compare specific positions in the rankings obtained by individual terminals. However, based on the analysis of the sign of the net preference flows Φ , we may indicate terminals that were

dominant or dominated both in 2019 and 2022. Two Polish terminals, DCT Gdańsk and GCT Gdynia, should be mentioned in this regard as these are the only terminals in all six rankings for which the net preference flows were positive. On the other hand, four terminals: BCT Riga (LV), Euroports Finland (FIN), GCT Gävle (S) and Västhamnen (S) have always been dominated (in all six rankings the net preference flow was negative).

5. Discussion

This study presents a multicriteria analysis of the competitiveness of maritime container terminals in the BSR. To this end, 18 major container terminals in 2019 and 15 in 2022 were analyzed after the prior exclusion of four Russian terminals and the inclusion of one Swedish terminal in 2022. The multicriteria analyses were carried out based on the PROMETHEE II method using a set of seven criteria considered to be the most important and relating to the technical infra- and superstructure. Since multicriteria methods show significant sensitivity to the values of weights assigned to individual criteria, three rankings were built for each year based on subjective and objectified weights (resulting from the collected input data).

Even though the obtained rankings used different sets of weights and thus show some differences, it was possible to identify groups of similarly rated terminals. The obtained results show that two Polish maritime container terminals can be assessed as the most competitive both in 2019 and 2022. These are DCT Gdańsk and GCT Gdynia. The high competitiveness of these terminals is visible in all rankings, regardless of the weights' values. In addition, after excluding Russian terminals from the analyses, terminals whose competitiveness seems to be greater compared to others are: Lithuanian Kleipėdos Smeltė and Finnish Vuosaari. On the other hand, regardless of the changes in terminals' set and values of the weights, the lowest positions in the rankings were maintained both in 2019 and 2022 by two Swedish ports: GCT Gävle and Västhamnen, one Finnish (Euroports Finland) and one Latvian (BCT Riga).

The results of our study allow us to draw some general conclusions as regards the competitiveness of maritime container terminals in the BSR before and after covid-19 pandemic and Russo-Ukrainian war. First, after the Russian invasion on Ukraine in February 2022 and sanctions imposed afterwards on Russia, there were significant drops in TEU handled in Russian Baltic container ports. In consequence, Russian terminals in the BSR have lost their highly competitive position and we may have recently observed higher turnover of containerized cargo in Polish, Finnish and Baltic states' seaports (Global Ports Investments PLC, 2023). Our results confirm this as generally Polish, Finnish, and Baltic states' terminals improved their positions in our multicriteria rankings for 2022. At the same time, according to our findings, the terminals in Gdańsk, Gdynia, and Klaipėda are most competitive in the BSR in 2022. As our criteria sets comprise infra-, superstructural as well as service factors, it may

suggest that these terminals invest more than their competitors in their port site infrastructure and company's reputation. Indeed, in Table 3 we may notice that DCT Gdańsk, GCT Gdynia, KCT Klaipeda and Klaipedos Smelte terminals improved at least one of their criteria in 2022 compared to 2019.

As in general huge investments are made when the terminal's TEU turnover increases, this prompted us to compare whether terminals in question intercepted part of the container traffic from sanctioned Russian ports. Latest results show, however, that in 2022 the Port of Gdańsk handled 2.2% TEU less than in 2021 while the Port of Gdynia handled 7.3% less y/y. Both in the BCT and in the GCT a decrease in container turnover was noticeable. These decreases were caused by changes related to handling transshipments from/to Russia, which accounted for a significant part of the ports' handling. Yet, there were huge increases in the container turnover in both ports in 2021, and last year's decreases still bring the number of TEU handled there at the higher level than before the covid-19 pandemic and the Russo-Ukrainian war. On the other hand, impressive growth was recorded by the Port of Klaipeda (+57% y/y). This is the result of the introduction of new container routes in 2022, including the MSC connection connecting Klaipeda, Gdynia, and Gothenburg with New York. Thus, it is of no surprise that the growth in container handling was also noticed in the Port of Gothenburg (+6.9% y/y). In 2022 container throughput in the Port of Riga also increased (+10.8% y/y), while the biggest container terminal operating in the port, the BCT Riga, reached a record result of 326,000 TEU. Finally, moderate growth in the number of TEUs handled was also noticed in the ports of HaminaKotka, Aarhus, Helsinki, and Rauma (+6.0%, +5.7%, +5.4%, +1.0% y/y, respectively) (Ziajka, Rozmarynowska-Mrozek, 2023).

6. Conclusion

This broader perspective allows us to draw more conclusions as regards this study. First, considering seven criteria chosen for our research, the biggest competitive potential in the BSR have such maritime container terminals as DCT Gdańsk, GCT Gdynia, Klaipedos Smelte and Vuosaari. Second, the maritime container traffic on the Baltic Sea is of regional character. It means that there is a high level of competitiveness between seaports in the BSR. Thus, high positions in our multicriteria rankings of the abovementioned terminals should be a warning signal for other maritime terminals located in their vicinity, especially for BCT Gdynia, KCT Klaipeda and Mussalo CT in HaminaKotka. Finally, our results suggest that the terminal geographical location and the geopolitical situation in the BSR are of uttermost importance regardless of infra- and superstructural investments and/or hinterland connections with other modes of transport. Thus, our findings should be of interest to terminal operators and managers planning their strategy for next years, especially if they want to maintain their competitive advantage in the region after the lifting of sanctions imposed on Russian ports.

Like any study, this study has some limitations. The first and the most important one is about the data availability which influenced the choice of criteria used in the study. As it is usually difficult or impossible to obtain operational and/or financial data for all analyzed terminals, we had to exclude some criteria suitable for this research. Then, because of the website data sources used in the study, there may be some errors and discrepancies which could affect the accuracy of our calculations. Finally, the subjectivity involved in the selection of chosen criteria and some of their weights could also lead to different competitiveness assessment results of maritime container terminals in the BSR. Yet, these limitations constitute the research opportunities for the future as, for example, inclusion of other criteria sets could lead to interesting conclusions concerning the problem in question.

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SERVICE SABOTAGE: AN EXAMINATION OF SELECTED ANTECEDENT AND OUTCOME VARIABLES IN HIGH-CONTACT ORGANIZATIONS

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Purpose: The purpose of the paper is to explore selected antecedent and outcome variables of employee dysfunctional behavior directed at customers in a high-contact service environment. The linkages among customer mistreatment, service sabotage, and competitive performance of an employing organization were examined.

Design/methodology/approach: A quantitative approach was adopted, based on a self-administered online survey. Data were collected from 144 food service employees in Poland. Hierarchical multiple regression analyses were performed to test the proposed research model.

Findings: The results demonstrate that both work-related and person-related mistreatment by customers contribute to service sabotage. Service sabotage in turn leads to deterioration of competitive performance of a food service establishment.

Research limitations/implications: The study adopted a cross-sectional design, which makes the direction of causality open to debate. Also, the data collection was based on the non-random sampling technique and the sample size was relatively small, which limits generalization of the findings beyond the specific context of this research.

Practical implications: From a managerial perspective, the confirmed relationships stress the importance of preventive measures to be taken to reduce the adverse effects of dysfunctional customer behavior on employee behavior and competitive performance of an employing organization.

Originality/value: The present research furthers the understandings of antecedents of service sabotage and its effects on service organization's performance.

Keywords: service sabotage, customer mistreatment, competitive performance, high-contact service organization.

Category of the paper: research paper.

1. Introduction

High-contact service organizations rely extensively on human resources to create customer-oriented culture and achieve competitive advantage in the marketplace. This is why service employee attitudes and behaviors, especially those pertaining to employee-customer relations, have attracted considerable research interest. It is generally acknowledged that the dyadic exchange between parties involved in a service encounter is at the core of the success or failure of the service delivery, as customers' evaluations of the service experience are affected by perceptions of the quality of interpersonal interactions (Groth, Grandey, 2012). Empirical research in various service settings provides convincing evidence that the course of employee-customer exchange exerts effect on crucial service outcomes, such as customer satisfaction, customer perceived value, and customer loyalty. Such links have been reported in studies carried out, *inter alia*, in hospitality (Uslu, Caber, 2022), recreation (Eskiler, Safak, 2022), retail trade (Hwang, Lee, Kim, 2021), ridesharing (Boninsegni, Furrer, Mattila, 2021), and beauty treatment (Delcourt et al., 2013).

The widespread recognition of the essential role of service interactions in achieving service organization's success has led to the increased attention being paid to employee behavior that deviates from organizational rules by sabotaging service delivery. Although a growing number of research projects have explored workplace sabotage targeted at customers in high-contact service contexts (e.g. Harris, Ogbonna, 2012; Skarlicki et al., 2016; Tan et al., 2020) scholarly efforts to understand the nature of the phenomenon and its correlates have been somewhat scant. Furthermore, studies on customer-directed workplace deviance mostly seek to advance knowledge about its determining factors, while its effects, at the organizational level in particular, remain relatively under-researched (Bednarska, Łuka, 2022; Liu et al., 2022). The present study's purpose, therefore, is to investigate selected antecedent and outcome variables of employee deviant behavior directed at customers in high-contact service settings. More specifically, it examines the linkages among customer mistreatment, service sabotage, and competitive performance of an employing organization.

To reach the purpose proposed, the remainder of the paper is organized as follows. First, the literature on service sabotage is reviewed and the research model, which is developed based on this review, is presented. In subsequent sections research method is described and the results of the study are reported. Finally, the main findings are discussed, limitations of the study are provided and avenues for future research are suggested.

2. Literature review

Employee sabotage, like other forms of counterproductive work behavior, has the potential to exert deleterious effects on organization's ability to achieve its strategic goals. Due to its pervasiveness in workplaces and adverse outcomes, it has aroused a growing interest among scholars. While early studies aimed at developing understanding of sabotage actions focused on manufacturing context, Harris and Ogbonna (2002) explicitly concentrated on the phenomenon in a service environment. As advocated by the authors, service sabotage has unique characteristics (compared to manufacturing sabotage) that warrant research attention. In service settings, sabotage is commonly public, the effects of sabotage are usually immediate, and the targets of sabotage are largely customers. Accordingly, sabotage behavior disrupts service encounters and negatively affects employee-customer dynamics (Harris, Ogbonna, 2006).

Service sabotage refers to any deliberate behavior by organizational member that is designed to affect negatively customer service (Harris, Ogbonna, 2002). Examples of service sabotage include providing customers with incomplete or false information, altering the speed of service to match personal needs, showing frustration or hostility to customers or blatantly ignoring customers. Reasons why service employees consciously choose to engage in antiservice behavior (and, as a consequence, harm service organization's interests) can be grouped into two broad categories: dispositional and situational (Harris, Ogbonna, 2012). The former relates to employees' individual dispositions (i.e. personality traits), while the latter includes intra- and extraorganizational factors. Previous research has demonstrated that there are meaningful linkages between customer-directed deviant work behavior and trait anger (Hunter, Penney, 2014), risk-taking proclivity (Harris, Ogbonna, 2006), core self-evaluations (Dai et al., 2019), abusive supervision (Ma, Zhou, Mu, 2021), co-worker undermining (Hongbo, Waqas, Tariq, 2019), customer negative events (Chi, Tsai, Tseng, 2013), labor market fluidity (Harris, Ogbonna, 2006).

Amongst multiple antecedents of service employees' dysfunctional behavior targeted at customers, customer-driven motives are major predictors of service sabotage (Harris, Ogbonna, 2012; Liu et al., 2022), which is in line with the social exchange-based target similarity model (Lavelle, Rupp, Brockner, 2007). It argues that employees who are mistreated are likely to direct their attitudinal and behavioral responses towards the party held accountable for mistreatment. Customer mistreatment, defined as low-quality interpersonal treatment received by employees from customers during their work-related interactions (Wang et al., 2011), refers to situations where customers act towards employees in an unreasonable, disrespectful, demeaning or hostile manner. Alike other negative acts in the workplace, customer mistreatment can take two main forms: work-related and person-related (Einarsen, Raknes, 1997). The former includes behaviors directed at tasks performed by employees in their

job positions (e.g. questioning employees' professional expertise or complaining without reason); the latter involves behaviors affecting directly employees' psychological or physical well-being (e.g. talking down to employees or acting rudely towards them).

Service employees' negative reactions towards misbehaving customers can be explained by an organizational justice framework. Since workplace encounters involving customers and employees are interactive in nature, interactional justice (Bies, Moag, 1986) has been considered most relevant to this kind of exchange (Rupp et al., 2008). Customer mistreatment has been conceptualized as a specific form of interactional injustice, as it violates norms of mutual respect during employee-customer social interaction (Koopmann et al., 2015). When employees are confronted with misbehaving customers, they judge whether their fundamental right to be treated fairly has been violated and are likely to show a desire to retaliate against wrongdoers to punish them for their transgressions (Skarlicki, van Jaarsveld, Walker, 2008). Customer-directed revenge-motivated behavioral reactions may take the form of service sabotage.

In high-contact service settings, Yeh (2015), based on a sample of Taiwanese flight attendants, reported that perceptions of customer verbal aggression predicted revenge motive, which resulted in service sabotage behavior to restore a sense of justice. Sommovigo et al. (2020), in their study among Italian retail and restaurant employees, showed that in response to a customer-initiated unjust event individuals experienced negative emotions, which exerted a significant influence on generalized customer-directed incivility intentions. Lavelle et al. (2021), who surveyed American employees in various service roles involving face-to-face customer interactions, found support for the linkage between perceptions of customer interpersonal injustice and customer-oriented counterproductive work behavior through emotional exhaustion and surface acting.

The service management and marketing literature suggests that the intangible nature of service encounters makes employee-customer interface particularly salient in customers' evaluations of the service quality as treatment by employees often is the performance of the service in the mind of customers (Cook et al., 2002). Quality, as posited by Porter's (1980) model of generic competitive strategies, serves as a driver of the market offering differentiation. Measures taken to assure quality enable an organization to distinguish itself from competitors and make its products perceived as unique. Therefore, quality, as a differentiating attribute that is valued by customers, lies at the heart of the organization's strategy to gain competitive advantage and enhance performance. Following this line of reasoning, it is plausible to assume that a negative employee-customer interaction, which is perceived as a service failure, can have serious consequences not just for that relationship but also for the organization as a whole (Groth, Grandey, 2012). When faced with service failures, customers may choose to avoid potentially dissatisfying experiences in the future by switching service providers or voice their concerns by complaining and spreading negative word-of-mouth (Singh, 1990), which indisputably impairs organization's performance.

In high-contact service contexts, Bonifield and Cole (2007), in their study on emotional and behavioral post-failure responses in restaurants in the US, found that consumers who blamed the service provider for a service failure experienced anger and reported a high likelihood of engaging in retaliatory actions against the organization. Su and Teng (2018), using a content analysis of negative reviews of museums worldwide posted on TripAdvisor, observed that service failures related to staff were among the top three reasons for voicing complaints. Köcher and Paluch (2019), who examined experiences of railway passengers in Germany, concluded that exposure to a service failure resulted in lower service satisfaction and service reusage intentions and that the negative link between a service failure and its effects was stronger for full-service (compared to self-service) delivery mode.

The aforementioned theoretical and empirical evidence leads to the following hypotheses (which are illustrated in Figure 1):

H1: Work-related customer mistreatment (H1a) and person-related customer mistreatment (H1b) are positively related to service sabotage.

H2: Service sabotage is negatively related to competitive performance.

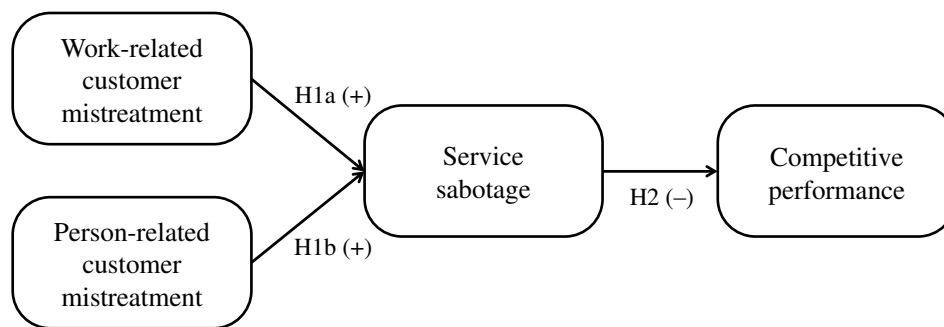


Figure 1. Proposed research model.

3. Methods

The data used to test the proposed research model were collected from employees in the food service industry in Poland. The chosen sector was deemed appropriate for exploring high-contact environment since it is a labor-intensive industry requiring regular and direct contact with customers. We recruited respondents using a non-probability sampling technique, namely voluntary response sampling. We posted invitations on social networking sites to take part in our survey and asked potential informants who had professional experience in the food service industry to follow a link to an online questionnaire. In total, 167 employees participated in the study. Among the returned questionnaires, 23 were identified as containing incomplete information or showing implausible response pattern and these were excluded from the analysis, leaving 144 responses in the final sample. As presented in Table 1, the majority of respondents were females (78%), aged between 21 and 25 years (70%). Most of the participants

held frontline positions (89%), worked in full-service restaurants (74%), and had between 3 and 12 months of experience in the food service industry (35%).

Table 1.
Respondent profile

| Variables | Category | N | % |
|-----------------------|--------------------------------|-----|------|
| Gender | Female | 112 | 77.8 |
| | Male | 32 | 22.2 |
| Age | 20 years old or less | 22 | 15.3 |
| | 21-25 years old | 101 | 70.1 |
| | 26-30 years old | 10 | 6.9 |
| | 31-35 years old | 5 | 3.5 |
| | 36 years old or more | 6 | 4.2 |
| Position | Frontline | 127 | 88.8 |
| | Non-frontline | 16 | 11.2 |
| Industrial tenure | 3 months or less | 30 | 20.8 |
| | More than 3 months to 1 year | 50 | 34.7 |
| | More than 1 year to 3 years | 33 | 22.9 |
| | More than 3 years to 5 years | 20 | 13.9 |
| | More than 5 years | 11 | 7.6 |
| Type of establishment | Full-service establishment | 107 | 74.3 |
| | Non-full-service establishment | 37 | 25.7 |

Due to missing data, the number of observations varies for analyzed variables.

We adopted a self-administered online survey in order to avoid interviewer bias. The questionnaire was developed for the purpose of this study and it was comprised of three sections. The first one dealt with dysfunctional behaviors of customers and employees and these were measured with items derived from previous investigations on deviant activities of parties involved in service interactions (Dormann, Zapf, 2004; Harris, Ogbonna, 2006; Shao, Skarlicki, 2014; Szczygieł, Bazińska, 2013). Following Walker, van Jaarsveld and Skarlicki (2014), we conceptualized deviant behaviors as entity-level constructs and asked informants about their generalized perceptions of negative exchanges between customers and employees in their workplace. They reported how often they witnessed or were involved (as targets or instigators) in 6 manifestations of work-related customer mistreatment (Cronbach's $\alpha = 0.909$), 6 manifestations of person-related customer mistreatment (Cronbach's $\alpha = 0.855$) and 12 manifestations of employee service sabotage (Cronbach's $\alpha = 0.821$). All items were measured on a seven-point Likert-type scale ranging from 1 – never to 7 – on a daily basis. Section two was devoted to organizational performance. Using Likert-type items, we sought information about employees' opinions on the establishment's overall performance compared to major competitors in the market. Response options ranged from 1 – much worse to 7 – much better. In the final section, socio-demographic and job-related data were collected.

To analyze the data from the questionnaire, we employed descriptive statistics and correlations to summarize the basic features of variables under study and associations between them. To examine the relationships between service sabotage and its hypothesized antecedent and outcome variables, we performed hierarchical multiple regression analyses. The data were processed utilizing the SPSS software.

4. Results

Means, standard deviations, and correlations between the variables under study are presented in Table 2. On the whole, it shows that in the food service establishments, work-related customer mistreatment was more common than person-related one and behaviors targeted at employees were reported with higher frequency compared to those targeted at customers. It should be noted, however, that the proposed model was tested with data obtained from employees. In self-reports, organizational behavior measures are prone to a social desirability bias, which is caused by the tendency on the part of individuals to present themselves in a favorable light due to the need for social approval (Podsakoff et al., 2003). Moreover, as expected, service sabotage is significantly and positively associated both with work-related ($r = 0.390$, $p < 0.01$) and person-related customer mistreatment ($r = 0.386$, $p < 0.01$). Also, as assumed, service sabotage remains in a significant negative relationship with competitive performance of an employing organization ($r = -0.339$, $p < 0.01$). These results give preliminary evidence for our hypotheses.

Table 2.

Variable descriptive statistics and correlations

| Variables | Mean | Stand. dev. | Correlations | | | | | | | |
|---|------|-------------|--------------|---------|---------|--------|--------|---------|---------|----------|
| | | | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
| 1. Gender | 1.22 | 0.417 | | | | | | | | |
| 2. Age | 2.11 | 0.854 | 0.087 | | | | | | | |
| 3. Position | 1.11 | 0.316 | 0.190* | 0.276** | | | | | | |
| 4. Industrial tenure | 2.53 | 1.188 | 0.002 | 0.411** | 0.214* | | | | | |
| 5. Type of establishment | 1.26 | 0.438 | 0.030 | 0.241** | 0.246** | 0.073 | | | | |
| 6. Work-related customer mistreatment | 4.40 | 1.369 | -0.222** | -0.078 | -0.039 | 0.175* | 0.125 | | | |
| 7. Person-related customer mistreatment | 2.81 | 1.039 | -0.108 | 0.050 | 0.045 | 0.090 | 0.180* | 0.666** | | |
| 8. Service sabotage | 2.04 | 0.655 | -0.012 | 0.148 | -0.029 | 0.086 | 0.063 | 0.390** | 0.386** | |
| 9. Competitive performance | 4.58 | 1.549 | 0.069 | -0.197* | 0.055 | -0.073 | 0.045 | -0.167* | -0.166* | -0.339** |

Gender: 1 = female, 2 = male; age: 1 = 20 or less, 2 = 21-25, 3 = 26-30, 4 = 31-35, 5 = 35 or more; position: 1 = frontline, 2 = non-frontline; industrial tenure: 1 = 0.25 or less, 2 = 0.25-1, 3 = 1-3; 4 = 3-5; 5 = more than 5; type of establishment: 1 = full-service, 2 = non-full-service.

Significant at * $p < 0.05$; ** $p < 0.01$ (2-tailed).

The results of hypotheses testing are summarized in Tables 3 and 4. To test hypothesis 1, which predicted that both forms of customer mistreatment are positively related to service sabotage, we entered variables in two separate steps. In the first step, we included socio-economic variables to control potentially confounding effects of gender, age, position held, industrial tenure of respondents, and type of establishment; next, we added independent

variables. As shown in Model 2 of Table 3, both work-related customer mistreatment ($\beta = 0.288$, $p < 0.01$) and person-related customer mistreatment ($\beta = 0.206$, $p < 0.05$) significantly and positively contributed to service sabotage above and beyond the effects of socio-economic variables and type of establishment. Thus hypothesis 1 found support in the data.

Table 3.

Results of hierarchical regression analyses (service sabotage as the dependent variable)

| Variables | Model 1 | Model 2 |
|--------------------------------------|---------|----------|
| Step 1 – control variables | | |
| Gender | 0.009 | 0.089 |
| Age | 0.180 | 0.235* |
| Position | -0.092 | -0.081 |
| Industrial tenure | 0.013 | -0.073 |
| Type of establishment | 0.034 | -0.051 |
| Step 2 – independent variables | | |
| Work-related customer mistreatment | | 0.288** |
| Person-related customer mistreatment | | 0.206* |
| R ² | 0.036 | 0.223 |
| ΔR^2 | | 0.187*** |
| F | 1.036 | 5.540*** |

Reference categories: gender – female, position – frontline, type of establishment – full-service.

Standardized beta coefficients are provided.

Significant at * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

To test hypothesis 2, which predicted that service sabotage is negatively related to competitive performance, we followed analogous procedure. In the first step, we entered the aforementioned control variables; next we added an independent variable. As presented in Model 2 of Table 4, service sabotage significantly and negatively contributed to competitive performance ($\beta = -0.302$, $p < 0.001$) above and beyond the effects of socio-economic variables and type of establishment. Thus hypothesis 2 was supported.

Table 4.

Results of hierarchical regression analyses (competitive performance as the dependent variable)

| Variables | Model 1 | Model 2 |
|-------------------------------|----------|-----------|
| Step 1 – control variables | | |
| Gender | 0.053 | 0.055 |
| Age | -0.283** | -0.228* |
| Position | 0.093 | 0.065 |
| Industrial tenure | 0.032 | 0.036 |
| Type of establishment | 0.094 | 0.105 |
| Step 2 – independent variable | | |
| Service sabotage | | -0.302*** |
| R ² | 0.072 | 0.160 |
| ΔR^2 | | 0.088*** |
| F | 2.121 | 4.307*** |

Reference categories: gender – female, position – frontline, type of establishment – full-service.

Standardized beta coefficients are provided.

Significant at * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

To summarize, the study findings provide empirical validation for the proposed research model. Specifically, the results demonstrated that when employees experience or witness work-related or person-related mistreatment from customers, they are more likely to engage in generalized customer-directed service sabotage. Furthermore, service sabotage affects negatively competitive performance of a service organization.

5. Discussion

Our research contributes to the existing body of knowledge and furthers the understanding of service sabotage and its correlates in several ways. First, unlike the majority of the prior empirical work that deals primarily with factors contributing to antiservice employee behavior, this study's purpose is to explore both antecedent and outcome variables of service sabotage. In this way, we address the call by Liu et al. (2022) for empirical studies enriching the service sabotage model and take a step toward a more holistic view of the phenomenon of interest by placing it within a broader framework.

Second, the results regarding the relationship between customers' and employees' dysfunctional behaviors further confirm the role of perceived organizational injustice in fuelling acts of service sabotage and the presence of target similarity effect in a high-contact service context. Specifically, we demonstrated that interactional injustice, manifested in employee-directed customer mistreatment, prompts customer-directed reciprocal reaction in the form of service sabotage. Our findings are in accord with those obtained in other service organizations and regions. For instance, Skarlicki et al. (2016), based on data gathered from call center employees in the US and South Korea, reported that low customer justice was associated with high levels of customer-directed sabotage and this negative association was exacerbated by low supervisor justice. Similarly, Tan et al. (2020), in their study among retail employees in Hong Kong, found that jaycustomer behavior, as a form of perceived injustice, triggered anger and led subsequently to the development of sabotage towards customers.

Third, our investigation provides further support for the utility of the generic competitive strategies model (Porter, 1980) for examining consequences of service sabotage in high-contact service organizations. We showed that antiservice behavior exhibited by employees leads to deterioration of competitive performance of a food service establishment. This finding corresponds to the one provided by Harris and Ogbonna (2006), who revealed, using data from customer-contact employees within restaurant sector in the UK, that service sabotage behavior negatively affected company performance both directly and indirectly through functional quality. Our result is also in line with Grisseemann, Plank and Brunner-Sperdin's (2013) study, which showed, based on data from hotel managers in the Alpine regions of five countries, that a decrease in customer orientation was associated with a decrease in both financial and non-financial business performance.

Fourth, when investigating customer and employee deviance, we adopted the entity perspective and took into consideration the social context in which negative encounters take place. Due to the public nature of service interactions, negative exchanges have high potential to spill over to third parties (Groth, Grandey, 2012) and affect the organization's social landscape. Service sabotage, therefore, can be brought about by employees' overall perceptions of customer misbehavior regardless of whether they were directly affected by the mistreatment or not; accordingly, it can become a type of generalized reaction towards customers as a social entity (Sommovigo et al., 2020).

The findings of this study raise a number of implications for business practice. Unlike the behavior of customers, which is outside an organization's direct control, the behavior of employees may be shaped by managers with the goal of reducing the deleterious effects of customer deviance on job performance and, by extension, on organizational performance. A strongly recommended initiative organizations could consider is equipping employees – through the provision of training – with knowledge and skills on how to avoid or resolve conflicts, manage stress, regulate emotions during interactions (Sommovigo et al., 2020). Such programs enhance employees' personal resources that can be used to counter the demands imposed by challenging work events (Hu et al., 2018) and help resist the inclination to address experienced mistreatment with revenge-motivated service sabotage.

Managers may also adopt empowerment as an organizational practice. Empowering leadership style provides greater decision-making autonomy and expresses confidence in subordinates' capabilities. When led by empowering supervisors, subordinates are more likely to invest extra effort in their work and are more committed to their teams and organizations (Zhou, Ma, Dong, 2018). Empowerment may also be a signal of an organization's trust in and respect for its employees, which enhances their evaluation of the ability to cope with threats (Ben-Zur, Yagil, 2005) and elicits reactions to customer mistreatment that move beyond an eye-for-an-eye retributive response.

Organizations should not understate the role of social support from their members. Social resources are believed to mitigate the detrimental effects of stressful interpersonal relations on employee well-being and task performance. Hence, managers should ensure that employees have access to social support from supervisors and co-workers, can share their encounters with misbehaving customers and their experiences in coping effectively with these negative events (Wang, Wang, 2017). Such practices have been shown to present service provider with opportunities for recovery from demanding interactions with customers. Accordingly, they decrease the likelihood of engaging in acts of retaliations and degrading service quality (Groth, Grandey, 2012), as they make incidents of customer mistreatment a weaker catalyst for antiservice behavior.

Finally, employers should seek to build a safe and respectful environment for their employees. Managers are therefore recommended to develop formal policies or guidelines to establish standards for dealing with dysfunctional behavior exhibited by customers.

Such procedures could allow employees become more aware of violations of social interaction norms and strengthen their confidence in handling customer-related social stressors (Kim et al., 2014). Also, employees who operate in a psychologically safe environment may be more likely to engage in constructive resistance, which helps prevent negative behaviors from spiraling out of control (Greenbaum et al., 2013).

The findings of this study should be considered in light of its limitations. First, the investigation adopted a cross-sectional design, making conclusive causal inferences between the constructs impossible. Future research should be encouraged to use a longitudinal design to examine the relationship dynamics by addressing the temporal precedence of variables. Second, since the study relied on data from a single source and the key variable was based on self-reported measures, we cannot rule out the presence of common method bias resulting from social desirability effect and consistency motif. Further studies that can expand data collection to avoid single-source bias would shed more light on the relationships of interest. It would be certainly worthwhile to include customers' and managers' perceptions of employee-customer interactions and organizational outcomes, respectively. Third, as much of the variance in the outcome variables was left unexplained, we recommend incorporating other factors into the research model. In particular, it would be of value to explore the role of mediators and moderators, which could advance the understanding of the mechanism through which customer mistreatment translates into service sabotage and service sabotage into competitive performance as well as the boundary conditions under which the effects of interest are stronger or weaker. Fourth, to test the proposed hypotheses, we employed individual-level perceptions of entity-level constructs. Thus, future studies that pursue multi-level approach should be advised to account for data hierarchies. Finally, we employed a non-probability sampling technique and an online survey to collect data, which may have led to a biased sample. Moreover, the questionnaire was distributed among food service employees in Poland and the sample size was relatively small. Therefore, replication studies are required to examine the degree to which the results of the present investigation are industry- and country-specific or universally observed in high-contact organizations.

6. Summary

Customer and employee deviance and its implications for organization's success have captured relatively scant attention in the academic literature (Bednarska, Łuka, 2022). This is a serious omission considering that service interactions play a pivotal role in creating service experiences and sustaining competitiveness in the market. The present investigation addresses this dearth in research by offering insights into the relationships among customer mistreatment, service sabotage, and competitive performance in high-contact service settings.

The main contribution of our study is to provide empirical validation for the research model, based on the combined rationales of an interactional justice framework (Bies, Moag, 1986), the target similarity model (Lavelle, Rupp, Brockner, 2007) and the generic competitive strategies model (Porter, 1980), which predicted that exposure to work-related or person-related customer mistreatment triggers service sabotage, which in turn affects negatively competitive performance of an employing organization.

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ATTITUDES OF VISITORS TOWARDS CHRISTMAS LIGHTING AT THE CHRISTMAS MARKET IN THE FACE OF THE ENERGY AND CLIMATE CRISIS

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Purpose: The main objective of the study conducted was to determine the attitude towards Christmas lighting in the context of an energy crisis.

Design/methodology/approach: A regression model developed during the research illustrates the factors that shape the respondents' attitudes towards holiday illuminations. The study utilized theories such as Ajzen's Theory of Planned Behavior and the Technology Acceptance Model by Davis.

Findings: It was found that the respondents have a positive attitude towards the analysed illuminations, which is strongly influenced by their perceived usefulness, including the opportunity to take interesting photos, as well as awareness of the energy-saving solutions used.

Research limitations/implications: The study can serve as a starting point for decision-makers on behalf of local governments in researching the attitudes of visitors to local events. However, the possibility of prediction is limited due to the sample selection used.

Practical implications: The current energy crisis, climate change, and other factors are prompting people to save energy. However, will rational arguments about the need to reduce energy consumption change the priorities of residents and local community leaders and convince them to give up their traditions and holiday attractions? The energy crisis triggered by Russia's invasion of Ukraine has led many local governments in Poland to forgo traditional city decorations with holiday lights or to cancel Christmas markets. However, some cities, such as Gdańsk, have preserved the holiday traditions while promoting energy-efficient solutions. This created an opportunity to study the attitudes and opinions of visitors to the Gdańsk Christmas Market during a period of wide-ranging debate on the need for energy conservation by local governments.

Originality/value: Studying the specific attitudes of event participants, especially in the context of Christmas markets, is a rarely addressed issue. Thanks to the analyses conducted, the significance of factors influencing the investigated attitudes has been presented.

Keywords: Event Marketing, Sustainable energy development, Christmas market, Theory of Planned Behavior.

Category of the paper: Research paper.

1. Introduction

Christmas markets are a commercial and cultural event which many cities around the world have been involved in organizing since the Middle Ages. Their tradition can be traced back to Roman culture (Brida et al., 2012; Szymanderska, 2005), but, due to their flexibility, the tradition of Christmas markets has also been adopted in other cultural circles, including the American (Chacko, Schaffer, 1993), Anglo-Saxon (Halpenny et al., 2021), Romance (Casteran, Roederer, 2013), Germanic (Broeckerhoff, Galalae, 2022; Spennemann, Parker, 2021), and Slavic (Kantor, 2017) cultures. According to Spennemann and Parker, Christmas markets provide visitors with a multisensory experience that constitutes a complex form of intangible heritage (Spennemann, Parker, 2021).

In this article, the authors decided to focus on the visual aspect of Christmas markets, which is created by various holiday decorations, including illuminations. The study described in the paper examines the attitudes of Christmas market participants towards such holiday illuminations, which are an important part of the decorations in the area where the markets take place. However, Christmas lighting is energy-intensive and costly, which, given the energy and climate crisis, may be perceived by some as unnecessary. Therefore, the authors believe that understanding the attitudes of participants at the Gdańsk Christmas Market towards holiday lighting can contribute to reassessing or confirming the validity of similar organizers' actions regarding illuminations and serve as a voice in the discussion about the justification of costs incurred by local governments or entities responsible for adorning the city during the holiday season. It is important to note that such attractions are part of the cultural heritage and can impact the attractiveness of urban spaces for both tourists and residents, while stimulating socio-economic development.

During the pre-Christmas period, Christmas markets occupy an important part of the urban public space, where various stalls and decorations are installed. They are often located near major tourist routes, significant in the commercial, historical, or cultural context of the city, thus influencing the experiences of tourists and residents who visit their area. These events often attract thousands of visitors, making their economic, environmental, and social impact on the surrounding environment significant.

The year 2022 was a period of struggle worldwide with the consequences of the war in Ukraine (Mnif et al., 2022; Mroua, Bouattour, 2023). One of the most significant consequences of this conflict was an energy crisis associated with structural changes in fossil fuel supply and inadequate access to renewable energy sources (Thorp, 2022). As a response, many countries, especially in Europe, called on communities to save energy (Parag et al., 2023). Poland is one of the countries where a relatively small percentage of energy comes from renewable sources, and at the end of 2022, local governments faced a sharp increase in energy prices. As a solution, many local authorities chose to reduce the city's lighting, including a decrease in the number of

Christmas illuminations. This decision also resonated with one of the demands of the European movement for mitigating the effects of climate change. German environmentalists proposed that not only cities but also owners of private homes and apartments should give up Christmas illuminations in the name of combating the consequences of the energy and climate crisis (Mendgen, 2022).

However, for many people, the Christmas season is a time when savings are not a priority. The desire for magical and sparkling holidays often triumphs over reason and costs (Freeman, Bell, 2013). In the context of Christmas markets, decorations, especially Christmas illuminations, are an important aspect and, according to Prideaux and Glover (2015), they constitute one of the most significant Christmas symbols. The market space, including the illuminations, is designed to create places of interaction between event attendees and the local architecture, aligning with contemporary trends in the arrangement of city areas where such events take place (Smith et al., 2020).

Furthermore, as indicated by Werner, Peterson-Lewis, and Brown (1989), pre-Christmas decorating not only has an aesthetic and traditional dimension but can also influence the perception of individuals who embrace this tradition. They are perceived by others as more friendly, sociable, open, and oriented towards integration and socialization compared to individuals who do not decorate their surroundings. According to the findings of this study, Christmas decorations contribute to social evaluations and impressions. Additionally, creating a cohesive Christmas atmosphere through scents, music, and decorations leads to consumers having a more favourable evaluation of the selling environment, its surroundings, and the offered products. Moreover, as demonstrated by an experimental study conducted by Spangenberg, Grohmann, and Sprott (2005) during the Christmas season in a retail store, inconsistency in aspects such as the use of non-seasonal music and Christmas scents leads to lower consumer ratings.

The significance of the 'Christmas ambiance' created through street and store decorations, such as Christmas lighting, trees, and the availability of special Christmas-related food products, has been highlighted in the context of the development of tourist destinations by Prideaux and Glover (2015). Therefore, the issue of the attitudes held by residents and tourists towards Christmas illuminations during Christmas markets is particularly important, especially from the perspective of marketing (Li et al., 2016) and the energy policies of cities.

The aim of this study is to present the research findings on the attitudes of visitors to the Christmas Market in Gdańsk in 2022 towards Christmas illuminations. Gdańsk was chosen as the study location because it is a city with a long tradition of Christmas markets and is one of the largest events of its kind in Europe. Additionally, the location of the market in the historic part of the city allows for the creation of spectacular decorations and Christmas illuminations in a historical atmosphere, imposing restrictions on the organizers due to the cultural and historical character of the area. Such a location of the market in a specific urban space provides

the opportunity to create and disseminate spectacular media images (Smith, McGillivray, 2020) in a Christmas context that includes illuminations.

Another factor determining the choice of Gdańsk is the adoption of the ‘Gdańsk 2030 Plus’ development strategy by the city authorities in September 2022, which includes four strategic goals: a green, inclusive, accessible, and innovative city (Gdańsk 2030 Plus, 2022). The concept of sustainable development serves as a cohesive element in the actions aimed at achieving these goals.

The conducted study fills a research gap in analysing the needs and attitudes of urban residents towards Christmas illuminations in the context of discussions on energy savings in the face of an energy crisis. Furthermore, understanding the behaviours and attitudes of the local community towards limiting Christmas lighting can help shape better urban policies and help cope with the economic, social, and environmental implications of the energy crisis (Parag et al., 2023).

In the first part of the paper, the authors present a literature review on studying participants' attitudes towards various aspects related to event organization. They also discuss reactions to the energy crisis observed in Europe in 2022, placing it in the context of municipal government policies. In the later part of the article, the authors analyse the results of a study conducted in November and December 2022 on attitudes towards Christmas illuminations among participants of the Christmas Market in Gdańsk. The authors developed a regression model that considers the influence of the perceived utility of illuminations, including factors such as the ability to take more interesting photos, the impact of perceived emotions associated with illuminations, the influence of others' opinions (social influence), and awareness of energy-saving illuminations on participants' attitudes towards illuminations. The analyses were conducted using the IBM SPSS package, based on data provided by the Professor Brunon Synak Pomeranian Research Institute and information provided by the International Gdańsk Trade Fairs – the event organizer.

2. Theory

2.1. Study of Participants' Attitudes towards Events

The economic, environmental, and social impact of events on the environment depends to a certain extent on the attitudes of their participants. Attitudes and the resulting behaviours, especially those related to mitigating the negative environmental or social effects of an event, can in turn encourage organizers to take specific actions (Alanzeh et al., 2022; Mueller et al., 2018). Therefore, studying the attitudes of participants in mass events towards various aspects

of these events is a topic of interest for researchers and practitioners (Bagiran, Kurgun, 2016; Wang et al., 2018; Marinova, Fox, 2019).

Zhang, Kim, and Xing (2020) investigated the influence of the consistency between the image of the event in which the participants took part and the host city on their attitude towards the event, manifested in their intention to revisit and recommend the event and city to others. According to their findings, perceiving consistency between the host city and the event had a significantly positive impact on the participants' attitude towards the city and their recommendations regarding that city. However, it did not have a significant effect on their intention to revisit the event or their attitude towards the event itself.

When examining the impact of event organization on sustainable regional development, Alanzeh et al. (2022) found that the awareness of organizing an event in a particular place, community involvement, and consideration of the attributes of the destination, positively influence the residents' attitudes towards the event. Additionally, the involvement of the local community in the event's preparation and their actual participation in the event are key factors in sustainable regional development (Sustainable Regional Development, SRD). To illustrate the differences in shaping SRD between the involved and uninvolved groups in organizing the festival, researchers utilized analysis of variance (ANOVA) methodology.

On the other hand, Mueller et al. (2018) focused on examining the attitudes of participants in outdoor sports events towards the 'Leave No Trace' programme, which aims to promote sustainable behaviour among participants in wild and natural areas. By investigating the attitudes of participants in various types of races towards 18 behaviours aligned with the Leave No Trace (LNT) principles, they utilized Ajzen's Theory of Planned Behavior (TPB). Participants' attitudes varied depending on the type of race they were involved in. Motorcyclists showed the weakest belief in the effectiveness of the LNT principles, and runners exhibited the least compliant attitudes with LNT principles, while cyclists demonstrated the highest compliance.

TPB has also been the basis for research conducted by Santos et al. (2022) on the attitudes of conference participants towards giving conferences a more sustainable dimension. The researchers found that gender and age explained fundamental differences in pro-environmental attitudes. Women and older individuals expressed stronger, positive attitudes towards choosing more sustainable conference venues, catering, conference materials, and accommodation. The weakest attitude was observed regarding the use of more sustainable means of transportation.

The impact of national culture on attitudes towards music festivals and their social significance in Serbia and Hungary was explored by Pavluković, Armenski, and Alcantara-Pilar (2017). The study revealed both positive and negative perceptions of the impact of festivals on the community. The researchers concluded that national culture significantly influences attitudes towards the studied events. Intercultural research was also conducted by Okayasu et al. (2016), examining the influence of cultural differences on the attitudes of Japanese and

American participants in recreational sports events. The findings of this study showed that different attitudes did not depend on variables describing gender and age.

As the above examples demonstrate, studying the attitudes of event participants covers various aspects related to their organization, ranging from attitudes towards the event itself and the host city, to attitudes towards sustainable catering at scientific conferences. Considering the existing literature on attitudes towards different aspects of events, it is difficult to determine definitively which factors are most significant when designing research in this area. Therefore, individual aspects require separate analysis.

2.2. Reactions to the energy crisis

Energy sources and costs are significant issues in urban management in many countries around the world. First, the COVID-19 pandemic presented serious challenges to city managers due to limited urban budgets and shifting priorities (Angelidou et al., 2022). The development of smart cities, including the implementation of smart offices, LED lighting systems, and intelligent traffic management projects, has been delayed or replaced by projects related to security and medical services (Kamruzzaman, 2022).

Subsequently, the invasion of Ukraine by Russia has caused significant challenges, particularly in Europe, in achieving energy policy goals regarding resource access. The need for sustainable, balanced, and equitable energy transitions in the face of the climate and war crisis also presents many dilemmas in urban energy management. According to Kuzemko et al. (2022), considering the observed changes, energy policy faces an energy trilemma: ensuring energy security, sustainable energy development, or energy equality, while aiming to meet societal expectations. In the context of Christmas, a fourth element, which city managers face, can be added to the discussed dilemma – concerning the preservation of holiday traditions associated with additional decorative lighting in cities or the organization of Christmas markets to provide a sense of normalcy to local communities. However, this implies a higher demand for urban electricity.

Meanwhile, Osička and Černoch note that the energy crisis, in the longer term, may present an opportunity for faster decarbonization and reducing Europe's energy vulnerability and dependence by shifting towards renewable energy and changing the European energy paradigm (Osička, Černoch, 2022). They emphasize that this will require coordinated, pan-European actions, including increasing awareness and acceptance of these solutions among the diverse societies in Europe, which do not hold a uniform stance on this issue. This is evidenced by the variation in the share of renewable energy used among European countries (Eurostat, 2023).

Parag et al. (2023) have developed guidelines for studying European reactions to the energy crisis in the years 2022-2023. They found that exceptionally high energy prices are influencing a change in the energy usage system for many households, businesses, and other organizations, including local governments (Parag et al., 2023). Understanding the attitudes and behaviours

of communities towards various manifestations of the current energy crisis can help improve social resilience and better prepare societies for future energy shortages caused by climate change or other factors.

Public lighting in cities, as part of the energy strategy, is perceived by individuals, as noted by Kasseh, Touzani, and Majaty (2023), as a factor indicating the development, attractiveness, and safety of the city. At the same time, for city managers, the challenge remains in developing an energy management strategy that ensures public lighting, which typically represents a significant burden on the urban budget, is as efficient, energy-saving, and conducive to the city's sustainable development goals as possible. To achieve this, cities worldwide are implementing various solutions, particularly related to intelligent energy management systems (Selvaraj et al., 2023) and supporting sustainable development in this area (Quereshi et al., 2021; Li, 2022).

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

3. Results

3.1. Context

The Christmas Market in Gdańsk is the largest event of its kind in Poland. In its current form, it has been organized for over 20 years. However, the history of this event dates back much further, to the 17th century. In the past, it was not a regular occurrence like it is now but rather an occasional event held in various parts of Gdańsk. The first historical descriptions of the Gdańsk Christmas Market come from the 17th century. Charles Ogier, the secretary of a French envoy, described the Gdańsk market in 1635 as a three-day fair where people of different social classes came to buy Christmas gifts. Descriptions from the 19th and early 20th centuries suggest that during that time, the market was held in one of Gdańsk's most prestigious landmarks, the Artus Court. It was an opportunity for selected entrepreneurs, craftsmen, and traders to showcase their products to a wider audience of visitors. In the 1920s, the market began to resemble its current character. Alongside commercial exhibitors, there were also food stalls and cultural attractions. Visitors could participate in concerts and admire Christmas illuminations (Mielke, 2021).

In 2022, the Christmas Market took place in Gdańsk from November 18th to December 23rd. In the European Best Christmas Market competition, the 2022 edition of the Gdańsk Christmas Market was recognized as the second-best event of its kind in Europe. It is worth noting that the competition included Christmas markets from nearly 100 European cities, and over 374,000 visitors voted for these events. The competition is organized annually by the

European Best Destinations organization, which promotes and supports the best European destinations worldwide. It collaborates with over 300 European tourist offices, including 80 centers for sustainable tourism, and hundreds of thousands of tourists who evaluate the selected destinations.

In 2022, the Gdańsk Christmas Market was visited by approximately 700,000 guests. Among them were residents of Gdańsk and the Gdańsk-Gdynia-Sopot metropolitan area, as well as people from other parts of Poland and abroad, mainly from the Scandinavian countries and Germany.

Given the longstanding tradition, the organizer – the Gdańsk International Fair and the City of Gdańsk as the host – did not cancel the next edition of this event. At the same time, the organizers sought solutions to maintain the festive atmosphere of the event provided by the illuminations while reducing the energy consumption. To achieve this, energy-efficient lighting based on eco-LED technology was installed, which requires nine times less electricity than traditional bulbs. The ChM organizers included information about reducing energy consumption and the better cost-effectiveness of the implemented solutions in their media materials. Local and regional media also highlighted this aspect when reporting on the illuminations. The *trójmiasto.pl* portal addressed the topic of Christmas illuminations at the ChM in fifteen articles published during the event. Five of them included information about energy efficiency and the costs of the festive lighting. Similarly, the *gdansk.pl* portal covered the topic of Christmas lighting at the ChM in eleven texts, including three that referred to its costs and energy efficiency.

3.2. Methods

The target group in the empirical study consisted of participants of the Christmas Market (JB). The study was conducted using the Computer Assisted Personal Interviewing (CAPI) method on different days and times during the market period. The constructs used in the survey were adapted from previous research. They included elements from the Theory of Planned Behavior (TPB, Ajzen, 1991), which had been previously adapted for studies related to individuals' attitudes in various tourism domains (Alonso et al., 2015; Elnadi, Gheith, 2022), as well as the Technology Acceptance Model (TAM, Davis, 1989).

According to the TPB, attitude is understood as a positive or negative evaluation of an action taken, taking into account the social influence associated with the perceived pressure from the individual's environment to conform to social norms. The Technology Acceptance Model, on the other hand, considers the perceived usefulness and other factors that may be relevant in studying attitudes towards a specific issue (Venkatesh et al., 2003; Almunawar et al., 2021). Therefore, the study included both emotions evoked by the illuminations and awareness of their energy efficiency as factors contributing to the formation of the attitudes towards the investigated phenomenon (Venkatesh et al., 2003).

Table 1.
Constructs and measurement items

| Constructs | No. | Items |
|---|-----|---|
| Attitude | 1 | Christmas illuminations during this year's Christmas Market is a good idea. |
| | 2 | I like the idea of this year's Christmas Market illuminations. |
| | 3 | Installing Christmas illuminations at the Christmas Market is beneficial. |
| Perceived usefulness | 4 | I believe that Christmas illuminations are necessary. |
| | 5 | Taking pictures of Christmas illuminations makes it easier for me to capture and document memories. |
| | 6 | Christmas illuminations make my photos more interesting. |
| Perceived emotions | 7 | The Christmas atmosphere is enhanced by the illuminations. for me. |
| | 8 | Watching Christmas illuminations is enjoyable. |
| | 9 | Watching Christmas illuminations is engaging. |
| Awareness of illumination's energy efficiency | 10 | If it were up to me, I wouldn't install Christmas illuminations. |
| | 11 | This year's Christmas illuminations consume very little energy. |
| | 12 | In my opinion, the organizer made an effort to ensure that the Christmas illuminations were energy-efficient. |
| Perceived social norms | 13 | My family believes that we should see this year's Christmas illuminations. |
| | 14 | My friends think that we should see this year's Christmas illuminations. |
| | 15 | People whose opinions I value think that we should see this year's Christmas illuminations. |

Source: prepared by the authors

A convenient, non-random sampling technique was used to collect the data, which allowed obtaining information from respondents based on their availability and willingness to participate in the study. A total of 204 completed questionnaires filled with responses from Christmas Market participants were subjected to analysis.

3.3. Respondents

The table below presents the characteristics of the respondents by gender, age, place of arrival, education and declarations of having children.

Table 2.
Overview of demographic characteristics of study participants (n = 204)

| Gender | % |
|--|-------|
| Female | 62.75 |
| Male | 37.25 |
| Age | |
| 18-24 | 19.61 |
| 25-34 | 36.76 |
| 35-44 | 17.65 |
| 45-54 | 45.54 |
| 55-64 | 6.86 |
| 65+ | 6.86 |
| Where did the respondent come from? | |
| from Gdańsk | 29.35 |
| from Gdynia | 21.39 |
| from Sopot | 12.44 |
| from outside the Tri-City, Pomeranian Voivodeship | 26.37 |
| from outside the Pomeranian Voivodeship, other parts of Poland | 10.45 |
| Abroad | 1.45 |

Cont. table 2.

| Education | |
|---------------------------|-------|
| elementary | 1.96 |
| vocational | 18.14 |
| secondary | 33.82 |
| post-secondary | 9.8 |
| higher | 36.27 |
| Number of children | |
| I don't have | 43 |
| I have 1 child | 24 |
| I have 2 children | 20 |
| I have 3 children | 11 |
| I have 4 or more children | 2 |

Source: prepared by the authors.

On average, respondents who visited the market in a group consisting of family members or friends were accompanied by 3 to 6 people.

3.4. Analysis

The participants provided responses on a 7-point Likert scale (ranging from strongly disagree to strongly agree), which allows for the application of the selected analytical approach in this case (Harpe, 2015; Wadgave, Khairnar, 2016). This means that, for example, a rating of 5.46 indicates a positive attitude towards the illuminations (the average response value between 'somewhat agree' and 'agree'). The results are presented in Table 3.

Table 3.

Respondents' response values for the measured items (n = 204)

| Constructs | Items | Median | Mean | STD |
|---|---|--------|------|------|
| Attitude | Christmas illuminations during this year's Christmas Market is a good idea. | 6 | 5.46 | 1.00 |
| | I like the idea of this year's Christmas Market illuminations. | 6 | | |
| | Installing Christmas illuminations at the Christmas Market is beneficial. | 5 | | |
| Perceived usefulness | I believe that Christmas illuminations are necessary. | 6 | 5.51 | 1.20 |
| | Taking pictures of Christmas illuminations makes it easier for me to capture and document memories. | 6 | | |
| | Christmas illuminations make my photos more interesting. | 6 | | |
| Perceived emotions | The Christmas atmosphere is enhanced by the illuminations. for me. | 6 | 5.78 | 0.97 |
| | Watching Christmas illuminations is enjoyable. | 6 | | |
| | Watching Christmas illuminations is engaging. | 6 | | |
| Awareness of illumination's energy efficiency | If it were up to me, I wouldn't install Christmas illuminations. | 4 | 4.75 | 1.10 |
| | This year's Christmas illuminations consume very little energy. | 5 | | |
| | In my opinion, the organizer made an effort to ensure that the Christmas illuminations were energy efficient. | 2 | | |
| Perceived social norms | My family believes that we should see this year's Christmas illuminations. | 5 | 5.04 | 1.11 |
| | My friends think that we should see this year's Christmas illuminations. | 5 | | |
| | People whose opinions I value think that we should see this year's Christmas illuminations. | 5 | | |

Source: prepared by the authors.

Summarizing the collected results, it is worth noting that the respondents perceive the evaluated illuminations as useful and evoking positive emotions. They had difficulty in relating to the energy consumption of the illuminations, as indicated by the value of 4 – ‘hard to say’. Their ratings indicate social support for the evaluated installations, with a rating of 5 – ‘somewhat agree’ for all the measured constructs. Although there are no comparative data from the period preceding the energy crisis, which was a topic of media agenda in the second half of 2022, the collected results do not indicate negative attitudes towards the solutions adopted by Gdańsk.

Considering the assumptions of TPB and TAM, a model of attitude towards the Christmas illuminations at the Christmas Fair was developed, as presented in Table 4. The model explains 40% of the variability in attitudes towards the illuminations (R -squared = 0.398).

Table 4.
Coefficients influencing the attitude towards the illuminations

| Model | Non-standardized coefficients | | Standardized coefficients | p value |
|---|-------------------------------|----------------|---------------------------|---------|
| | B | Standard error | Beta | |
| (Constant) | 1.543 | 0.383 | | 0.000 |
| Perceived usefulness | 0.243 | 0.067 | 0.293 | 0.000 |
| Perceived emotions | 0.210 | 0.080 | 0.204 | 0.010 |
| Awareness of illumination's energy efficiency | 0.208 | 0.057 | 0.229 | 0.000 |
| Perceived social norms | 0.076 | 0.052 | 0.085 | 0.147 |

Source: prepared by the authors.

The factor that most strongly shapes the positive attitudes of the respondents is the perceived usefulness of lighting ($\beta = 0.29$, $p < .001$). Participants who believe that illuminations are necessary and contribute to the ability to document memories and take more interesting photos demonstrate a more positive attitude. The attitude is also influenced by the belief in the energy efficiency of the evaluated illuminations ($\beta = 0.21$, $p < .001$). The more convinced the participants are that the organizers made efforts to provide lighting that consumes less energy, the more positively they perceive it. The attitude becomes more positive with an increasing belief that the illuminations contribute to the sense of holiday spirit and that viewing them is enjoyable, engaging, and evokes positive emotions ($\beta = 0.20$, $p < .010$). However, the social influence was found to be statistically insignificant.

To examine which sources of information are most strongly associated with awareness of the energy efficiency of the illuminations installed at ChM, the relationship between the opinion on the energy efficiency of the illuminations and selected sources publishing information about ChM was analysed. The dependency was assessed using the Spearman's rho correlation coefficient.¹ The correlation coefficients for each source of information about ChM and awareness of the energy efficiency of the illuminations are presented in Table 5.

¹ The Spearman's rho correlation coefficient is a nonparametric equivalent of Pearson's correlation and also takes values ranging from -1 to 1.

Table 5.

Relationship between the use of sources of information about ChM and awareness of the energy efficiency of the illuminations

| Items | | Awareness of illumination's energy efficiency | |
|--|--|---|--------|
| The Spearman's rho | Awareness of illumination's energy efficiency | Correlation coefficient | -- |
| | | p value | |
| | | N | 204 |
| | I actively use Facebook. | Correlation coefficient | .221** |
| | | p value | 0.002 |
| | | N | 204 |
| | I often read Dziennik Bałtycki. | Correlation coefficient | 0.127 |
| | | p value | 0.071 |
| | | N | 204 |
| | I often read the Tricity edition of Gazeta Wyborcza. | Correlation coefficient | 0.111 |
| | | p value | 0.115 |
| | | N | 204 |
| | I often use the trójmiasto.pl portal. | Correlation coefficient | .155* |
| | | p value | 0.026 |
| | | N | 204 |
| | I often listen to Radio ESKA. | Correlation coefficient | 0.080 |
| | | p value | 0.256 |
| | | N | 204 |
| I often visit the gdańsk.pl website. | Correlation coefficient | .206** | |
| | p value | 0.003 | |
| | N | 204 | |
| I visit the website of the Christmas Market regularly. | Correlation coefficient | -0.001 | |
| | p value | 0.992 | |
| | N | 204 | |

Source: prepared by the authors.

Only correlations with active use of the Facebook portal, use of the trójmiasto.pl portal, and the gdańsk.pl website were found to be statistically significant in terms of awareness of the energy efficiency of the Christmas illuminations installed at ChM. However, awareness of the energy efficiency of illuminations is not associated with the use of other local sources of information, including traditional media such as newspapers and radio, as well as the ChM website run by the event organizer

4. Discussion

Christmas illuminations play an important role in shaping the atmosphere of Christmas celebrations. With the ongoing climate change, not everyone can rely on snowy holidays and Christmas trees. Therefore, Christmas lights and other characteristic decorative elements increasingly create the festive ambiance (Prideaux, Glover, 2015). As noted by Prideaux and Glover, researchers in the field of tourism during the holiday season have observed that tourists expect the places they visit to reflect this specific time of the year, regardless of the weather or

purpose of their travel. Therefore, the elimination of Christmas markets or holiday illuminations does not seem like a favourable solution. On the other hand, there is growing pressure on local authorities to reduce energy consumption and costs. However, it appears that these two trends can be reconciled. As the study reveals, the Christmas illuminations are perceived as necessary (useful) by the respondents. They evoke a range of positive emotions and allow for the documentation of memories. People should not be deprived of these experiences in the name of cost reduction or energy consumption, especially considering that there are still many other areas where savings can be sought. As noted by Castéran and Roederer, Christmas illuminations are an essential element that shapes the Christmas atmosphere, impacting not only the appearance of urban spaces but also the perception of the event's authenticity, such as the Christmas market (Castéran, Roederer, 2013).

Giordano, on the other hand, observes that the function of urban lighting has evolved over the years. The traditional role of light in cities, associated with ensuring the safety of the population, has been complemented by aesthetic functions aimed at beautifying the city. Designing lighting for aesthetic purposes that supports tourism development is becoming an increasingly important element of planning in tourist cities (Giordano, 2018), especially considering limited urban budgets, climate change, and the current energy crisis. Research by Alexander, Teller, and Wood (2020) confirms that the perception of the connection between the material environment and the experience influences the city brand. Therefore, Christmas markets held in city centres serve to reinforce the traditional role of the city centre as an important place for social, commercial, and cultural activities. Thus, presenting appropriate lighting in this area supports the shaping of visitors' experiences. Taking into account the findings of Kasseh et al. (2023) regarding the perception of lighting in cities as a factor indicating their development, attractiveness, and safety, it is evident that the local government of a tourist city like Gdańsk places particular importance on the quality of lighting, including Christmas illuminations. In the context of the energy crisis, they also strive to ensure energy-efficient solutions in their installation. Perhaps, following the principles outlined by Parag et al. (2023), the introduction of energy-saving measures in the installation of Christmas illuminations will have a positive effect amidst the energy crisis.

5. Conclusions

In conclusion, it is appropriate to maintain the tradition of Christmas markets and the festive lighting of their spaces and cities, while also utilizing innovations that reduce energy consumption. This approach can have educational value and lead to a ripple effect of imitation. It is important not only to implement energy-saving solutions but also to effectively

communicate them. This can reduce the user's sense of guilt and, as seen from the research results, influence the formation of a positive attitude. However, from the analysis of the collected material, it can be concluded that the affirmation of energy efficiency in the implemented solutions must come from sources other than just the event's website managed by the organizer. The opinions of others, with whom the respondents interact and identify, also proved to be influential in shaping their attitudes.

6. Limitations

The study can serve as a starting point for further in-depth analyses related to the significance of actions undertaken by organizations and local governments in promoting an ecological mindset among residents and tourists. The research was conducted in specific Polish conditions, where pro-environmental and energy-saving attitudes are still being shaped. Perhaps in other cultural contexts, such as Scandinavian communities, the reduction of energy consumption and the implementation of energy-saving solutions in events organized by local organizations and governments hold greater importance for the community compared to the Polish context. It is undoubtedly important to also consider the issue of media usage and the development of appropriate messages that support the cultivation of pro-environmental attitudes among residents and tourists. Furthermore, the applied research methodology, especially the non-random sampling, limits the generalization of results and drawing conclusions about larger populations.

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POLAND'S CURRENT ACCOUNT: THE ROLE OF INVESTMENT INCOME BALANCE

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Purpose: The paper aims to present the role of net investment income in the current account in Poland's balance of payments and to investigate the main factors driving net investment income.

Design/methodology/approach: The study uses quarterly, secondary data spanning from 2004 to 2022. The data gathered in the research were analysed using the ordinary least squares (OLS) regression.

Findings: The empirical results of research show that the balance of investment income in the analysed period was characterized by a persistent deficit. The scale of the net investment income' impact on the current account balance has increased. The income balance was mostly determined by the net foreign assets position while exchange rate had no significant effect.

Practical implications: Understanding variables that influence country's net investment income is essential for designing appropriate economic policies aimed at ensuring external balance. The research results can be used to formulate policy recommendations, which help to minimize vulnerabilities of external position of Poland. A policy suggestion is that in order to reduce imbalance between payments and receipts in investment income flows, efforts should be made towards promoting domestic investments abroad. Poland should also decrease dependence on external financing and increase reliance on domestic savings. In addition, the results of study provide a reasonable basis for further research on the influence of the investment income composition on the balance of income account.

Originality/value: Until now, little research has been done about determinants of investment income balance. The study contributes to better understanding of changes in net investment income and dynamics of external position of Poland.

Keywords: balance of payments, net investment income, net financial assets, Poland.

Category of the paper: Research paper.

1. Introduction

The current account of balance of payments informs about the country's external position and stability of external finance. High level of deficit in this account increases the risk of a rapid outflow of foreign capital from the country, which destabilizes the economy and may trigger a crisis. Hence, the current account balance and the resulting net capital flow have become crucial for assessing the economy's vulnerability to the financial crisis (Butzen et al., 2014). A prolonged current account deficit can be a signal of unsustainable balance of payment.

The ongoing globalization process forces a new approach to the analysis of external stability using the current account balance. In the era of increasing capital flows, the assessment of external stability based solely on the level of the current account deficit does not reflect all the problems related to ensuring balance in cross-border payments. What generates the deficit and how it is financed provides important information about the sources of imbalances and financial threats to the economy.

Due to a build-up of gross external asset and liability positions of countries over recent decades, net investment income has become a large contributor to the current account balance in many countries. The net investment income from foreign investments, together with the balance of remittances and other income constitutes the primary income balance, which is a component of current account (NBP, 2019). Understanding the drivers of these compositional change in current account and the consequences of the growing investment income balance is important for the external sustainability analysis. Until now, relatively few studies have focused on international investment income flows. Previous literature have mostly focused on trade balance, given that it is typically the largest component of the current account (Romelli et al., 2018; Adamu, Audu, 2018).

The paper aims to present the role of net investment income in the current account in Poland's balance of payments and to investigate the main factors driving net investment income. For this purpose specifically the impact of net foreign assets and exchange rate on the income balance was examined, using quarterly time series data for the period from 2004 to 2022.

The study contributes to better understanding of changes in net investment income and dynamics of external position of Poland. The relevance of such a study is becoming increasingly important, as over recent decades, the deficit in Poland's investment income balance has increased significantly, making the debate on the role of foreign capital in financing the development process crucial.

2. An overview of the literature

The historical and empirical evidence suggest that persistent and large current account deficit increases country's vulnerability to disruptions in international capital flows. The long-term negative current account balance results in an increase in the country's foreign debt, which may lead to a decrease of credibility on the international markets (Kaminsky, 1998). This could in turn cause a lower inflow of foreign capital (or even a capital flight from domestic market) and an increase in the cost of financing, as a premium for growing risk resulting from the deteriorating creditworthiness of the debtor. In an extreme case, this may trigger a debt crisis, the consequence of which is the loss of external balance by the country (UN/DESA, 2016).

Traditionally, country's current account dynamics were mainly driven by trade balance. However, the rapid growth of foreign assets and liabilities over the last decades, both in absolute terms and in relation to GDP, had an impact on the value of income flows and the balance of investment income. According to (Behar, Hassan, 2022) the net income is at least half of the trade balance in half of the world's countries and the income balance exceeds the trade balance in 20 percent of countries. (Forbes et al., 2016) have pointed out that net investment income now constitutes a larger share of the current account deficit than trade balance in a number of countries, such as South Africa, Colombia, Peru, Brazil, Australia, New Zealand, Indonesia, Chile and Mexico. Moussa (2016) examined the main components of Sub-Saharan Africa's balance of payments and found that, since 1984, investment income payments, due to net payments to foreign direct investors, have been the main source of the deficit in their current accounts. Also Strauss (2015) pointed out that interest and dividend payments to foreign investors in its debt and equity markets determine South Africa's current account deficit. Lane (2015) claimed, that a drop in net foreign direct investment income, has been the primary factor in the recent deterioration in the United Kingdom's current account balance, with the trade balance relatively stable.

Considering above, the investment income balance has gained importance as a driver of the current account in many countries. Large current account deficits are not synonymous with large trade deficits, but could be the result of a negative investment income balance (Forbes et al., 2016). This means that the assessment of risks arising from a negative current account balance should also take into account the impact of changes in the balance of investment income.

The link between the balance of investment income and the current account balance has not been the subject of frequent analyses in the literature. (Forbes et al., 2016) investigated the role of financial components of current account for the risks related to the current account in a sample of OECD economies and found that they are increasingly important source of country's vulnerabilities related to current account. The results of (Behar, Hassan, 2022) show that the income balance may destabilize the current account through a liability trap. A country with

a higher net external liability position will tend to have a more negative income balance, a bigger deficit on current account and more net foreign borrowing needs, which in turn would decrease the income balance. However, they argue that the net investment could potentially stabilize the current account balance, due to a negative correlation with the trade balance.

Investment balance should be positively related to country's net foreign assets (Aberola, 2018), because it is generated by external assets and liabilities. The growing involvement of foreign investors in the domestic economy (increase in foreign liabilities) results in an increase in income paid to foreign entities. On the other hand, increasing investments of domestic entities abroad (increase in foreign assets) lead to an increase in income from foreign investments. Countries with a negative net foreign assets (an excess of foreign liabilities over assets, indicating that the country is a net debtor) tend to have a deficit in investment income balance, which has a negative impact on the current account balance, and conversely.

At the same time, the exchange rate should affect investment income balance. This is because foreign assets and liabilities are denominated in foreign currencies (Hattori et al., 2023). The impact of a change in the exchange rate is not straightforward. The currency denomination of foreign assets and foreign liabilities has mechanical effects on the investment income balance. An appreciation (depreciation) would decrease (increase) both inflows and outflows. But the net effect depends on the relative sizes of investment income receipts and payments as well as their currency denomination. In countries with a value of foreign liabilities significantly higher than the value of its foreign assets an appreciation would likely result in decrease in the income balance. Conversely, in countries with a large net creditor position, an appreciation would likely lead to an increase in the income balance (Colacelli et al., 2021). However, the exchange rate could also affect income flows through other channels, such as profitability (and hence investment income). A depreciation that increases exports would contribute to the profitability of domestic foreign direct investment and therefore profits (Joyce, 2019).

Relatively few studies have investigated empirically the determinants of net investment income. (Alberola et al., 2018) analysed the impact of foreign stock positions on the current account balance and its components and found that the income balance was mostly determined by the net foreign assets position while exchange rate had no significant effect.

Joyce (2019) examined the investment income flows of a group of 26 emerging market economies over the period of 1995 to 2015. He analysed the determinants of net investment income and found that total net investment income rises in response to increase in country's net international investment position. The results for the disaggregated income flows demonstrate that they respond to different factors. The openness of an economy can lead to outflows of income from direct investments, but capital openness has the opposite effect on income from other sources. Financial development, which is not significant for direct investment flows, affects income from portfolio investments. Other investments' income and the income from foreign exchange reserves have a negligible role in total investment income.

Colacelli et al. (2021) regressed the investment income flows on the exchange rate using a sample of more than 40 advanced and emerging economies. Separating income credits and income debits they found that an appreciation in the real effective exchange rate tend to decrease both inflows and outflows, mostly reflecting a mechanical effect due to the currency composition of the net foreign asset position. However, for large net creditor countries, the income balance response to exchange rate fluctuations may reinforce the trade balance response and reduce it in large debtors.

The same conclusions can be found in (Behar, Hassan, 2022). They use a similar approach as (Colacelli et al., 2021) in order to estimate elasticities with respect to the exchange rate but for a broader country sample. They find that the income balance is generally not a significant channel through which the exchange rate stabilizes the current account. This is to some extent due to the fact that income debits and credits offset each other in response to exchange rate changes. Depreciations tend to deteriorate investment income deficits and increase surpluses.

Hattori et al. (2023) investigated the impact of the exchange rate on income balance in Japan. They regressed not only net income but also income credit and debit separately in order to avoid the offsetting effects on the flows of income. They found that the real effective exchange rate does not affect income balance, both on gross and net basis. They also showed that accumulation of net foreign assets has fostered the income balance surplus in Japan. The gross level results indicate that foreign assets or debts have statistically significant impacts on income flows, while the real effective exchange rate is non-significant (Hattori et al., 2023).

Limbergen (2020) investigated EU Member States with persistent net investment income deficit. By comparing two groups of countries: potentially exposed to Aggressive Tax Planning (ATP) behaviour and catching-up countries, they determined variables that have a similar effect on the investment income balance for both groups of countries (such as net international investment position or the foreign-owned share of gross value added) and variables that differentiate between them (which relate to multinational enterprises activity and special purpose entities activity).

3. Trends in investment income and current account balance in Poland's balance of payments

The balance of investment income in the analysed period was characterized by a persistent deficit and additionally because of the faster growth of payments than receipts, it was deepening (Figure 1). In the years 2004-2022, the deficit in this item of the balance of payments more than doubled and in 2022 it amounted to -4.1% of GDP. The development of the economy based on foreign capital resulted in a growing burden of the costs of servicing foreign liabilities.

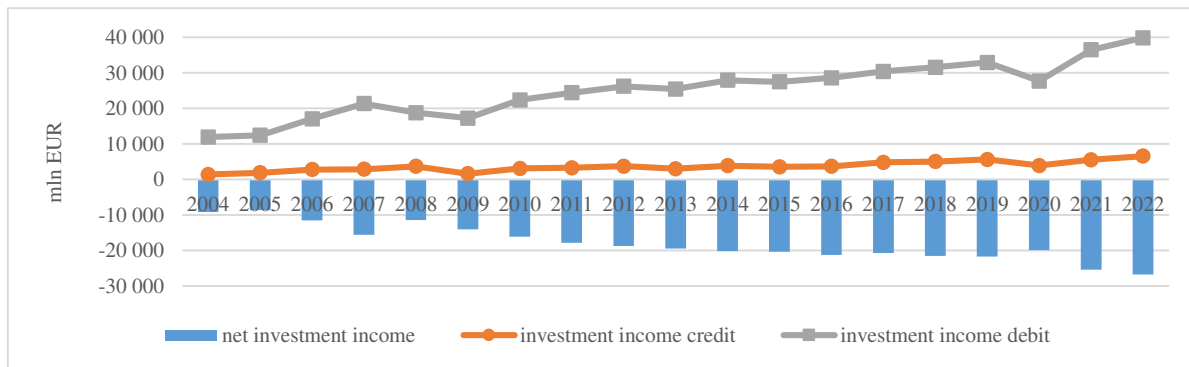
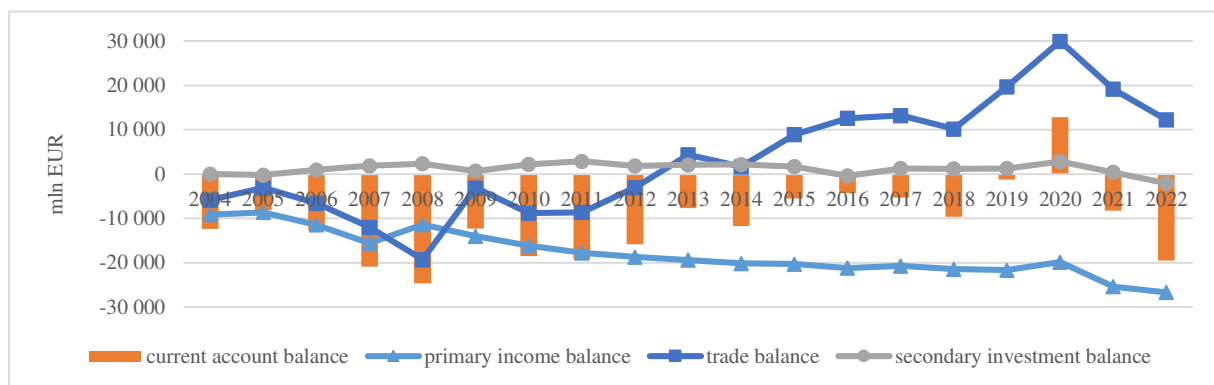


Figure 1. Investment income in Poland's balance of payments in 2004-2018 (EUR million).

Source: NBP.

Figure 2 shows the time series of Poland's current account balance and its components. As Poland's primary income balance is composed mainly of net investment income in further considerations, primary income and investment income balance will be treated as equal. The composition of current account balance has changed over time, with increasing investment income deficit. During 2004 -2008 the deficit of current account in Poland was growing due to negative both trade and investment income balances. After the global financial crisis the current account improved in tandem with a trade balance. However, a rising trend of the trade balance has been offset by an downward trend in the investment income balance. Changes in the net investment income contributed to the deterioration of the current account balance. The scale of the impact of the net investment income on the current account balance increased in the analysed period. Currently, the net income investment is a serious cause of external imbalance in the economy. The secondary income balance remained low and relatively stable over the whole period, increasing only moderately in recent years.



Note: The trade balance is identified with the difference between value of export and import of goods and services.

Figure 2. Current account balance and its components in Poland's balance of payments in 2004-2018 (EUR million).

Source: NBP.

4. Research methods

In line with the objective of this study, to empirically examine the influence of net foreign assets, exchange rate and GDP growth on the investment income balance in Poland, secondary, quarterly data, spanning from 2004 to 2022 were used. The selection of period is based on the availability of data. The ordinary least squares (OLS) regression model was used to test the relationship among the selected variables. The estimated model in this work is based on (Hattori et al., 2023). The empirical analyse is based on the following equitation:

$$IB_t = \alpha_0 + \alpha_1 NFA_{t-1} + \alpha_2 \Delta \ln(REER)_{t-1} + \alpha_3 GDP\ Growth_{t-1} + \varepsilon_t,$$

where (at time t):

IB_t – investment income balance scaled by GDP,

NFA_t – net foreign assets scaled by GDP,

REER – real effective exchange rate,

GDP Growth – GDP growth rate,

ε_t – error term.

Lagged values of the determinant variables are used to avoid endogeneity (Joyce, 2019).

The data collected from the Central Statistical Office, National Bank of Poland and OECD were used.

5. Results of the research

The results of the analysis of the determinants of net investment income are presented in Table 1. Model 1 is an estimate with only the NFA variable included, model 2 with the NFA and REER variables included, and model 3 with all three variables. With respect to the first variable in the equation the regression provides the expected result. The coefficient of NFA has a statistically significant, positive impact on the investment income balance. Net income rises in response to an increase of one percent in a country's NIIP/GDP by 0,008 of a percent of GDP. This relationship remains significant also when the REEF and GPD Growth control variables are included. This finding is in line with literature which claims that there is a positive relationship between net investment income and net financial asset (Joyce, 2019; Aberola et al., 2020; Hiattori et al., 2023).

Table 1.

The OLS estimation results of modelling Net Investment Income/GDP in the period 2004-2022

| Variables | Coefficient | Std. Error | t-Statistic | P-value |
|---------------------------|-------------|------------|-------------|----------|
| N = 74 model 1 | | | | |
| Constant | -0,024850 | 0,004485 | -5,54103 | 0,000000 |
| NFA | 0,008977 | 0,002067 | 4,34304 | 0,000045 |
| N = 74 model 2 | | | | |
| Constant | -0,025793 | 0,004503 | -5,72828 | 0,000000 |
| NFA | 0,008564 | 0,002073 | 4,13051 | 0,000097 |
| $\Delta \ln(\text{REER})$ | 0,038396 | 0,027053 | 1,41930 | 0,160188 |
| N = 74 model 3 | | | | |
| Constant | -0,0255 | 0,0046 | -5,5164 | 0,0000 |
| NFA | 0,0086 | 0,0021 | 4,1196 | 0,0001 |
| $\Delta \ln(\text{REER})$ | 0,0388 | 0,0273 | 1,4250 | 0,1586 |
| GPD Growth | -0,0002 | 0,0005 | -0,3480 | 0,7289 |

Note. For variables definitions and sources see section 4. N – number of observations. Significance was tested for $\alpha = 0.05$.

Source: Author's computation using STATISTICA version 13 Software.

As the value of Poland's foreign liabilities is significantly higher than the value of assets we could predict that a depreciation of exchange rate would also increase the value of payments of foreigners, resulting in an increase in the net income deficit. Results of research indicate that REER has statistically insignificant impact on net investment income, what is inconsistent with expectations. However, similar results has been found by Hattori et al. (2023) and Alberola et al. (2018, 2020). The statistical insignificance of exchange rate to income balance requires further examinations, which should take into account the currency structure and components of income balance. GDP growth variable also does not significantly affect investment income balance.

6. Conclusions

A deepening integration with international financial markets and investments of foreign capital in domestic economy led to changes in investment income flows in Poland's balance of payments. Due to investment income debits significantly larger than credit, a net investment income has consistently registered deficits in the analysed period. The results of empirical research show that net foreign assets have a strong impact on investment income balance. Net income deficit rises in response to increase in negative net foreign assets in relation to GDP. The research on the subject should be continued, in order to make the obtained results more detailed. Further analysis could disaggregate income flows and their currency composition in order to examine how they respond to different factors.

The results of research demonstrate that investment income balance become a significant component of Poland's current account in the analysed period. Servicing foreign liabilities absorbs a significant part of export revenues. This may mean difficulties with balancing the current account and improvement of the external position of Poland. If the deficit in the income account continues to deepen, balancing the current account will need a continuous increase in the trade balance, what requires reducing the level of national absorption. Moreover the rising deficit in net investment income in relation to trade balance makes the external stability of the economy more dependent on changes in the level of profitability of financial assets in the global market.

The study contributes to better understanding of changes in investment income balance and vulnerabilities of external position of Poland. Thus explaining the factors influencing current account is important for better designing the policies aiming at reducing the risks arising from the current account deficit and ensuring external balance of the economy. A policy suggestion is that, an economy in order to grow needs both foreign and domestic investment, however in order to reduce imbalance between payments and receipts in investment income flows, efforts should be made towards promoting domestic investments abroad. Another policy suggestion is that, in order to reduce the risks arising from dependence on foreign financing, government should strengthen policies aimed at mobilizing the accumulation of domestic savings to provide financial base for investment and accelerate economic growth.

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THE DEVELOPMENT OF PROFESSIONAL EXPERIENCES AND SOCIAL COMPETENCES OF STUDENTS AT THE EXPO 2020 DUBAI

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Purpose: The article presents the results of research on the development of social competences, including, among others, language competences and those associated with suitability for teamwork and useful on the labor market) of students who underwent an apprenticeship in the Polish Pavilion during the World Exhibition Expo 2020 Dubai.

Design/methodology/approach: The study was conducted on a target group of 50 people, students representing five Polish universities. A relatively small group, however, came entirely from purposeful selection.

Findings: Results indicate a clear positive impact of experiences shaped by cooperation in an international, multicultural environment on the preparation of representatives of the young generation to the challenges defined by contemporary business practice. They also point to positive changes in the sphere of understanding other cultures and young people's readiness to function in non-homogeneous conditions.

Social and practical implications: Conscious international activity of representatives of the young generation is something that should be taken for granted in the era of globalization. In a situation where a university is systematically able to provide at least some of its students with a chance to engage in a project that ensures development on many levels (language, culture, team competences, awareness of differences), observations and conclusions may (and should) urge higher education entities to be even more open and foster broadening of horizons.

Originality/value: Examination and analysis of changes in the way of thinking of representatives of the young generation (who are not pupils, but students) as a result of their involvement in an international project seems to be relatively rare. Therefore, the results of the study are original and include interesting conclusions.

Keywords: Students' competences, Foreign apprenticeships, Usefulness on the labor market, International environment influence on development.

Category of the paper: Research paper.

1. Introduction

The World EXPO is the largest economic event on a global scale. They are an arena for presenting the economic, cultural and educational potential of each of the participating countries. Participation in the EXPO World Exhibition is an excellent opportunity to strengthen the image, confirm development, economic and social growth, and actively demonstrate its role and importance on the international arena. The program of the presence of any country at EXPO is an element of the country's promotion strategy. It is developed in cooperation with ministries, cultural institutions, local government offices and the business world. A properly constructed concept also includes the involvement of academic centers, especially those involved in the process of preparing foreigners for studies in a given country. Their participation in the preparations for this promotion at EXPO is an obvious task to achieve statutory goals while increasing the level of internationalization of activities.

Each exhibition is a phenomenon of cultural and political life. Any kind of exhibition agitates cultural traditions of certain nations and its meaning is to show innovation and cultural policy of this nation (Kulsariyeva et al., 2014). The implementation of the internship in the international environment, direct involvement in the promotion of Poland, active participation in projects highlighting the huge potential of each country, including the economy and culture, is, a premise that deserves consideration.

The EXPO is a world important event and in its significance can be compared with the world sport event. EXPO has become a symbol of industrialization and technological achievements. It is a place for a dialogue between different cultures as well as exhibitors and visitors are given the opportunity to review the values and traditions of different people. EXPO exhibitions have become a worldwide event opens the opportunity to review the economic, scientific, technological and cultural achievements of the world, also it is a mirror of historical experience, the exchange of innovative ideas and a platform for the integration of future collective gaze. Thus, the international exhibition is a great opportunity not only for the development of cross-cultural communication, as well as to create a cultural dialogue. Expos are transformative and innovative mega-events that have a defining role in knowledge-sharing, cultural diplomacy and the promotion of progress for all (Cesar, 2017).

Between October 2021 and March 2022, Dubai became the host of the World EXPO. The originally planned opening date of the exhibition had to be postponed by a year due to the global coronavirus epidemic. Nevertheless, the EXPO in Dubai was a historic event, after all, it was organized for the first time in an Arab country. Official data published by the organizers after the closing of the exhibition indicate that there were 24.1 million visits guests from 178 countries, with 30.3% coming from overseas and over 1 million school trips took advantage to visit the exhibition (EXPO, 2022). It is worth noting that earlier estimates predicted the participation of 18 million visitors, more than 70 percent of whom will be citizens of countries

other than the organizing country – United Arab Emirates. However, this does not change the fact that the World Exhibition EXPO 2020 Dubai turned out to be a real success.

The University of Lodz was one of five Polish universities that joined the cooperation with the Polish Investment and Trade Agency – the entity responsible for Poland's participation in the World Exhibition EXPO 2020 in Dubai. Thanks to funding from the special-purpose subsidy of the Minister of Education and Science, the funds necessary to finance the costs of students' stay in Dubai were obtained. Participants of the internship not only had travel, accommodation and insurance covered, but also received a scholarship to cover the costs of their stay during the internship. The University of Lodz delegated to Dubai 25 students, while the total number of them (from all Polish universities) reached 134.

2. Research problem

In the literature, references can be found to research on the impact of participation in exhibitions and activation centers on supporting the education of children and youth and changing their perception or readiness to learn. Rennie & McClafferty (1995) have shown that visiting science centers had a positive impact on students' attitudes towards science. Falk & Needham (2011) observed that visits to science centers increased students' interest, curiosity, and attentiveness to science. Falk & Dierking (2000), for instance, described science centers within the contextual model of learning, comprising physical, sociocultural, and personal contexts. These contexts were important for the course of a visit and learning outcomes (Schwan, Grajal, Lewalter, 2014). In this respect, the physical context refers to the characteristics of a science center, including exhibit organization and orientation, physical layout or architectural design. The sociocultural context considers interactions and collaborations within groups at science centers, along with cultural considerations. The personal context comprises visitors' previous knowledge, beliefs, interest, motivations, expectations, and experiences (Falk, Storksdieck, 2005) and *physical*, *sociocultural* and *personal* aspects are involved. Ayar (2016) presented the analysis of the literature in more detail, concluding that there is no doubt that visiting exhibitions has a potential in enhancing student visitors' interest and curiosity in science, their knowledge and insights about world concepts.

The problem faced by the Authors is the relative lack of references to research showing the impact of long-term participation of students in the exhibition through their involvement in the service of the exhibition on the development of their social and professional competences. The identification of a research gap inspired the Authors to conduct a study on a group from a deliberate selection (50 students – program participants). This group consisted of students of five Polish universities who were involved in the apprenticeship (internship) program in the Polish Pavilion at EXPO 2020 Dubai.

Conducting a study on how participation in the largest international exhibition event in the world influenced the change in the way of thinking of the participants of the internship program, the perception of themselves and the environment, and the improvement of skills and competences (e.g. language, professional, teamwork, decision-making, readiness to engage into various initiatives) became a natural and logical element for the authors to learn about the effectiveness of education offered by universities as part of the study program. It should be emphasized that the student-participants of the program studied in various fields of study (and both degrees, bachelor's – 62% and Master's degrees – 38%), including: *Accounting & Controlling*, *Arabic Studies*, *Asian Studies* (3 students), *Banking & Digital Finance*, *Bioinformatics & Biology Systems*, *Chemistry*, *Economics*, *International Business Economics*, *International Relations* (5 students), *English Philology*, *Spanish Philology*, *Polish Philology*, *Finance & International Business* (5 students), *German Studies*, *Economic Informatics*, *Investments & Real Estate*, *Linguistics for Business*, *Logistics* (7 students), *Management* (6 students), *Marketing*, *Modern Business Management*, *Spatial Planning & Organization*, *Sociology*, *Spatial Management*, *Tourism & Hotel Industry* (4 students). Collecting assessments from such a diverse group of respondents, presenting a different degree of social preparation, coming from various cultural circles (the trainees in the Polish Pavilion were not only Polish citizens, but also citizens of Armenia, Kazakhstan, Ukraine and Uzbekistan studying in Poland), increased the value of the results, making it a cross-cultural study.

3. Methodology

The survey entitled *The development of the competences of students involved in the logistics of a mass event on the example of the EXPO 2020 World Exhibition in Dubai* was carried out in connection with the participation of representatives of five Polish universities (University of Warsaw – 14% respondents, University of Lodz – 48%, Krakow University of Economics – 14%, University of Bialystok – 4% and the Vistula Group of Universities – 20%) in the apprenticeships program, held at the Polish Pavilion. Formally, in the period from October 1st, 2021 to March 31st, 2022, when the exhibition was open to visitors (however, in practice from September 26th, 2021 to April 3rd, 2022, a total of 134 students were staying in Dubai, carrying out three- and six-month professional internships at the EXPO.

The intention of the Authors was to check to what extent the involvement of students in the implementation of tasks in the field of service and support commissioned by the Polish Pavilion at EXPO, which is in fact a unit of the Polish Investment and Trade Agency, influenced the change in their way of thinking about the surrounding world, perceiving their own role in the decision-making chain occurring in large and complex organizational units, consolidating the possessed skills and competences, acquiring new skills and competences and verifying the

individual beliefs existing in the period preceding the departure for the internship in the scope related to the broadly understood socio-economic environment, especially the labor market, it considers important, desirable or required. The intention of the Authors was also to prove the positive impact of international initiatives involving representatives of the young generation, enabling their active participation in the daily functioning of business entities. It was also desirable the study to become a confirmation of the advisability of undertaking similar valuable initiatives and activities involving students in the future.

The invitation to participate in the study was addressed to all participants of the apprenticeship program (internships), constituting a targeted selection group, and participation was voluntary. The study involved 50 students, 24 of whom were students of the University of Lodz and 26 students of other universities. In addition to the survey, in-depth interviews were conducted with selected students (9 people). Interviews were also conducted with representatives of the Polish Investment and Trade Agency S.A. (2 people), who are direct supervisors of students in the implemented program of internships.

The assessment of the development of students' competences was carried out by:

- on-line questionnaires (CAWI),
- in-depth interview with students undergoing a professional internship at EXPO 2020 in Dubai and people responsible for its organization on behalf of the Polish Pavilion at EXPO 2020 in Dubai and the Polish Trade and Investment Agency,
- observation conducted during research visits to EXPO 2020 in Dubai.

The questionnaire survey was carried out as an on-line form and was divided into parts, including: status and assessment of skills and competences before departure for the EXPO 2020 in Dubai, and after returning from internship in Dubai, as well as imprint. Respondents independently answered the questions included in the sheet. The questions used in the questionnaire were of a varied nature: both closed (single and multiple choice) and open-ended.

The survey was anonymous. The selection of the sample for the study was intentional. The questionnaire contained a metric, with the help of the answers to the questions contained therein, it was verified, among others, gender, age, year, degree and field of study and the home university. Fifty students aged 19 to 27 participated in the study, of whom 66% were women and 34% were men. The study was conducted between December 2021 to April 2022.

4. The research results

During the professional internship at the EXPO 2020, students could develop and improve their competences and knowledge in a very wide range. Therefore, in the part concerning the research results, selected comparisons the state before leaving and after returning from

apprenticeships were presented. Such a reference helps to contribute to the indication of differences in the attitudes of the respondents.

In survey, students answered a series of questions divided into groups relating to their individual (personal), professional and educational expectations. Figure 1 shows how the respondents assessed the fulfillment of expectations that accompanied participation in internships at EXPO in these dimensions.

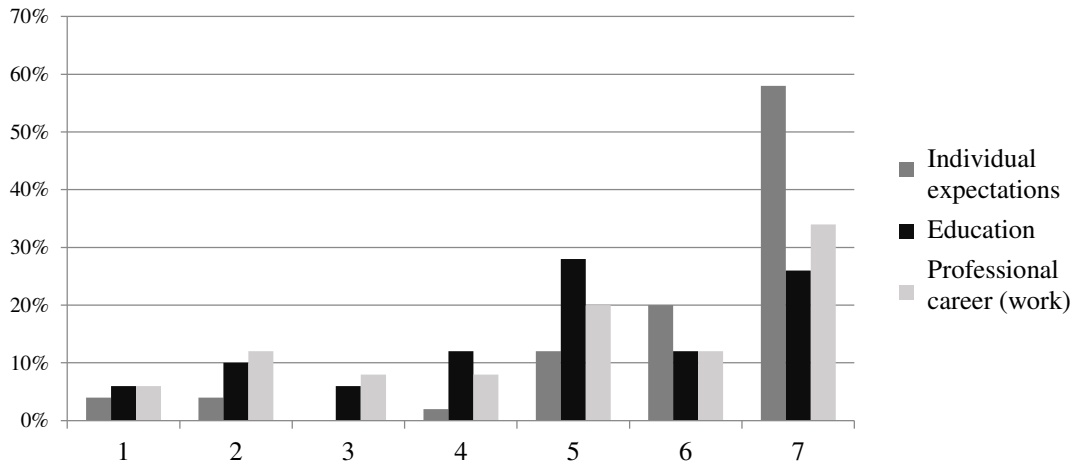


Figure 1. Evaluation of meeting expectations regarding the internship according to criteria on a scale from 1 (*very poor*) to 7 (*very high*) (in %).

Source: Research led by the Author.

Interestingly, the majority of respondents assessed apprenticeships in Dubai as good and very high (scores from 5 to 7), with as many as 90% of respondents assessed on such a level their individual expectations, 56% in relation to education, and 66% in relation to future professional career (work).

Figure 2 presents how the respondents used advantage of the opportunities that came from professional practice in Dubai in the context of major dimensions.

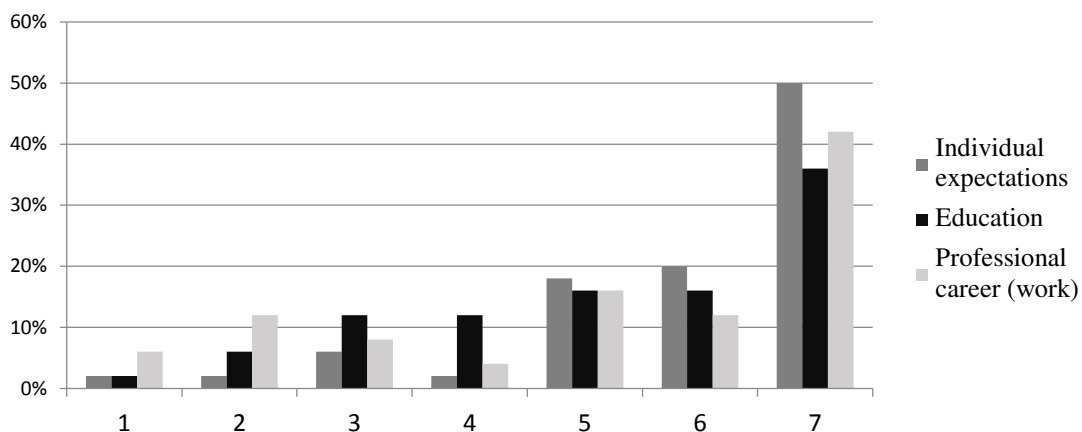


Figure 2. Evaluation of the use of the opportunity provided by the internship according to the criteria on a scale from 1 (*very poor*) to 7 (*very high*) (in %).

Source: Research led by the Author.

Noteworthy, most of the respondents assessed the use of opportunities as highly and very highly (scores from 5 to 7), with as many as 88% of respondents assessed on that level their individual expectations, 68% in relation to education, and 70% in relation to future professional career.

Figure 3 presents the general assessment of the professional practice (the totality of experience in operating at the Polish Pavilion, skills acquired or improved there).

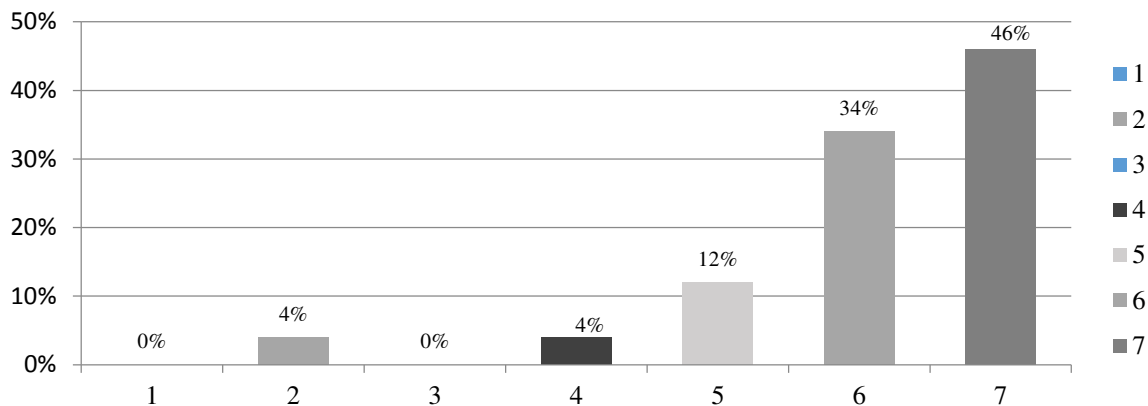


Figure 3. Overall evaluation of the internship after returning from Dubai on a scale of 1 (*very poor*) to 7 (*very high*) (in %).

Source: Research led by the Author.

As many as 80% of the students participating in the program rated it high or very high (grade 6 and 7). It is worth noting that only three respondents would not take advantage of the internship opportunity again (and only because of 'personal reasons'). Also, when asked what kind of job they imagine themselves in after graduation, overwhelmingly give specific plans. Only 10% of the respondents do not know yet what they would like to do professionally.

The assessment of students' readiness to change their place of residence, which is shown in Figure 4, indicates that 52% of the respondents are willing to work abroad. At the same time, 34% of respondents are open to what the future will bring them. This is a value confirming that a few-month internship abroad allowed young people to believe in themselves and convinced, at least some of them, that they are able to cope with professional challenges outside the country where they study.

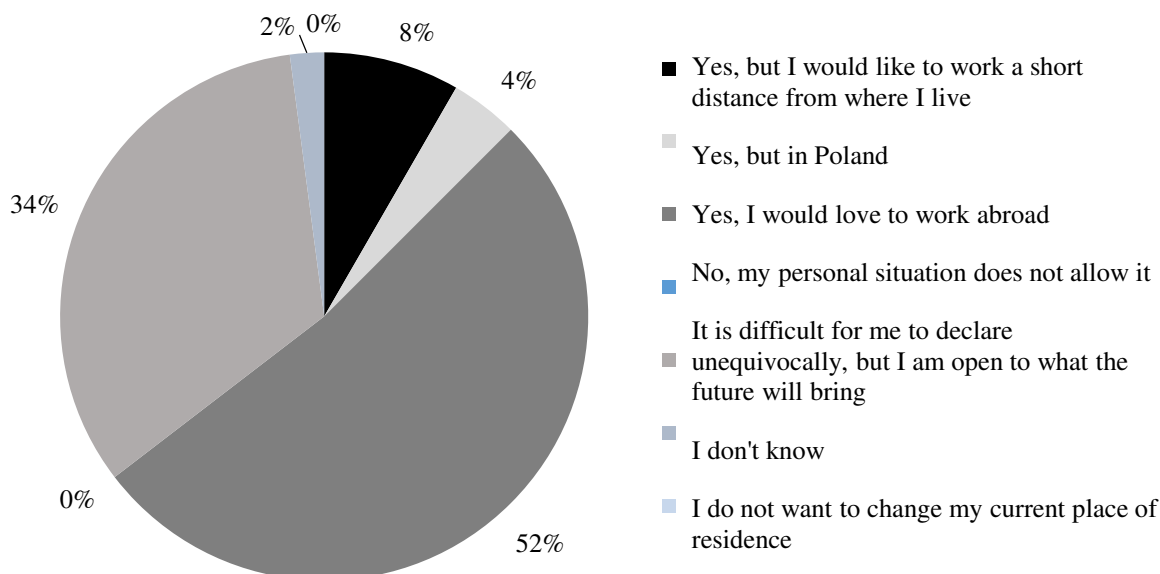


Figure 4. Mobility of students examined by the possibility of changing the place of residence due to the future work (in %).

Source: Research led by the Author.

The data included in subsequent cross-checks show how the respondents assessed the relationship between the possibility of participating in the service of a large exhibition event and the chance to meet a person who may be useful for their future professional career (Table 1) while relationship between the ability to act under stress and the capacity to solve problems (Table 2).

Table 1.

Assessment of expectations related to future professional work in the context of active participation ("from the inside") in the largest promotional and exhibition event in the world [1] and the possibility of potentially meeting and communing with important people (representatives of governments, the diplomatic corps, presidents of well-known enterprises, etc.) [2] on a scale from 1 (very poor) to 7 (very high) (in %)

| [2] \ [1] | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------|----|----|----|----|----|-----|-----|
| 1 | 2% | 0% | 0% | 0% | 2% | 0% | 2% |
| 2 | 0% | 0% | 0% | 0% | 0% | 2% | 0% |
| 3 | 0% | 0% | 2% | 2% | 0% | 0% | 2% |
| 4 | 0% | 0% | 0% | 0% | 0% | 4% | 0% |
| 5 | 0% | 0% | 0% | 0% | 6% | 12% | 6% |
| 6 | 0% | 0% | 0% | 0% | 0% | 8% | 8% |
| 7 | 0% | 0% | 0% | 0% | 2% | 2% | 38% |

Source: Research led by the Author.

Table 2.

Evaluation of professional experience in terms of skills in relation to the need and ability to act under stress [1] and problem-solving skills [2] on a scale from 1 (very poor) to 7 (very high) (in %)

| [2] \ [1] | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------|----|----|----|----|----|----|-----|
| 1 | 2% | 2% | 0% | 0% | 0% | 0% | 0% |
| 2 | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 3 | 0% | 0% | 8% | 2% | 0% | 0% | 0% |
| 4 | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 5 | 0% | 0% | 0% | 6% | 8% | 4% | 0% |
| 6 | 0% | 0% | 0% | 0% | 4% | 8% | 14% |
| 7 | 0% | 0% | 0% | 0% | 0% | 0% | 42% |

Source: Research led by the Author.

Clear indications at levels 6 and 7 confirm that students-participants of the program perceive the opportunities offered by the apprenticeship program as an element of building their own competences and skills useful in professional life.

The results shown in Table 3 should be assessed slightly differently, where the declared readiness to submit to the decisions of superiors (also when respondent disagree with them) and responsibility for their own decisions (also when they turned out to be wrong after some time) were compiled.

Table 3.

Evaluation of the impact of the EXPO internship in terms of skills in terms of readiness to submit to the decisions of superiors (also when you disagree with them) [1] and responsibility for your own decisions (also when they turned out to be wrong after some time) [2] in scale from 1 (very poor) to 7 (very high) (in %)

| [2] \ [1] | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------|----|----|----|----|----|----|-----|
| 1 | 0% | 0% | 2% | 0% | 0% | 0% | 0% |
| 2 | 0% | 2% | 0% | 0% | 2% | 0% | 0% |
| 3 | 0% | 0% | 4% | 0% | 0% | 0% | 2% |
| 4 | 0% | 2% | 0% | 2% | 2% | 0% | 0% |
| 5 | 0% | 0% | 0% | 2% | 6% | 0% | 4% |
| 6 | 0% | 0% | 0% | 8% | 8% | 6% | 2% |
| 7 | 2% | 0% | 0% | 0% | 6% | 8% | 30% |

Source: Research led by the Author.

It can be presumed that the greater variety of assessments (in relation to both factors, the respondents used each of the available scale values when answering) is related to the approach of "healthy egocentrism" towards work and superiors, characteristic of the young generation.

Knowledge of foreign languages and the ability to communicate in an international environment is extremely important, especially in today's reality. The surveyed students demonstrate knowledge of many languages, research covered eight of them – English, German, French, Russian, Spanish, Arabic, Italian and Chinese, although some respondents also declared knowledge of other languages, e.g. Korean and Japanese. Respondents definitely know English

to the best extent, which was a prerequisite for qualifying for a professional internship at EXPO. It is worth noting that the surveyed students assessed that their knowledge of English had improved after returning from the internship. In the case of most other foreign languages, the changes were not so visible and significant. Nevertheless, it is worth noting the impact of participation in the program on the Arabic language – the EXPO 2020 Dubai was held in an Arabic-speaking country. In this context, it can be indicated that before leaving, over 80% of the respondents practically did not know the Arabic language at all, and after returning, just 40% claimed that they did not know the language. In the part concerning the knowledge of foreign languages, not only the knowledge, but also the efficiency of acting in a foreign language (languages) was verified. It can be noticed that the surveyed people indicated a clear progress. At a very good level, the efficiency of acting in a foreign language (languages) was assessed by 64% of the respondents after returning, compared to only 26% before departure.

Participation in the professional internship also contributed to the acquisition and consolidation of practical knowledge about the world. Before leaving, the respondents indicated that their knowledge of the world oscillates on a scale of 3 to 7 (5 and 6 are the most common), and after returning from 4 to 7 (6 and 7 are the most common). The fact that the students were in an international environment could have had a positive impact on their knowledge of the world. As part of learning about another (different) culture, which for the majority of respondents could actually turn out to be something new, unknown, and thus attractive, the respondents assessed this expectation as important and very important for the most part. It should be emphasized that before leaving, over 40% of the surveyed people considered that getting to know another culture is very important for them, while after returning, over 75% of them. Participation in the professional internship itself and the opportunity to spend three or six months in the space of Arab or, more broadly, international culture, certainly contributed to increasing the level of knowledge about various cultures with which students had the opportunity to commune. It is worth noting that before leaving, just several people indicated that they know other cultures and the differences associated with them very well.

Inclusion in the group undergoing an internship at the EXPO 2020 is an ideal opportunity to test yourself in an international environment in terms of how a person feels in such a space. The students rated this aspect rather well and very well. Importantly, they did not overestimate their expectations compared to the actual situation. The overwhelming majority of respondents indicated that they feel very comfortable in the international space. In the survey, the respondents referred to the aspect related to checking how well they feel in a multicultural environment. The vast majority of people indicated that they feel very good in such an environment, both before leaving and after returning from it. The assessment after returning was higher than before.

At the same time communication is one of the key elements of any well-functioning organization. The surveyed students assessed the ability to communicate slightly worse before leaving than after returning – 60% of the respondents indicate that after returning their ability to communicate is at a very good level. Also over 60% of the respondents indicated that ‘Effective communication’ was of great importance during the internship.

5. Discussion

The results presented in the previous part are only a fragment of the study. For obvious reasons (volume limitations), it is not possible to present all the conclusions. Based on the results of the study, which also included structured interviews with selected internship participants and representatives of the Polish Pavilion at EXPO, responsible for supervising students involved in guest service, it should be stated that:

1. Students participating in the program increased their language competences, especially in relation to the knowledge of English.
2. After completing the internship, students better assess the level of their general knowledge and knowledge of other cultures – it is especially worth emphasizing the high evaluation of their sense of efficiency in international and multicultural environment.
3. Program participants declare better planning skills, better teamwork skills, as well as readiness to learn and acquire new skills.
4. Students do not see the possibility of using the ability to manipulate, and do not indicate that at the stage of the program implementation they would have a chance to demonstrate the ability to manage.
5. Students participating in the program, both: before and after return, evaluate personal development very highly, which is an indisputable advantage of including them in the program.

Participation in the professional internship as part of EXPO 2020 involved the performance of many tasks that were entrusted by superiors. Such tasks should be carried out with the greatest care. The respondents were aware of this, as indicated by their answers within the given skill category. After returning from the professional internship, all respondents assess the ability to be responsible for the entrusted tasks highly and very highly (at 5, 6 and 7). The ability to self-presentation was rated relatively high by each of the respondents. Most indicated that they could perform well or very well. Each of the surveyed people, in order to get an internship, went through several stages of recruitment, which may be a reason for these results. It is worth mentioning that after returning, more than half of the respondents assessed their self-presentation skills as very high, only 16% said so before leaving. It can be concluded that the internship as part of EXPO 2020 contributed to the improvement of this skill.

The possibility of professional practice abroad, which is the place of study, was an additional stimulus for students' development. They gained not only the opportunity to acquire typical business (corporate) skills, quite universal in economic practice. They also gained a chance to get to know, better understand and gain experience resulting from staying and communing with representatives of a number of other cultures (guests of the pavilion from around the world) and the need to correctly position themselves, a representative of the country participating in the exhibition, in a complex international space. These conclusions were clearly drawn from conversations with people evaluating each of the participants of the internships.

An Author believes that the long-term effects of students' participation in the program, which translate into practical professional skills, better understanding of intercultural contexts or the ability to take action taking into account the international specificity of the team, will be revealed more widely later. When students finish their education and start full-time work, they will be able to fully use the experience acquired during the internship at EXPO 2020 Dubai, and the added value of participating in the foreign internship program will determine their effectiveness and competitiveness in relation to those who have not had the opportunity to collect such experience.

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LIMITATIONS ON THE ACTIVITIES OF SENIOR NON-GOVERNMENTAL ORGANIZATIONS IN UPPER SILESIA. ANALYSIS OF FOCUS GROUP INTERVIEWS

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Purpose: The article will address the issue of structural, cultural and agency barriers limiting the development of social innovations in selected Silesian senior non-governmental organizations (NGOs). One of the main barriers to the implementation of social innovations is the barrier of agency.

Design/methodology/approach: The theoretical basis of the research presented in the article is Margaret Archer's morphogenetic theory of structure and agency (Archer, 2013, 2016, 2019). On their basis and using the qualitative analysis of data obtained during group interviews (FGI), a diagnosis of developmental limitations and barriers will be made. A qualitative research method (FGI) was used to obtain empirical data. This method allows for the analysis of structural elements, cultural features of a given organization, as well as the capabilities of individual social and organizational entities. Based on the theoretical assumptions and the author's observations, four research questions were posed: (1) What structurally conditioned agency barriers have been observed by the examined seniors while undertaking innovative activities? (2) What awareness agency barriers have been observed by the examined seniors?

Findings: If we use the language of the morphogenetic theory and refer to its causal analysis scheme (Archer, 2005, 2010, 2013, 2015, 2019) then: (1) the surveyed members of non-governmental organizations in the processes of implementing innovations constantly diagnose structural and cultural conditions and (2) determine the objective incompatibilities between them (indicated deficits and barriers). (3) They then collectively analyze, emotionally and reflectively, the external conditions to give feedback. (4) They interact socially and culturally with the environment. (5) The resources of objectified and conscious agency that the surveyed seniors have at their disposal make it possible to overcome specific barriers and take action in accordance with the morphogenetic scenario related to collective autonomous reflexivity.

Originality/value: The added value of the presented research in the theoretical dimension is the operational clarification of the morphogenetic scheme of the Margaret Archer causal analysis. Theoretically, an important novelty is the conceptualization of the concept of structurally conditioned (objectified) agency and agency of consciousness, which allowed for a precise operationalization of the main research questions regarding barriers to agency. In the empirical dimension, barriers appearing in the implementation of social innovations in selected Silesian non-governmental organizations were diagnosed. In the future, the application-based research results will allow for the implementation of educational and implementation projects (action research), adequate to the needs of the surveyed social groups.

Keywords: social innovation; non-governmental organizations (NGOs); agency; digital competences; qualitative analysis FGI.

Category of the paper: research paper.

1. Introduction

The deepening change in the demographic structure of Polish society towards an increase in the share of people aged 60+ in the population is conducive to increasing the agency of seniors in social life, e.g. by increasing their participation in civil society or educational institutions. The challenges resulting from the aging of the society require taking multi-directional actions, the main objectives of which are: ensuring dignified aging by improving the quality and standard of living and creating conditions for professional and social activity of people aged 60+. According to the forecast of the Central Statistical Office, in 2035 people aged 60 and more will constitute almost 1/3 of the Polish population. In 2050, already 40% of the population. Observing the dynamics of demographic changes in recent years, a systematic increase in the 60+ age group can be observed (Rudnicka, 2021; GUS, 2022).

The aging of the society is clearly visible in Upper Silesia, where depopulation as a result of economic emigration is accompanied by an intensive economic transformation, as a result of which entire professional categories, such as miners, steelworkers, railway workers or employees of the defense industry, retire early. These processes generate an overrepresentation of people at retirement age in most cities in the region. The social group of seniors who in the most active and effective way is trying to find themselves in the new reality of the region are the leaders and members of senior non-governmental organizations. Therefore, the study covered all leaders and members of non-governmental organizations participating in the project, in particular from the Universities of the Third Age from the vast majority of cities and communes of Upper Silesia. Members of Silesian Universities of the Third Age and senior non-governmental organizations are prosumers of social innovations created by and for seniors. They are prosumers of social innovations they make, because they take over the role of initiators, testers, users and recipients of innovations (Weryński, Dolińska-Weryńska, 2021).

The subject of the research were leaders and members of the UTW and senior non-governmental organizations from 21 Silesian communes. The huge popularity of this type of facilities both in Poland and in the world gives grounds for considering the direction of their further development, especially in the context of new technologies¹. Universities of the Third

¹ The research was carried out as part of the project *Social innovations as the third mission of the university* (NCBiR), which was carried out under the direction of dr. Piotr Weryński from December 1, 2018 to February 28, 2021. The aim of the project was to improve the competences (enabling the expansion of knowledge and skills in the field of creating social innovations, digital competences, social communication) of 252 leaders and members of senior organizations (177 women and 75 men) aged 60+ from 21 local communities (cities and

Age, whose aim is to educate and integrate senior citizens, operate in various forms, of which over 56% are in the form of associations (Grzanka-Tykwińska, 2015).

Currently, among the elderly, there is an increasing interest in lifelong learning and care for maintaining activity in late adulthood. Such a situation is a challenge for institutions such as UTW, especially in the era of turbulent changes in the field of e-technology or e-media of modern societies (Zielińska-Więczkowska, 2010).

The key factor influencing the quality of life is intellectual activity and a sense of belonging to a community. Quality of life is not only physical existence, but also the possibility of enriching the spirit and mind, the possibility of education, as well as creation and creativity (Grzanka-Tykwińska, Chudzińska, Podhorecka, Kędziora-Korantowska, 2015; Wolniak, 2020). The development of Universities of the Third Age, the growing number of people involved in their activities, as well as the increasing diversity of the offer do not allow you to pass by this phenomenon indifferently. Universities allow for continuous expansion of knowledge, stimulate activity, facilitate establishing interpersonal relationships, mobilize and give the opportunity to take care of one's physical condition (Borczyk, 2012).

Poland was the third country, after France and Belgium, where the movement of Universities of the Third Age was adopted and developed (Williamson, 2000; OECD, 2011). Currently, the UTW movement in Poland consists of over half a thousand organizations operating throughout the country. The Universities of the Third Age operating in Upper Silesia aim to improve the quality of life of broadly understood seniors over 60, as well as to use the potential of older people on the labor market - knowledge, skills and life experience, for and social development of the country (Borczyk, 2012; Borczyk, Nalepa, Knapik, 2012). The research and observations of the author of the article show that the Silesian UTW model is similar to the so-called the British model, which is based on self-education and self-help of seniors, without support from the university (Hrapkiewicz, 2009). This means that Silesian senior organizations have a strong driving force and are prosumers of social innovations created by themselves and for themselves (Borczyk, Nalepa, Knapik, 2012).

2. Theoretical assumptions of research on development barriers for senior NGOs

Non-governmental organizations operating in Upper Silesia and UTW are at the same time the creators and recipients of social innovations. The social implications of innovation were already noticed by Josef Schumpeter as a precursor of scientific reflection on innovations (Schumpeter, 1960; McCraw 2007; Mendes, Batista, Fernandes, 2012). The social sciences

communes) of the Silesian Voivodeship. The effect of the project is to increase the level of their social and civic involvement, to increase the representativeness of their interests in local and regional politics.

systematically undertook research on the social effects of innovation in the early 21st century (Mulgan, 2007; Bukowiecki, 2012; Herrera 2016; Fougère, 2017; Weryński, 2014). The increased interest in these issues was related in the economic dimension to the effects of the financial and economic crisis that occurred after 2009 (Wronka-Pośpiech, 2015). Its effect is to draw even stronger attention to the role of creativity, innovation, including social innovation, in supporting economic growth, creating safe jobs and increasing the competitiveness of societies in Western countries struggling with, among others (Klimczuk, 2015).

At the basis of the author's operational definition of the concept of social innovation lies a pragmatic approach to truth (Weryński, Dolińska-Weryńska, 2021; Weryński; 2022). A pragmatically approached theory of truth accepts as true what is confirmed by its consequences, mainly practical ones (James, 2001). The above understanding of the truth is close to identifying it with effectiveness, efficiency, and indirectly with the adequacy of meeting human needs in a specific situational context. Pragmatists look for the criterion of truth in experience, everyday life and the consequences of actions taken. Truth is not an unchanging category, it becomes and verifies in the effects of social activities. Pragmatically understood social innovation emphasizes the importance of the effects of social activities, the importance of activities focused on research in action, i.e. research, action and cooperation (Greenwood, Levin, 1998; Chrostowski, 2008). The above approach to social innovation includes diagnosis of reality, identification of the problem, initiation, testing, implementation and possibly validation of the final product of innovation (i.e. product, service, model), which in turn leads to a permanent and largely anticipated change in a specific environment, social group, organization. It is implemented through cooperation and mutual inspiration of innovators, users and recipients.

The innovation process in an NGO is determined by complex factors, both external and internal (Human Smart City, 2020). Some of them are barriers defined as forces hindering the initiation and development of innovations. The authors of the work *Barriers to Social Innovation* pointed to two groups of barriers in innovation processes: structural and agency barriers (Mendes, Batista, Fernandes, 2018).

Structural barriers are related to the complexity, uncertainty of social processes, political, cultural and economic contexts. They are determined by:

1. Social context: complexity of the problem, unpredictability of side effects, a strong component of binding but not bridging social capital, information gaps and uncertainty about the impact of innovation in the future, lack of strictly ex post data and the possibility of validating innovative products;
2. The political and cultural context is created by: monopoly of political power, barriers to free communication, freedom of speech and media, top-down approach in formulating and implementing policies and strategies, lack of legal and cultural recognition, inadequate public order system, culture oriented towards the functioning of state institutions, but no social, weak knowledge transfer policy;

3. The economic context is: limited opportunities for self-financing of initiatives, too high costs of innovation, no mechanism for scaling innovation, a potentially large number of entities, activities and technologies that will be negatively affected by innovation, the nature of the public good resulting from innovation.

On the other hand, the barriers of intermediation (as defined above) related to the activities occurring in the process of implementing innovations are manifested by: reluctance to innovation, insufficient usefulness of innovation, a small number of alternative solutions for innovation, low efficiency of innovation, various groups and individual interests, human state of mind, personal relationships between people (jealousy), mistrust towards innovators, lack of consent of the environment for mutual approach to changes caused by innovations, lack of intermediary partners in the social life of the network, lack of networks in communities, lack of competence in many social areas, including the ability to develop institutional entrepreneurship, protectionism and risk aversion, problems with supervision and coordination (Mendes, Batista, Fernandes, 2018; Weryński, Dolińska-Weryńska, 2021).

In order to complete the conceptualization of key concepts, it is necessary to define one more category - agencies. Margaret Archer's morphogenetic theory assumes, on the one hand, that agency results from an internal dialogue, an internal conversation of the subject, its specific reflexivity (Archer, 2013, 2015, 2019). On the other hand, it expresses his ability, more or less conscious, to influence his social environment (Archer, 2015). According to the assumptions of Roy Bhaskar's critical realism, mentioned by Archer, the causal forces of social forms are influenced by social agency (Bhaskar, 1989). They are conditioned by the emergent (non-reductive) properties of the subjects of individual and collective action. In other words, the agency of executive subjects has subjective and intentional features that should be associated with their reflexivity. At the same time, it conditions and is conditioned by the environment, its structural and cultural properties (Archer 2010, 2013, 2014).

A constitutive feature of agency understood in this way is not only the ability of the subject (subjects) to act, but it is expressed in the very existence of this subject (Archer, 2003, 2005, 2015). In the study area, the very existence of organized senior communities, as entities of collective action, proves their causative capacity. The problem remains to determine the scale of their ability to act and the barriers determining their effectiveness. The author distinguishes two original types of causative barriers - structurally conditioned (objectified) barriers and awareness barriers. The first type of barriers are determined by the contexts resulting from the infrastructural, economic, intellectual, communication and digital potential of the members of the surveyed NGOs. The second type of barriers concerns the mental state of the respondents, attitudes towards social innovations (pro- and anti-innovation), attitudes towards innovation participants (e.g. trust and normative community or distance and envy), attitudes towards the need to build social bonds in the micro-, meso- and macro-environment (bridging or bonding social capital).

The conceptualization of both types of agency requires reference to theoretical concepts that, in addition to emphasizing the reflexivity and intentionality of the subject, also take into account its causative capacity in the existing structural and cultural contexts. Within this framework, the individual has the ability to change certain social conditions within a certain time frame, transforming or preserving various social forms. Archer's morphogenetic theory assumes, on the one hand, that individual agency results from the internal dialogue and specific reflexivity of the subject (a component of agency related to consciousness). On the other hand, it indicates the subject's ability (material resources, knowledge, skills, experience) to influence its social environment (and thus a component of structurally conditioned, objectified agency).

The analytical separation of the two types of subjectivity was of key importance for the description and explanation of social changes (morphogenesis) in the studied organizations and their social environment. Broadly understood agency creates conditions for innovation, leads to innovation, meeting the appropriate structural and cultural conditions. This is a necessary but not sufficient condition for innovation to occur. It is therefore necessary to define in what structural and cultural conditions and with what kind of reflexivity innovations can be implemented (Weryński, Dolińska-Weryńska, 2021).

3. Methodological assumptions of research on development barriers for senior NGOs

The final analysis and interpretation of the results was carried out in relation to the following research questions in the following order: organizing raw data - collecting facts (data descriptions) - interpretation. It was important to analyze the behavior of the interviewees, their doubts and questions, their motivations and objections to the researched topic. The order of research within the main qualitative technique used - focus group interviews (FGI) - defined the focus scenario in which the main research questions were operationalized. The interviews were in the form of discussions led by a moderator and focused on the main thematic threads outlined by the above-mentioned research questions.

The method of analyzing data obtained through focus group interviews was determined by the assumptions of grounded theory (Konecki, Chomczyński, 2012; Hensel, Glinka 2012). An inductive method of analysis of the collected research material was used. Therefore, no initial assumptions were made as to the nature of the relationship between the variables, no hypotheses were made that would be subject to verification during focus groups. Potentially not entirely accurate initial assumptions regarding new research topics, e.g. the attitude of specific groups of respondents to the subject of research could determine the method of interpretation of the results obtained.

The selection of people for the research groups was intentional. This means that obtaining fully representative distributions of socio-demographic characteristics in the composition of individual focus groups was not as important as saturation with people with maximally diverse and well-established attitudes, knowledge, judgments and opinions on the image, online communication and building relationships with the environment. It was also assumed, in accordance with the principles of grounded theory, that the data collected in individual groups will be compared with each other on an ongoing basis in order to extract codes from the focus groups that organize and interpret the research material. More generalized categories were then constructed (by grounding in similar cases) to show associations between categories (Konecki, Chomczyński, 2012; Hensel, Glinka, 2012).

In the FGI qualitative study took part 168 people, 84 leaders (board members) and 84 senior members of non-governmental organizations. The study covered 21 senior communities (non-governmental organizations and UTW) from all centers participating in the Social Innovation project as the third mission of the university. Respectively, rural areas were represented by organizations from the Nędza and Bobrowniki communes, communities from small towns were represented by organizations from Poręba, Łazów, Wojkowice, Lubliniec and Mikołów, from medium-sized cities by organizations from Tarnowskie Góry, Mysłówice, Zawiercie, Czechowice-Dziedzice, Jaworzno, Piekary Śląskie and as representatives of metropolitan environments The respondents are seniors from Katowice, Sosnowiec, Gliwice, Bytom, Chorzów, Tychy, Dąbrowa Górnicza and Rybnik. The focus group interview was conducted with each of the environments separately. The focus groups included equal percentages of representatives of the local University of the Third Age and the local Municipal Council of Senior Citizens competent for a given territory.

4. Results

The conducted focus research aimed, among other things, at examining the barriers limiting the introduction of social innovations. More precisely, the scope of occurrence of barriers concerning several components of objectified and conscious agency of leaders and members of Silesian senior non-governmental organizations and UTW was analyzed. In this subchapter, the author will first refer to the components of the structurally conditioned, i.e. objectified agency of the respondents. Secondly, the components of conscious agency will be analyzed, which are mainly a derivative of the reflectiveness of the leaders and members of the surveyed NGOs. An attempt will be made to answer the question: what structurally conditioned (objectified) agency barriers are perceived by the surveyed seniors in their innovative activity and what barriers of awareness agency limit their innovative activity, according to the respondents.

All types of barriers suggested by the participants of the analyzed group interviews and the connections between them have been synthetically presented on the perception map below, generated in the Atlas.ti program. The Atlas.ti tool enabled the generation of codes and their families, presenting the main categories of respondents' answers received from group interviews, as well as emerging terms that allowed for a clear presentation of research results. For example, one of the most significant codes is called "envy" and consists of two elements: the first is the grounding degree (21), which is the association of one code with other codes. This code has been classified as a family of codes (CF): barriers to innovation. The presented list of codes and code families was created on the basis of the analysis of 12 focus group interviews representing four organizations from large, medium and small cities, respectively.

The surveyed members of senior non-governmental organizations see several key groups of barriers in their social, economic and political environment as well as in interpersonal relations in organizations (jealousy, reluctance to implement innovations), limiting the implementation of social innovations. However, the lack of computer knowledge and skills, i.e. digital and communication competences stereotypically attributed to people aged 60+, is not one of these barriers and, according to the respondents, it is not a significant barrier conditioning their social agency. A telling proof of this is the low frequency of indicating difficulties resulting from digital competence deficits and lack of communication between barriers to innovation implementation, which is shown in Figure 1 (code: communication barriers - indicated by 4 FGI participants {4-0} and code: lack of specialist knowledge - indicated by 5 FGI participants {5-0}).

Both structurally conditioned barriers and awareness barriers of action, negatively conditioning the initiation, testing and implementation of innovations, were diagnosed. When it comes to objectified barriers, and more specifically the economic context, the participants of the group interviews emphasized the importance of financial constraints (code: finance {14-0}). In terms of significant barriers objectified in the political and cultural context, the following were selected: top-down approach to formulating and implementing policies and strategies (code: policy-related barriers {10-0}), lack of legal recognition (code: lack of access to information {4-1}); culture oriented towards state institutions instead of social institutions (code: no local government assistance {9-0} and code: bureaucratic barriers {6-0}).

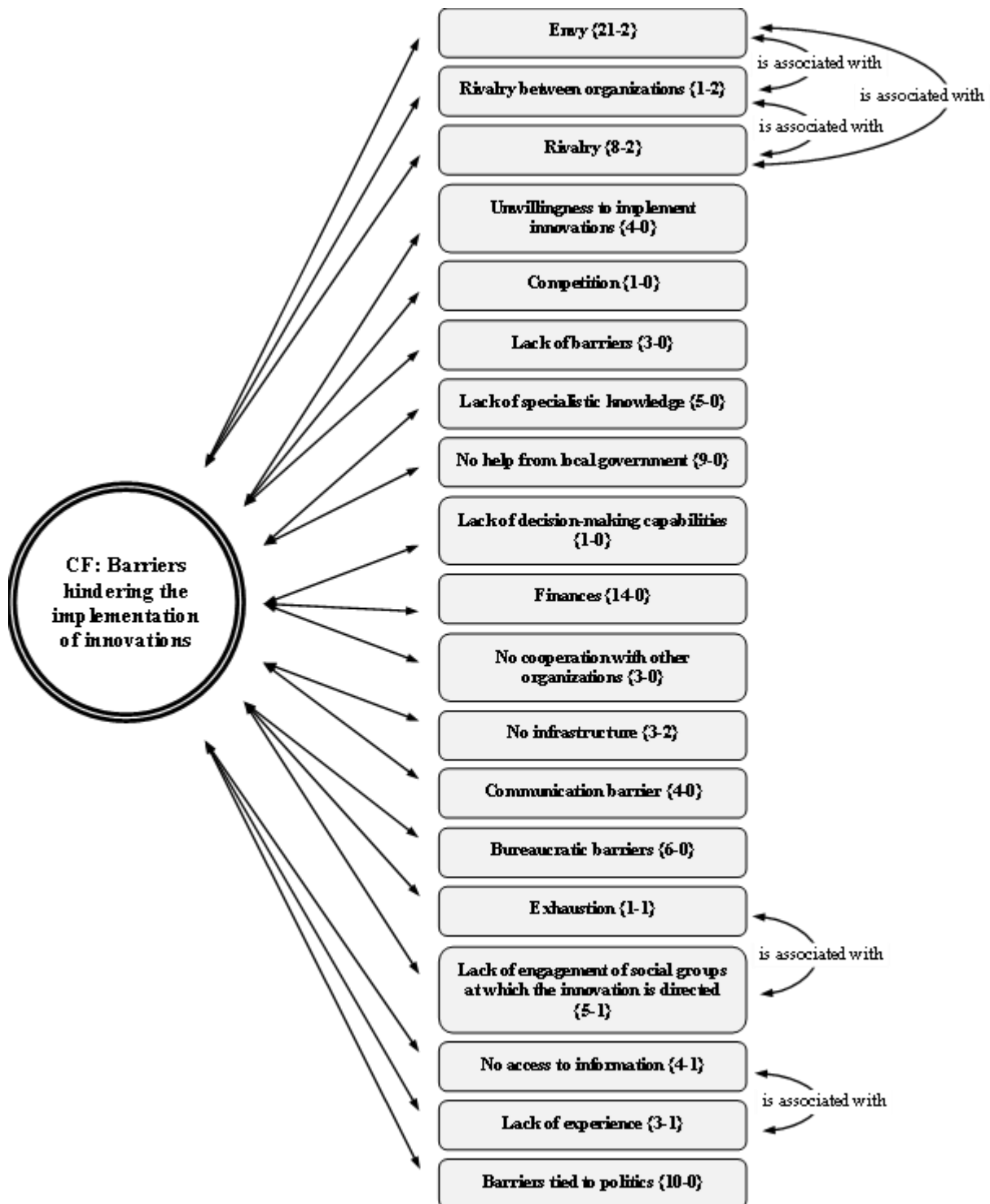


Figure 1. Code family perception map: barriers to innovation in senior NGOs.

Source: own work.

Barriers limiting social innovation in this area of agency, according to the respondents, additionally concern interpersonal relations, their complexity and intensity, tensions and conflicts within the organization, which determine the degree of their innovativeness. Among the barriers related to the agency of consciousness, the role of negative group emotions was strongly emphasized - jealousy and resentment (code: jealousy {21-2}), then the lack of consent of the environment for a joint approach to changes caused by innovation (code: lack of

involvement of the social group to which the address was addressed). there is innovation) {5-1}), a network of trust and cooperation in their communities that exists only to a limited extent or does not exist at all (code: rivalry {8-2} and code: rivalry between organizations {1-2}). In addition, the respondents pointed to agency limitations conditioned by the state of mind of both those implementing innovations and users (conservative), distrust towards other innovators (code: lack of cooperation with other organizations {3-0}).

These types of agency barriers result from everyday, unavoidable contact of all organization participants, regardless of their functions, often within organizational structures that are not fully defined in the functional context. They operate through personal and group competition, factionalism in perceiving and articulating group interests, initiating and implementing innovations, often being in opposition to specific group or environmental interests.

In the analyzed context, the phenomenon of jealousy deserves attention. The respondents pointed out that negative emotions, mainly envy and resentment, are a particularly important factor limiting the building of an innovative community. Its sources in the Polish political and cultural context can be seen in the ideological polarization of society (anti-European Catholic conservatism versus pro-European left-liberal secularism). Hence, rivalry (e.g. for funds) between circles and organizations is often burdened with ideological envy. There is also a more universal way of explaining this phenomenon. Helmut Schoeck has shown that envy is a universal negative social emotion (Schoeck, 1966). It is a certain anthropological constant that cannot be completely eliminated from social relations. It can only be reduced through conscious and consistent socialization to freedom, not to equality.

The results presented above prove the existence of deficits in the field of bridging social capital and the lack of interpersonal and group trust in the surveyed groups and organizations. A low level of bridging social capital and generalized trust in social interaction partners is a feature of Polish society historically perpetuated during the communist rule (1945-1989), which structurally inhibits the development of civil society and grassroots social innovations. This also applies to the surveyed environments and organizations.

What types of reflexivity dominate among respondents undertaking social innovations? According to Archer, the feature of agency is not only the ability of the subject to act, but it is also expressed in the very existence of this subject (Archer, 2007). Therefore, the very existence of organized seniors' communities as entities of collective action is proof of seniors' abilities. The dominance of morphogenetic activities and autonomous reflexivity of members is related to the essence and goals of these NGOs and the UTW. Because it is based on free and bottom-up participation, largely self-financing and prosumer orientation of its members and supporters.

Despite the presented deficits in the objective and awareness dimension, most of the respondents take organizational actions in accordance with the morphogenetic scenario, which is accompanied by a kind of autonomous reflexivity. Respondents are characterized by a critical and active approach to individual aspects of the organization's life and the local environment, which leads to social innovations in their environment. They are able to take advantage of the

opportunities offered by the structural and cultural context, avoiding the associated barriers. Has the knowledge and competence to actively participate in social networks, including social media. He is prepared to cooperate with the institutional and social environment of the organization.

In the paper presented, two research questions were raised. The two research questions were related to the following issues: (1) what structurally conditioned barriers of agency are perceived by the surveyed seniors in their innovative activities and (2) what agency awareness barriers are noticed by the surveyed seniors? As a result of the analysis of qualitative data from focus group interviews (FGIs), the types of agency barriers that negatively condition the initiation, testing and implementation of social innovation in the analyzed environments and non- governmental organizations were determined. In the area of structurally conditioned barriers, more precisely in the economic context, above all, the FGI participants emphasized the weight of financial restrictions. Bureaucratic barriers in local, regional, and central institutions, policies culture- oriented towards the actions of state institutions as opposed to social ones, and limited help from the local government were deemed to be the most significant barriers in political and cultural contexts.

Among the awareness barriers, the existing components of binding, non- bridging social capital, the lack of a strong social network in the communities, as well as rivalry between organizations, interpersonal and group envy, and other negative group emotions such as resentment were described as being the most serious. Furthermore, those examined pointed out the restrictions of agency conditioned by divergent group interests, states of minds of innovation implementers and users, a lack of trust toward the innovators, and a lack of agreement from the environment regarding a joint approach to changes created by innovations. When relating the types of agency barriers connected to the implementation of social innovation described above to the six stages of the innovation process provided in the “Open book of Social Innovation”—inspiration, proposition, prototype, maintenance, scaling, and system change—it should be stated that those examined most often are change inspirers themselves. They are the creators of the propositions of change, simulation, and prototypes executed on a small scale, e.g., in residential areas. Later, they gradually extend the scale of operations until actions move outside the city, region, and country.

The added value of the presented studies in the theoretical dimension is the operational specification of the morphogenetic scheme of causal analysis presented by Margaret Archer. In addition, the notion of structurally conditioned and awareness agency was conceptualized, which allowed the precise operationalization of the main research questions about agency barriers. Agency barriers that occur when implementing social innovations in the selected Silesian senior NGOs were identified. In terms of application, the obtained research results will allow for the implementation of educational and implementation projects (action research) that are adequate for the needs of a particular social group.

5. Discussion

The research results obtained prove that the respondents have a relatively high level of social agency. To a large extent, this was influenced by the social roles of those examined leaders and members of senior NGOs. These are mostly people with higher levels of education, who are leaders of local communities and organizations, who are relatively financially independent, and who have security in the form of a pension and savings, despite their age. They are professionally and socially active, possessing significant social capital at their disposal: bridging and binding. The attitudes of the respondents showed signs of autonomic reflexivity, which is conducive to innovation. A dysfunctional element of their generally pro-innovative reflexivity is the negative group emotions (envy) revealed by the FGI respondents. However, one has to introduce a stipulation concerning the specificity of the examined group, which is not representative of the larger population of retirees, and this changes the rather optimistic view of the results achieved. The author is aware of the fact that, for example, the digital and communicative competences of those examined may differ from the level of digital knowledge and skills of the majority of Poles of senior age. This opinion comes from knowledge regarding the level of education of those examined and from the managerial professional, social, and organizational roles and functions held by them, both in the past and currently. The extension of the research scope to include other Silesian senior environments, Universities of the Third Age, and non-governmental organizations and to undertake transregional and multinational comparative research remain tasks for the future. However, the fact that the vast majority of respondents belong to the so-called *intelligentsia*, which is historically a privileged part of society (about 15% of the population), makes them different from the wider Polish structural and cultural contexts. This context makes it difficult to construct comparative studies of social agency on an international scale, but does not exclude their construction.

6. Conclusion

As a result of the analysis of qualitative data from focus group interviews, identified by the leaders and members of senior NGOs, not only the previously existing types of structurally conditioned agency barriers, agency awareness barriers, but also specific barriers - agency barrier resentment, negatively conditioning initiation, testing and implementation social innovations in the analyzed environments and non-governmental organizations. Within the framework of structurally conditioned barriers, and more specifically the economic context, FGI participants emphasized the importance of financial constraints. Among the social barriers, the existing components of binding, not bridging social capital, as well as interpersonal and

group jealousy were considered the most serious. The most important barriers resulting from the political and cultural context were considered to be the existence of a top-down approach to the formulation and implementation of policies and strategies, the lack of legal and cultural recognition, a weak knowledge transfer policy, and a cultural orientation towards state rather than social institutions. In addition, the respondents pointed to the limitations of agency conditioned by divergent group interests, states of mind of those implementing and users of innovations, distrust towards innovators, including negative emotions - jealousy, lack of consent of the environment for a common approach to changes caused by innovations, lack of knowledge and skills in many areas of social life, limited existence or no network in their communities.

The task for the future is to extend the scope of research to other Silesian senior communities, Universities of the Third Age and non-governmental organizations, and in the long term to undertake supra-regional and supra-national comparative research. However, the fact that the vast majority of respondents belong to the intelligentsia, i.e. to a historically, culturally and largely economically privileged social class, significantly distinguishes the Polish structural and cultural context (15% of the population). This specific, Eastern European ethos context related to the overrepresentation of people with higher education among members of the UTW and senior non-governmental organizations may make it difficult to construct comparative studies on social agency on an international scale, but it does not exclude them.

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ETHICAL-THEORETICAL RECOMMENDATIONS FOR THE AREA OF CASE STUDIES OF NEW TECHNOLOGIES

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Purpose: The implementation effort of ethics involves actively entering the current discourse on new technologies, enhancing their credibility and minimizing ethical risks. Ethics can play an important role in enhancing their credibility.

Design/methodology/approach: The case method and its application can play an important role in this area. Case studies should not only be the result of specific research and their design but also take into account the current methodological requirements of applied ethics. By presenting a case study, we try to express the optimal variant of a case study and the application of these requirements.

Findings: We will try to point towards the establishment and development of the discourse of ethics and new technologies as well as the increasing potential of applied ethics and its constructive role in resolving ethically dilemmatic situations and creating preventive mechanisms for potential ethical failure.

Originality/value: The principles of utility minimisation and utility maximisation will trouble us for a long time to come as we introduce them into AI technologies. From this we can see that there will be mainly two dominant ethical theories - utilitarianism with the norm of minimizing the loss of life, health, suffering and deontological ethical theory with the ethical norm concerning the protection of the car passengers, their life. Personally, we would add the ethics of responsibility, which ethicists and lawyers will have to deal with because of not only material responsibility but also, say, loss of life. Here we can be partly inspired by the debate and conclusions on animal ethics.

Keywords: case study; new technologies; applied ethics; engineering and medical ethics; artificial intelligence.

1. Introduction

The origins of ethics date back to the period before the common era, when it was referred to as practical philosophy. It is important to say that it applied to the actions of so-called free beings. Already in the *Odyssey* (Homéros, 1966) we have the story of how Odysseus, on his return from the Trojan War, hanged a dozen of his female servants for bad behaviour. Because slave women were seen as property, Odysseus' actions were not considered unethical or inadequate. Since those times, ethics have evolved so that the moral attitudes of today are extended to all human beings. This has not stopped the development of ethics. On the contrary, Aldo Leopold (1887-1948) (Aldo, 1949, pp. 221-226; Kuzior, 2006, pp. 266-277), in his work *The Land Ethic*, pushed it further by expanding it to include the land, plants, and animals in addition to human beings. Since the Middle Ages, land as well as plebeians were considered property. Certain rights were exercised towards the land but no duties. Since the 1960s, various scientific initiatives (Peccei, 2005, pp. 39-46) to protect planet Earth and its climate have been emerging (Kuzior, 2014). The end of the 20th and especially the beginning of the 21st century has extended the limits of ethics to human products in the form of new technologies such as the Internet, artificial intelligence (AI), etc. (Kuzior, Kwilinski, Tkachenko, 2019, pp. 1353-1376; Fobel, Kuzior, 2019; Kuzior, 2021). This shift in ethics does not mark the final stop. We must therefore deal with the application of particular ethical theories - in the process of constructing and programming AI - in a way that avoids as much as possible the risks in practice. This is primarily due to the unstoppable progress in AI research and application, which itself brings into the debate questions of value as well as ethical attitudes in the field of rules of conduct, i.e. the use of AI (Kuzior, Sira, Brozek, 2022, pp. 69-90; Kuzior, Sira, Brozek, 2023).

In a short excursus we will try to indicate which of the ethical theories are applied in the construction and programming of artificial intelligence.

2. Ethical-theoretical recommendations for case studies

We begin with the oldest ethical theory, i.e. virtue ethics. Virtue – “the ability to act on the basis of certain accepted values” (Fobelová, 2002). It refers to a person who acquires it by life's practical experience, habit and practice. In AI, it would be mainly a combination of dianoetic (theoretical i.e. rational) virtues such as the capacity for wise judgment, scientific thinking and ethical (theoretical volitional) virtues that would be at the birth of AI programming. According to Aristotle, the combination of both kinds of virtues would mean that the rational person is the one who is able to find the middle way in his or her actions, and the wise person is the one who is able to pursue true happiness throughout his or her life. This ethical theory is therefore of

particular relevance to the selection of scientists, AI creators, but especially those who will use (pay for research and do business with) artificial intelligence.

The ethics of duty, with hints already appearing in the ancient ethical thought of the Stoics (4th century B.C.) and perceiving duty as a natural moral law or unwritten law for human actions (Tullius Cicero, 1913) above all a theory linked to the ethics of Immanuel Kant (Kant, 1990). For Kant duty meant the rationality of man. Man has a duty to do good for good's sake. This is deontological ethics, which examines man's moral motivation. All this is done against the background of Kant's view that we can substitute all things for other things, but we cannot substitute man for other man. The reason is that things have their price, but people have their dignity. So that man is never an instrument, a means to an end, but always a purpose, led Kant to explore the distinction between moral motive and utility, moral practicality and limited pragmatism. For both motive and purpose are present in moral decision-making. This is an important point for proper application to artificial intelligence if we want to apply an ethical dimension to this product. Compared to other ethical theories the deontological approach to the regulation of artificial intelligence (AI) is more in line with international agreements anchored by human rights and respect for human dignity, freedom (moral choice), equality and solidarity. We can see moral obligations as negative or as positive, but this does not solve the problem, because the universalistic understanding of morality and moral laws that apply universally to everyone in the same situation has long been invalid. Only the rational side of the will can constitute a moral valuation of action. Duty compels one's will and actions to honour moral laws that derive from reason. Such action is what Kant calls legality, in contrast to morality, which presupposes acting out of duty. Practical laws apply to the will, no matter what is caused by their causality. Deontological ethics (ethics of duty) is (should be) one of the supporting ethical theories in the creation of artificial intelligence (e.g. motive, intention to protect life in programming autonomous vehicles).

The ethics of utilitarianism (utility, benefit) has developed dominantly in parallel with deontological ethics (rationalism, rigorism) in a different cultural and mental environment (empiricism and hedonism). It is a type of ethics where the principle of utility from the position of the good for all is preferred as a moral criterion of action. What is ethically significant is not the motive or intention but the act and its outcome. J.S. Mill saw utilitarianism as the “art of living” as a unity of morality, politics and aesthetics. Utilitarianism is built on four moral principles:

1. Principle of Consequence.
2. Principle of utility (usefulness).
3. Hedonism (good as happiness, satisfaction).
4. Social (happiness for all concerned).

These moral principles are also fully applicable to artificial intelligence (autonomous vehicles). Conduct is subject to the rule of the majority at the expense of the minority. Man is responsible for all consequences of actions (even those he did not cause).

Utilitarianism is divided into act utilitarianism - an action is right only when it produces the best possible consequences (e.g. J.J.C. Smart, D. Regan - cooperative utilitarianism, D. Holbrook - qualitative utilitarianism, etc.) and rule utilitarianism (rule utilitarianism) - an action is right only when it follows a certain chosen rule valid in a society, social group. (R.B. Brandt, J.C. Harsanyi, P. Singer - preferential utilitarianism). Preferential utilitarianism considers an act as morally right only when it corresponds as closely as possible to the preferences of all beings affected by the act. A person who chooses an act should be informed about all possible alternatives to a future act. That person should think logically without prejudice or emotion in the decision-making. Consequentialism in its non-utilitarian form is an attempt to solve a problem by minimizing suffering, unhappiness.

The following three aspects of utilitarian ethics are essential:

1. Consequentialist - acting to bring about the best possible consequences.
2. Eudaimonistic - maximum happiness for maximum number of people.
3. Hedonistic - maximum pleasurable or maximum satisfaction of desire, happiness, pleasure, delight.

These principles include the principle of impartiality, which states that a moral subject should (must) attribute the same value to the needs of all moral subjects with the same consequences in his/her decision-making.

Based on the above, we can conclude that this ethical theory represents a type of ethics that is relatively easy to apply in practice, albeit with some difficulties. The principle of impartiality may run into a possessiveness problem. If someone owns an AI product (e.g. a robot or an autonomous vehicle) who is it supposed to serve? Would it be ethically acceptable for it to serve only the owner? Or should it constantly evaluate in the spirit of the theory in question and act on the basis of maximizing utility, benefit for all? Because in practice, we would expect the norm to apply that when we are the owners the AI will serve us. We would have to program the AI not with a pure version of utilitarian ethics but to combine it with a deontological norm (the duty to always favour the AI owner).

If we combine a form of non-utilitarian consequentialism i.e. negative utilitarianism (K.R. Popper) emphasizing the minimization of suffering, misfortune, and the use of autonomous vehicles (AV in practice), it may mean that in the spirit of ethical theory the AV will sacrifice the crew in case of their crash if the utility of their sacrifice is even slightly greater than the utility of not sacrificing them. If it's not supposed to protect me and the people present in the car, then why should we acquire it? The research and production of autonomous vehicles has a highly humane goal of reducing the number of road casualties ideally by up to 93%. However, assuming it highly protects the car's occupants at the expense of pedestrians, the moral credit of the autonomous car with humans vanishes. The designers of AV attempt to solve this moral dilemma by combining in some proportion a type of utilitarian and deontological ethical theory. It is necessary to identify the limit, the boundaries of acceptability of using both theories for the sake of the objective i.e. preservation of human life, health as well

as property. It would be a technical and ethical hybrid of the autonomous vehicle. This is not quite feasible in practice, because it is difficult to predict what will happen when the limit of one or the other ethical theory is exceeded even minimally. Hence the difficulties in determining the consequences of an action (these concern mainly the utilitarian ethical theory because the deontological one is directed to the motive of the action), which mainly concern the quantification of the maximization (minimization) of the good (evil, harm) - life, health, death, fractures, amputations, etc. Ultimately, such “bargaining” sounds absolutely immoral, inappropriate. One healthy person can save 5 lives by transplanting 5 organs, and so killing or letting die this healthy person is theoretically consistent with utilitarianism. We will not encounter a pure classical or non-classical form of utilitarian ethical theory in the field of artificial intelligence for the above reasons, even though it appears that it would be applicable to its control algorithms.

In the second half of the 20th century, deontological ethics was followed by the ethics of responsibility (H. Jonas), especially in the field of environmental protection. It is an ethical responsibility based on the voluntariness of the commitment we make, based on four components: who is responsible, to whom, for what and according to what criteria. With this ethical theory, some problematic questions about artificial intelligence (autonomous vehicles - AV) come to the fore Who will be responsible - the producer, the owner, the AI?

Finally, but not excluding all ethical theories, we will focus on the ethics of principles by V.R. Potter (Potter, 1971), one of the oldest in applied ethics, which emerged in bioethics and is currently experiencing its twilight. The ethics of principles is based on what are known as - *prima facie* - principles, namely:

1. Beneficence acts as a moral norm in a positive aspect. As far as artificial intelligence (AI) is concerned, it will be required to behave and act beneficially towards humans at all levels.
2. Non-maleficence as a moral norm says that if you cannot help at least do no harm, i.e. do not cause evil, misfortune, suffering, which also applies to AI in relation to human life, their health - physical and mental, protection (quality) of the environment, animals, plants and climate in general.
3. Autonomy - this is the free informed choice to lead a good life according to one's wishes. Artificial Intelligence (AI) is ordered in the form of moral norms not to lie, not to restrict movement, freedom, etc.
4. Fairness - a moral norm addressing the issue that everyone must get what is due to them while maintaining fairness in various spheres of life provided by the AI.
5. Transparency - accountability as a moral norm specifies this principle of AI ethics in requiring auditability and intelligibility by humans. People's life with artificial intelligence is present therefore we need to increase people's trust for it.

This ethical theory only works when all the principles are positively fulfilled, which is impossible in practice (as the practice of bioethics shows).

Situational ethics - deals with real, concrete phenomena, processes that cannot be predicted. Man exists in each situation uniquely unrepeatably, and therefore general, universally valid ethical norms cannot apply. A normative view is only deducible from a particular situation. Using this type of ethical theory would mean producing every single model of, for example, an autonomous vehicle in custom form, which would be costly and would not satisfy most people.

4. Case study: Caterpillar or calculator - autonomous vehicle

Statistics show that the majority of road accidents is caused by the human factor. Worldwide, 268,087 people have died in these accidents as of March 15, 2022 (www.worldometers.info/sk/14.3.2022). It is therefore a moral challenge for the engineers - the designers of artificial intelligence (autonomous vehicles) - to work on this project so that the responsibility is not shifted to artificial intelligence alone. A few autonomous vehicles have already been produced and are on the roads around the world.

In one of the world's metropolitan areas lives a more financially well-off family XY. The wife CD of a wealthy but mainly busy businessman ED, with their two minor children, longed for an autonomous vehicle that would make her life easier, but mainly ensure her safety, given that she is not an experienced driver. The husband ED agreed to the suggestion and subsequently bought the autonomous vehicle for his wife CD. She used it without any problems until she has a collision with another vehicle and both vehicles burst into flames. Fortunately, this collision resulted in minor injuries to the passengers in the autonomous vehicle, but unfortunately one person from the non-autonomous vehicle died. The wife CD began to be troubled by a moral dilemma regarding the safety of non-autonomous vehicles and the extent of her safe car's liability.

Hypothesis: *We assume that the wife CD will be more interested in the safety of the autonomous vehicle (assumed ideal safety is 93%) than in the consequences of collisions with other vehicles.*

Solution alternatives

1. The wife CD refuses to continue using the autonomous vehicle due to the consequences that remain with non-autonomous vehicles.
2. The wife CD, although frightened by the deaths of other passengers, decides to continue to use the autonomous vehicle because of the desirable consequences to her from collision with non-autonomous vehicle.
3. The wife CD learns from the experience and seeks to communicate the experience of using an autonomous vehicle in practice, so that conclusions are not drawn from laboratories or a single case only, but become paradigmatic.

The first alternative - to abandon the use of an autonomous vehicle - means fleeing, i.e. from the position of virtue ethics, it is a certain, if partly understandable, cowardice. From the position of the ethics of responsibility - who? - the wife CD is responsible (for what?) for the safe use of the autonomous vehicle (with respect to whom?) with respect to herself, her family and society (according to what criteria?) according to the supreme value, which is life, which every normal person cherishes, this is also assessed as a negative action. Given that she is one of those people who can afford this type of vehicle it is (should be) her duty - an ethic of duty based on reasonableness to help create safer transport.

The second alternative of getting scared and so preferring the use an autonomous vehicle so that no one threatens her and the children is commendable but supremely selfish from a position of virtue ethics. From the point of view of the ethics of utilitarianism - utility maximisation, happiness maximisation - this is also a negative attitude. Ensuring the greatest possible safety for oneself and loved ones may be a duty but it should not be at the expense (against the categorical imperative) of other road users.

The third alternative is balanced. The mother attempts to provide security for herself and the children, which from the aspect of virtue ethics we evaluate positively as bravery. From the perspective of responsibility ethics, this is a positive attitude towards herself and the children on the part of the mother CD (who?) with respect to her family and society (with respect to whom?) for safe transport (for what?) according to the expected benefits of this autonomous vehicle (according to what criteria?). It is also a reasonable duty of the mother CD in the spirit of the rules of the ethics of duty.

Solving the ethical dilemma

From the position of normative ethical theories, we consider the optimal solution to the moral dilemma to be the alternative listed as the third. In the ethics of the 21st century we observe a certain retreat from absolute universalism and at the same time the emergence of particularism, pluralism or discourse ethics, norms of contextualism and coherentism.

Therefore, the reasonable position of the wife-mother CD to use an autonomous vehicle, but to share the experience of it with the designers not only technical but also moral, is to be valued highly especially from the position of virtue ethics - as wisdom. From the aspect of the ethics of utilitarianism, we will especially highlight the maximization of utility, happiness and the minimization of suffering. So the moral algorithm driving the autonomous vehicle should accept, according to this ethical theory, the minimization of suffering, unhappiness, etc. If we choose the standards of the ethics of duty - even on the basis of rationality we would remain in the plane of the protection of the passengers of the autonomous vehicle, in other words, the owner (or those to whom he/she would give the vehicle to use) and his/her life would be taken into account. The *prima facie* standards (harmlessness, beneficence, autonomy, justice, responsibility) would only partially work with this AI. In terms of the ethics of responsibility, the mother-wife CD (who?) acted responsibly for safe transport (for what?) with respect to

herself, her family and society (with respect to whom?) according to her conscience and the values (especially the value of life) recognized by society.

This position is also viewed positively from the perspective of an ethic of fairness, which would ensure equal opportunity for all those involved in transport, and beyond, without guilt or remorse for doing the wrong thing.

The hypothesis was not confirmed because wife CD approached the solution wisely and sensibly.

4. Conclusion

If all interested parties would like autonomous vehicles to fulfil a moral status, we have no choice but to seek and find a balance (a norm of coherence) between the ethical requirements of their potential users and the regulation of the “behaviour” of autonomous vehicles in non-standard situations - in an accident, a collision, etc.

From this we can see that there will be mainly two dominant ethical theories - utilitarianism with the norm of minimizing the loss of life, health, suffering and deontological ethical theory with the ethical norm concerning the protection of the car passengers, their life. Personally, we would add the ethics of responsibility, which ethicists and lawyers will have to deal with because of not only material responsibility but also, say, loss of life. Here we can be partly inspired by the debate and conclusions on animal ethics.

The principles of utility minimisation and utility maximisation will trouble us for a long time to come as we introduce them into AI technologies.

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IMPACT OF FISCAL AND NON-FISCAL FACTORS ON THE MUNICIPAL DEBT: THE CASE OF WIELKOPOLSKA REGION IN POLAND

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Purpose: The aim of the paper is to examine indebtedness factors in the field of the structure of own revenues and expenditure as well as spatial relationships on the example of municipalities of the Wielkopolska Region in Poland.

Design/methodology/approach: The subject literature was studied to present miscellaneous predictors of the indebtedness of the local governments. Then, using the fiscal, socio-economic, and political variables for 222 municipalities from Wielkopolska Region in Poland, panel data models with fixed effects were estimated for the period 2010-2021, and the spatial autocorrelation statistics.

Findings: There is a direct relationship between the share of PIT and CIT in own revenues and the indebtedness of the municipalities. Furthermore, the decrease of the unemployment and the growth of the business density contribute to the decrease in the debt to revenues ratio. In addition, the increase of the indebtedness resulted from an increase of the investment activity, the share of spendings on wages as well as the expenditures on education. The use of EU funds also stimulates the indebtedness of the municipalities. Moreover, in 2018-2021 the territorial proximity affected the weak, positive correlation of the debt to revenues ratio between the municipalities.

Research limitations/implications: The research presents the predictive power of the applied variables, which contributes to the identification of the role of the predictor in the creation of debt.

Practical implications: The research study is aimed at the estimation of the models, which could be applied to predict the level of the indebtedness in the municipalities.

Social implications: The research contributes to the higher recognition of the relationships between the changing fiscal, economic and political circumstances on the indebtedness of the municipality, e.g., in the process of creating local strategies.

Originality/value: The study examines the indebtedness factors concerning the composition of the own revenues and expenditures, as well as the socio-economic issues and spatial relationships, considering the predictive power of each factor.

Keywords: municipality, debt, predictors, panel models, spatial autocorrelation statistics.

Category of the paper: Research Paper.

JEL Classification: E62, H72, H74.

1. Introduction

Predictors of the indebtedness of the local governments are key factors determining the fiscal situation of the local public finance. The theorists indicate both negative and positive aspects of incurring the debt. This is one of the sources of financing the capital spendings of the units in the process of the local development. Thus, the creation of new investments might increase the possibility of generating revenues in the future in the form of the local taxes and fees, as well as contribute to the satisfaction of residents or raising the standard of living (Owsiak, 2022, p. 110). Funding investment activity through debt also ensures intergenerational equity in the case of insufficient level of revenues. In turn, for the case of the operational debt there is no reasonable moral justification for increasing its level (Drew, 2020, p. 153). Thus, the use of debt for financing current tasks shows a structural maladjustment of the system of the financial receipts for local authorities. Low-restrictive budget policy (high debt ratio) (Owsiak, 2022, pp. 128-130), in contrast, is associated with higher future debt repayments. Simultaneously, a higher share of these outflows in relation to total spendings increases the probability of the fiscal distress (Gregori, Marattin, 2019, p. 1271). Hence, the indebtedness of the municipalities determines this distress (Galiński, 2022, pp. 102-105; Galiński, 2021, pp. 411-425) as well as a financial sustainability, perceived as the ability to meet service and financial commitments and to apply and maintain current policies without increasing level of the borrowing (Frintrup, Hilgers, 2023, p. 4).

In the subject literature, there are various studies on the determinants of the municipal debt. However, some of them show different outcomes. In many cases, this results from the applied set of variables, which should be adjusted to the regulations in the state and the practical frameworks of the functioning of the local government in the country. Numerous studies put pressure on the influence of changes in the level of revenues, expenditures, population on the indebtedness, analysing often aggregate data (Serbes et al., 2022, p. 145; Alińska et al., 2021, p. 121; Ehalaiye et al., 2017, p. 519; Wichowska, 2019, p. 124), and do not assess the impact of the budget composition, socio-economic structure, or potential spatial relationships amongst municipalities. Furthermore, the local units, which are functioning in the close proximity, may interact with each other due to the common characteristics.

Therefore, the aim of the paper is to examine indebtedness factors in the field of the structure of own revenues and expenditure as well as spatial relationships on the example of municipalities of the Wielkopolska Region in Poland. In addition, the research study is aimed at the estimation of the models, which could be applied to predict the level of the indebtedness as well as ordering the examined predictors according to their predictive power. This, in turn, may contribute to the higher recognition of the relationships between the changing fiscal, economic and political circumstances on the debt of the municipality, e.g., in the process of creating local strategies.

To attain the aim of this research study, the following hypotheses were formulated, i.e.:

- Hypothesis 1 (H1): There is an inverse relationship between the indebtedness of local government and the share of PIT and CIT inflows in own revenues, where the share of PIT has the higher predictive power.
- Hypothesis 2 (H2): There is a direct relationship between the indebtedness of municipality and the share of expenditures on wages in the total, which has the high predictive power.
- Hypothesis 3 (H3): The growing investment activity and the engagement in spendings on education results in a growth in the debt to revenues ratio of municipalities.
- Hypothesis 4 (H4): There is a direct relationship between the indebtedness of local government and the share of pre-working age population, since this population determines the expenditures on education.
- Hypothesis 5 (H5): The unemployment ratio and the business density have respectively positive and negative relationships with the debt to revenues ratio of the municipality.
- Hypothesis 6 (H6): Spatial proximity between local governments influences their indebtedness.

The novelty of this study is the examination of indebtedness factors concerning the composition of the own revenues and expenditures, as well as the socio-economic issues and spatial relationships, considering the predictive power of each factor. The applied research procedure contributed to showing the importance of the indebtedness predictors in the municipalities. The paper studies 222 municipalities from Wielkopolska Region in Poland, taking into account their certain relationships and similarity, e.g., access to funds from the European Union (EU) under the regional operational programme, functioning under the common regional development strategy of the voivodship prepared by its board, or similar environmental and geographical circumstances.

2. Literature review

The subject literature distinguishes certain reasons for the increase of the local government debt, which results primarily from the imbalance in the budget. Simultaneously, this imbalance may arise from internal (depending on the activities of local units and their financial condition) and external (the micro and macro circumstances). Thus, it concerns the specificity of revenues and expenditures. The revenue factors include the method of planning and collecting certain funds, their types, efficiency, and stability against the background of financial autonomy and independence. In turn, expenditure factors are analysed in the context of the scope of the tasks, the way they are planned and performed, their structure, taking into account the division into current (operating) and capital (investment) expenditures. Therefore, the local debt is perceived

as external resource of financing the budget deficit and financial shortages. Poniatowicz (2018, pp. 201-203) indicates issues, which lead to the borrowing for the local government activity, i.e.:

- the long-term budget deficit;
- the extensive public spending, e.g., due to the economic crisis;
- a faulty structure of public expenditures, especially due to dominance of the rigid expenditures. It is worth adding that budget rigidities stem from institutional arrangements which limit the budgetary authorities' ability to adjust the composition and the size of the budget in the short run (IMF, 2006, p. 28). In addition, the spending rigidity includes those categories which address rights and guarantees established by various types of regulations (Cetrángolo et al., 2010, p. 19). Therefore, the rigidity of some social expenditures (especially concerning education and health care) results from its legal stiffening, aimed at establishing certain guarantees to deliver this type of public goods appropriately (MF, 2015, p. 4);
- an implemented economic policy assuming conscious maintenance of the budget deficit and public debt as intervention instruments.

Furthermore, arguments for the need to incurring the debt are also highlighted, i.e. (Poniatowicz 2018, p. 203):

- an inadequate level of own revenues, especially in relation to the scope of the obligatory tasks, and thus limited fiscal capacity, identified as the ability to raise revenues from the own sources to finance required expenditures (Malinowska-Misiąg, 2020, p. 113). However, it may appear a situation, in which the municipalities financing most of their activities from intergovernmental funds present a lower level of indebtedness (Ramírez Camberos, Poom Medina, 2013, p. 88). On the other hand, in larger municipalities with the higher share of own resources in comparison to both medium-sized and small units, per capita debt can be higher. Therefore, the indebtedness might be driven by the composition of the own revenues (Horvat et al., 2020, p. 1089);
- the principle of intergenerational equality, which envisages the shifting part of the costs of the infrastructure investments, which were previously financed with the generated debt, to future generations due to the long-term use of these assets. It is also about the even distribution of fiscal burdens over time, i.e., within the functioning of individual generations (Gelfand, 1979, p. 550);
- the high cost and time-consuming infrastructural investments;
- an instability of investment expenditures;
- an access to non-refundable grants, which require own contribution, often in the form of the additional debt. Therefore, the debt is perceived as an instrument increasing the absorption capacity of the EU funds.

Analysing the relationships between the indebtedness and the revenues it is crucial to examine the revenues' structure, especially in the field of own revenues. Białek-Jaworska (2022, p. 970) found positive relationships between both tax visibility and the property tax burden variables with a local government's short-term and long-term debt. This, in turn, determines the expansion of the indebtedness. Moreover, unit's overall revenue diversification does not allow to collect enough funds to fulfil the needs of the local society, and only tax revenue diversification enables to decrease the short-term debts. It is worth adding that the revenue diversification is a strategy of effective fiscal management, aimed at a decrease of the instability of the overall tax revenues and can contribute to a more favourable business climate or soothe taxpayer discontent (Białek-Jaworska, 2022, p. 935). In the public sector the growth of the real interest rate on the debt may force the government to increase tax revenues to service the liabilities (Montiel, 2005, p. 271). Therefore, the composition of own revenues and the tax autonomy can stimulate the borrowing policy. In addition, the structure of own revenues reflects the circumstances of the local economy, i.e., the urbanization, situation on the labour market, households' incomes, the entrepreneurship, or the industrialization. Thus, a development of the municipality is affected by a high level of own revenues, revenues derived from sharing taxes, i.e., Personal Income Tax (PIT), and Corporate Income Tax (CIT), and the indebtedness (Standar, Kozera, 2019, p. 18). These shared taxes show higher procyclical magnitude of responses in comparison to local taxes, especially property taxes (Dybnikova et al., 2021, pp. 18-30). PIT and CIT, as shared taxes, are also affected by the regulatory changes, implemented by the central authorities.

The debt burden is also determined by the growth in fixed expenditures, especially the extensive level of the expenses for salaries. Their value in relation to other budget categories, e.g., total expenditure or current revenues, provides information on the budget rigidity (Scartascini, Stein, 2009, p. 14). Hence, their drop indicates the larger flexibility of the budget and the ability to adjust to unexpected events, economic downturn, or less pressure to generate new short-term liabilities. The concentration of expenses in the relatively rigid category means that local units may have difficulties to balance the budgets in the contexts of sudden changes in the structure and size of revenues (INC Rating, 2018). Muñoz and Olaberria (2019, p. 30) add that budget rigidities constrain the ability of the authorities to modify and adjust the size and structure of the public budget, especially in the short term. The wages, in contrast, are components of the fixed costs (OSC, 2015, p. 2) and their high share in operating expenditures may increase the pressure on debt growth due to insufficient fiscal capacity.

On the other hand, municipal indebtedness is stimulated by certain economic factors (Galiński, 2015, pp. 379-380), e.g., the unemployment, the entrepreneurship and the inflows of the businesses, and the demographic predictors, e.g., the level and the structure of the population. These aspects affect both the revenue and the expenditure sides of the local budget. However, in many cases the empirical calculations in the studies show different results. Feld et al. (2011, pp. 60-61) estimated that the unemployment rate has not a statistically

significant effect on per taxpayer public debt, whilst Veiga and Veiga (2014, pp. 31-32) revealed the significant direct relationship between the unemployment and the real gross debt to the three-year moving average of total effective revenues. Wassmer and Fisher (2012, p. 61) indicated that public school enrollment significantly influenced outstanding state and local government debt. Regressions of Bellot et al. (2017, p. 59) show, in contrast, that the share of the population over 65 years old may reveal disparate signs of the coefficients in the econometric models on the local indebtedness factors for different countries, indicating direct or inverse relationships between the studied variables. According to the findings of Wichowska (2019, p. 126) the proportion of the post-working age population in total population was significantly and positively correlated with per capita short-term debt in the studied units, while the number of businesses per inhabitants was not included in the final model with significant variables. Valkama and Oulasvirta (2021, p. 447), analysing the Finnish municipalities, showed that these units run into debt while the share of 65 and over population increased substantially. This could be examined in the context of urbanization. This results from the facts that the scale of local government debt is significantly driven by urban expansion (Yan et al., 2021, p. 1) and upfront capital expenditures required for many types of municipal systems (Kirkpatrick, 2016, p. 49).

The level and structure of local entrepreneurship, in turn, were the key factors influencing the revenue autonomy of the analysed municipalities by Wichowska and Wierzejski (2019, pp. 80-83). It results from the fact, indicated by these authors, that local entrepreneurs generate a substantial portion of a municipality's own-source revenues. In addition, these entrepreneurs are responsible for the part of income generated by CIT. Thus, the scholars claim that the insufficient amount of non-repayable financing and the restricted financial autonomy of municipalities to be among the reasons behind growing indebtedness (Kozera, Standar, 2020, p. 18). Klapper et al. (2010, pp. 130-136) presented that business density (the number of registered businesses as a percentage of the active population) is significantly related to indicators of economic development and growth in the country.

In the subject literature, political factors are also included in the studies as debt determinants. This results from the concept of the Political Budget Cycle (PBC), which refers to increases in government spendings or in the deficit, in an election year or preelection years. This is motivated by the incumbent's desire for reelection (Bonfatti, Forni, 2019, p. 327). The PBC also suggests that there is a debt expansion immediately before elections by the ruling party in an intent to promote its re-election (Benito et al., 2021, p. 2). Cuadrado-Ballesteros et al. (2013, p. 701) highlight that public debt has been used strategically by politicians to manipulate voter's preferences and to affect the voting results. Geys (2007, p. 247) revealed that in Flemish municipalities in an election year there was a strong increase in a debt growth between one- and two-party governments, whereas the additional increase was much more modest in coalitions consisting of three or more parties. Bohn and Veiga (2019, p. 448) argue that high-debt governments often face recessions, which force them to manipulate fiscal policy

more when elections are approaching. Therefore, fiscal rules have been found to reduce public debt (Gootjes et al., 2021, p. 3). However, Delgado-Téllez and Pérez (2020, p. 233-239) indicated that political variables and fiscal rules strength do not seem to have a noteworthy effect on the debt of the analysed units. The theorists also suggest that political ideology may affect indebtedness because left-wing authorities prefer larger public spendings covered by the borrowing in comparison to right-wing governments (Seitz, 2000, p. 184). In the group of the political factors coincidence of the political party between the local executive and the central government and the political fragmentation are also studied (Basílio, Borralho, 2021, pp. 7-8). Basílio and Borralho (2021, p. 16) found that less debt is present in municipalities which are ruled by a partisan of the same political orientation as the authorities at the central level. Moreover, in-between the elections, the probability of deficit is lower than in election year (Działo et al., 2019, p. 1046)

In the subject literature, in the estimations miscellaneous local (sub-national) debt predictors are considered within certain categories, which in most of the cases are adjusted to the fiscal regulations (e.g., revenue composition) in the country, i.e.:

- 1) financial and institutional (Ehalaiye et al., 2017, p. 519),
- 2) fiscal and financial, socioeconomic and political variables (Balaguer-Coll et al., 2016, pp. 516-519),
- 3) institutional, political, and ideological, fiscal, economic and financial forces (Ribeiro, Jorge, 2014, p. 70),
- 4) political, demographic, size, budgetary and economic indicators (Bellot et al., 2017, pp. 55-57),
- 5) financial, political, and socio-economic variables (Veiga, Veiga, 2014, pp. 11-12, 31),
- 6) budgetary variables in the field of revenues and expenditures (Alińska et al., 2021, pp. 118-119),
- 7) fiscal and financial conditions of units, economic and geographical position, social factors (Medvednikova, 2022, p. 538),
- 8) fiscal situation, political factors, indicators of inter-municipal cooperation (Pérez-López et al., 2014, pp. 197-201),
- 9) fiscal, institutional, political, external crisis appearance (del Castillo et al., 2022, pp. 8-9).

Thus, the predictors of the municipal indebtedness in specific countries are usually discussed under two broad categories, i.e.: financial (such as capital expenditure, taxation/revenue issues) and socioeconomic/political determinants (such as population/size, government fragmentation, debt regulations) (Ehalaiye et al., 2017, p. 515). Macroeconomic policy measures are also included. Nevertheless, the mentioned studies do not examine the spatial associations between local public units in the field of their indebtedness. However, certain relations may appear due to similar policy and structure in the field of revenues or expenditures because of common task performing, similar demographic structure

or economic conditions as well as an impact of the regional development strategy. It might be also driven by the access to non-refundable funds for programs and projects, where the own contribution is required, e.g., in a form of debt, within the existing system of their absorption in the region (voivodeship in Poland) and its specificity for this region. At the basis of the analysis of possible spatial associations is the First Law of Geography, developed by W. Tobler, which indicates that everything is related to everything else, but near things are more related than distant things. In turn, the Second Law of Geography states that the phenomenon external to area of interest determines what goes in the inside (Ghemawat, 2017, p. 3). Thus, it is worth analysing possible similarities on the debt to revenues ratio between the neighbouring local governments.

3. Data and Methodology

To examine the debt predictors of municipalities the paper studies 222 local units ($N = 222$) from the Wielkopolska Region in Poland in the years 2010-2021 ($T = 12$). The panel does not include four cities with the county rights (ccr) from this region since they are characterized by additional sources of revenues and tasks. The article uses the available data provided by the Central Statistical Office (CSO) in Poland as part of the Local Data Bank as well as the Ministry of Finance (MF) in Poland as a part of a database containing the debt level of the municipalities.

Due to the aim of the article and the longitudinal data, panel models were applied. These models have greater capacity for capturing the complexity of unit behaviour in comparison to a single cross-section or time series regressions and can control the impact of omitted or unobserved variables (Hsiao, 2007, p. 3-4). The simplest estimator for this data is the pooled OLS (Ordinary Least Square) model, in which all units, i.e., municipalities are assumed to be homogeneous (Das, 2019, p. 501). However, this is unlikely to be adequate, but it does provide a baseline for comparison with other types of the regressions, i.e., fixed effects models and random effects models (Cottrell, Lucchetti, 2022, p. 204). The pooled OLS model may be written as (1):

$$y_{it} = x_{it}\beta + u_{it}, \quad (1)$$

where:

y_{it} is the dependent variable for the cross-sectional unit i , i.e., municipality of the Wielkopolska Region, Poland in the period t ,

x_{it} is a $1 \times k$ vector of independent variables for municipality i in the period t ,

β is a $k \times 1$ vector of the parameters to be estimated on explanatory variables,

u_{it} is an error term specific to municipality i in period t .

The application of the type of the final longitudinal model resulted from the calculation of the Wald test (the F statistic), the Breusch-Pagan test (the χ^2 statistic) as well as the Hausman test (the χ^2 statistic) (Greene, 2003, pp. 283-301). In this paper the regressions with fixed effects were applied, in which u_{it} is decomposed into a unit-specific and time-invariant constant coefficient, α_i , and an observation specific error, ε_{it} . This model is as follows (2):

$$y_{it} = x_{it}\beta + \alpha_i + \varepsilon_{it}. \quad (2)$$

As consequence of a failure to meet assumptions of the distribution of residuals (the presence of the heteroscedasticity, verified by the Modified Wald test - χ^2 statistic, and the autocorrelation checked through the Breusch-Godfrey test for serial correlation - χ^2 statistic, as well as cross-sectional dependence, verified by the Pesaran test), the clustered standard errors were applied (Hoechle, 2007, p. 285; Janda, Zhang, 2022, p. 203). During the model estimation, the Variance Inflation Factor (VIF) was also calculated to control the potential problem of the multicollinearity (Bandyopadhyay, 2022, p. 200) with a rule of thumb indicated in Pesaran (2015, p. 70). For the final models there are presented goodness of fit measures: within R^2 , LSDV R^2 and Akaike Information Criterion (AIC), as measures of a predictive power (Lewis-Beck et al., 2004, p. 983; Maindonald, Braun, 2010, p. 187), as well as the Root Mean Square Error (RMSE).

In the regressions the debt to revenues ratio, % (Debt Ratio) of the municipalities was applied as the dependent variable in the models.

Taking into consideration the aim of the paper and the literature review, to identify the factors affecting the dependent variable, a certain set of independent variables is investigated, i.e.:

A. in the group of fiscal factors:

- 1) Investment expenditures in total expenditures, % (InvestExp) – this variable shows the significance of the capital spendings and the engagement in restructuring of the local economy.
- 2) Expenditures on Wages in Total Operating (Current) Expenditures, % (WagExOp) – this variable presents the share of the wages in the sphere of the current activity as fixed costs, which are not flexible in the short term.
- 3) Expenditures on Education in Total Expenditures, % (EduExp) – this ratio shows the significance of the most important task in the municipalities. In addition, expenditures on the education are spent under the strict regulations and affect rigidity of the budget. In Poland in the municipalities, the expenditures on education (section 801 in the budget) out of all budget categories (functions) have the highest share in the total spendings, e.g., 31% in 2017 (Statistics Poland, 2018, p. 89).
- 4) Personal Income Tax Revenues in Own Revenues, % (PITinOR) – this variable indicates the importance of the PIT in own revenues.
- 5) Corporate Income Tax Revenues in Own Revenues, % (CITinOR) – this variable shows the importance of the CIT in the own revenue.

- 6) Tax on Real Estate in Own Revenues, % (TREinOR) – this variable indicates the importance of the tax on real estate in own revenues and thus the circumstances of the local economy and the scope the fiscal autonomy.
- 7) Capital Revenues in Total Revenues, % (CapRev) – this ratio shows the significance of the grants and funds for investments, the inflows of the sale of assets and from the transformation of the right of perpetual usufruct into the right of ownership.
- 8) Revenues financing and co-financing the EU programs and projects *per capita* (EUfunds) – this ratio presents the engagement in the EU programs and projects to restructure local economy. Medve-Bálint and Bohle (2016, p. 22) found a direct relationship between local debt and EU funds in two very different territorial-administrative settings, i.e., in Poland and in Hungary.

B. in the group of socio-economic factors:

- 1) Business Density (BusinDen), as a number of companies per inhabitant (00s) in mobile age (18-44) population – this predictor represents the level of the entrepreneurship and its intensification. This also refers to the possibility of collecting the shared taxes in the area.
- 2) Unemployment Ratio, % (UnempRatio), as the number of the unemployed to the working-age population, which is an unemployment measure (Garloff, Carsten, Schanne, 2013, p. 399) – this ratio shows the conditions on the labour market and the loss of the capability to generate revenues from PIT.
- 3) Pre-Working Age (0-17) Population in Total Population, % (Pre-WorkAge) – this predictor determines the necessity of the service delivery in the field of the education.
- 4) Aging Index, as the Post-Working Age Population to the Pre-Working Age Population, % (AgingIndex) – this variable represents generation relationship of the number of persons 65 years old and more, per 100 persons 0-14 years.
- 5) Urban Population in Total Population, % (UrbanPop) – this variable identifies the specificity of the municipality, i.e., the level of the urbanization, which influences the revenue composition and the scope of the tasks.

C. Political factor:

- 1) Distance to Elections (DistElect) – this variable takes the value of 1 in the electoral year while in other years, it would take the level according to the formula: $1 \div \text{the number of years left until the forthcoming election}$. Thus, if there are four years between elections, the variable would take 0.25, 0.5, 0.75, and 1 – election year. This kind of variable was applied by Delgado-Téllez and Pérez (2020, pp. 224-225, 245), who based their study on the approach of Franzese (2000, pp. 61-83). In Poland, in the analysed period, local elections were held in 2010, 2014 and 2018.

Firstly, the single-factor models (with fixed effects because of the final model types) for each variable were calculated to show whether the single predictors are statistically significant, and to reveal the direction of the relationship as well as to check and control potential reverses of the coefficient sign in the final model with the set of statistically significant variables. In this way the confounding (perceived as a mixing of effects) was limited, which can make the exposure appear stronger, weaker, or opposite to the outcome than it truly appears (Howards, 2018, p. 395). In addition, the levels of the AIC and ‘Within R^2 ’ of these single-factor models contributed to the recognition of the importance of each predictor on the indebtedness.

The three models were then estimated, containing only statistically significant predictors. In the process of calculating the first two regressions the procedure was aimed at achieving the high ‘Within R^2 ’, applying the sets of fiscal and socio-economic variables. The third model, in turn, contains chosen variables concerning revenue and the political factor. It is worth highlighting that some researchers suggest not to include an excessive number of independent variables and consequently to focus only on the most relevant predictors (Benito, Bastida, 2004, 503), especially in terms of the study objectives.

Furthermore, to disclose the spatial relationships, and to identify the presence of spatial structure (Zhao et al., 2018, p. 33), between the municipalities in the field of the level of their debt ratio, the Moran’s Index (I) is calculated, for every year between 2010 and 2021. The formula of this ratio is expressed as follows (3) (Kopczewska, 2021, pp. 188-189):

$$I = \frac{n \sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^n \sum_{j=1}^n w_{ij} \sum_{i=1}^n (x_i - \bar{x})^2}, \quad (3)$$

where:

x_i is the observation in the municipality i ,

\bar{x} is the average of all the units studied,

n is the number of units

w_{ij} is part of the spatial matrix W .

The spatial weights matrix is standardised by rows up to 1, i.e., the row-standardise spatial weights matrix. Simultaneously, the queen’s case contiguity weight matrix with order 1 was employed (Chi, Zhu, 2021, p. 29).

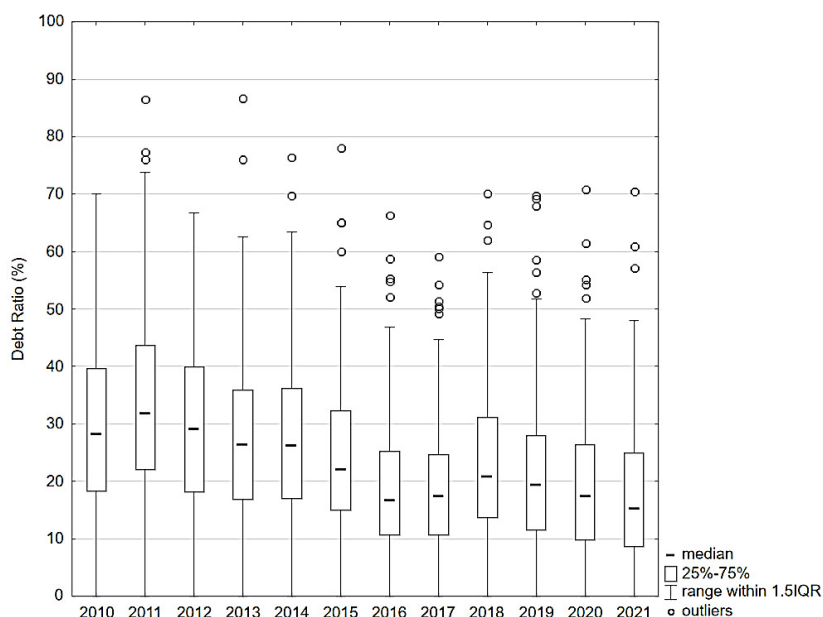
The Moran’s I index is interpreted based on the expected value calculated under the null hypothesis of no spatial autocorrelation, i.e., spatial randomness, and is statistically evaluated using a p -value (certain number of permutations is used here, i.e., 999 in this research study) and a z -score (Grekousis, 2020, pp. 211, 225). Since its values can be bounded to the range from -1.0 to +1.0, when the weights are row standardised, it is often interpreted as the correlation coefficient, testing its significance (p -value below 0.05 in this research study). This correlation occurs between the value of the variable in the analysed area (municipality in this paper) and the values of this variable in the neighbouring units. The positive or negative Moran’s I value implies the existence of positive or negative spatial autocorrelation over the

study area respectively, whereas the value 0 implies spatial randomness (Zhou et al., 2020, p. 112). In practice, its score higher than 0.3 or lower than -0.3 is an indication of relatively strong autocorrelation (Grekousis, 2020, p. 215).

In addition, using the local indicators of spatial autocorrelation – LISA (Kopczewska, 2021, p. 199), which decompose the global statistics of spatial association (Zhou et al., 2020, p. 112), certain types of spatial relations were studied. There were depicted on the LISA cluster map, i.e.: (a) ‘High-High’ (units with high values of the debt ratio surrounded by neighbours of similar high values of this indicator) – known as ‘hot spots’, (b) ‘Low-Low’ (units with low values of the debt ratio surrounded by neighbours of similar low values of this indicator) – known as ‘cold spots’, (c) ‘Low-High’ (units with low values of the debt ratio surrounded by the units with high values of this indicator) - spatial outlier/unstable spatial pattern, (d) ‘High-Low’ (units with high values of the debt ratio surrounded by the units with low values of this indicator) - spatial outliers/unstable spatial pattern, and (e) ‘Not Significant’ (areas that are not significant in the context of the analysed spatial relations, at significance level of 0.05) (Wang, 2011, p. 183; Zhou et al., 2020, p. 112). This spatial structure is also visualized by means of Moran’s *I* scatterplot which presents the relationships, i.e.: ‘High-High’ (I quadrant), ‘Low-Low’ (III quadrant), ‘High-Low’ (IV quadrant), and ‘Low-High’ (II quadrant). The slope of a regression line on this scatterplot fitted to the points in the scatterplot gives global Moran’s Index (Lloyd, 2010, p. 90).

4. Results and Discussion

In Poland, the revenues of municipalities consist of (a) own revenues, (b) general subvention, involving educational part, equalization part, balancing part, (c) and grants. These units have a tax authority within local taxes, the most important of which is a tax on real estate. Municipalities also receive revenues from the participation in shared taxes, i.e., in PIT and CIT, where PIT is the most important source of the tax revenues. As consequence, the own revenues to the total were: in all municipalities 44.62% in 2010 and 42.35% in 2021, in municipalities of the Wielkopolska Region/Voivodeship (WR) 49.62% in 2010 and 44.71% in 2021. In turn, in 2021 the expenditures mainly cover tasks in the field of education (29.5% in Poland; 31.0% in municipalities of WR), family (26.0% in Poland; 28.2% in municipalities of WR), municipal economy and environment protection (9.9% in Poland; 7.7% in municipalities of WR), public administration (8.2% in Poland; 7.9% in municipalities of WR), transport and communication (7.5% in Poland; 8.0% in municipalities of WR).



Note. Calculation of the range within 1.5IQR assumes that, using the values of quartiles (Q), the lower limit is: $Q_1 - 1.5IQR$, and upper limit: $Q_3 + 1.5IQR$.

Figure 1. The level of median, interquartile range (IQR) and outliers (outside the range within 1.5IQR) of the debt to revenues ratio in the municipalities of the Wielkopolska Region between 2010 and 2021.

Source: author's own study.

As far as the municipalities of the Wielkopolska Region are concerned, they differ in terms of their financial situation and the socio-economic conditions (Table 1). In 2010 and 2021 there were substantial differences in their indebtedness, investment activity, revenue and expenditure compositions, absorption of EU funds as well as the situation on the labour market, entrepreneurship, the demographic structure, and urbanization. However, between 2010 and 2021 it was seen a drop in median of the debt to revenues ratio (Debt Ratio), whereas some units were still characterized as outliers having a large level of this ratio in comparison to the others (Figure 1).

Table 1.

Descriptive statistics for the analysed municipalities in 2010-2021

| Variable | Mean | Std. dev. | Min | Max |
|-------------|--------|-----------|-------|----------|
| Debt Ratio | 24.00 | 14.42 | 0.00 | 86.76 |
| InvestExp | 15.85 | 8.15 | 0.55 | 53.58 |
| WagExOp | 35.36 | 5.77 | 16.77 | 50.59 |
| EduExp | 35.17 | 6.59 | 13.81 | 57.92 |
| PITinOR | 34.99 | 8.67 | 4.58 | 73.47 |
| CITinOR | 1.49 | 1.78 | -5.22 | 16.38 |
| TREinOR | 27.23 | 8.13 | 7.40 | 63.33 |
| CapRev | 6.43 | 5.25 | 0.00 | 39.59 |
| EUfunds | 139.66 | 203.94 | 0.00 | 2,332.44 |
| BusinDen | 22.63 | 7.37 | 8.44 | 73.43 |
| UnempRatio | 4.82 | 2.81 | 0.64 | 14.64 |
| Pre-WorkAge | 20.66 | 1.75 | 13.94 | 27.90 |
| UrbanPop | 25.36 | 31.01 | 0.00 | 100 |
| AgingIndex | 99.50 | 22.65 | 45.04 | 206.15 |

Source: author's own study.

The results of the single-factor models indicate that in the group of the examined fiscal factors the highest predictive power on the municipal indebtedness has the share of the wages to current expenditures ('Within R^2 ' is 0.1777) and then the share of investment spendings in the total ('Within R^2 ' is 0.1239). In turn, within the analysed revenue predictors the highest predictive power has the share of PIT in own revenues ('Within R^2 ' is 0.0898). Moreover, the higher the share of the expenditures on education, the higher Debt Ratio. This extends the statement, that in Poland a decrease in the proportion of general subsidies in the budgets of municipalities, and a surge of expenditures on education forced these units to allocate more funds on education from locally generated revenues (Wichowska, 2022, p. 141). The growth of these expenditures led to the additional borrowing.

Table 2.

Indebtedness predictors in the single-factor models with fixed-effects in municipalities of Wielkopolska Region in 2010-2021, ordered by the level of the AIC in the groups

| Model (factor) | Coefficient | Intercept | Within R^2 | LSDV R^2 | AIC |
|---|------------------------|--------------------------|--------------|------------|--------|
| Models for the group of fiscal factors | | | | | |
| WagExOp | 0.8525*** (0.0761) | -6.1355** (2.6901) | 0.1777 | 0.6424 | 19,485 |
| InvestExp | 0.4730*** (0.0324) | 16.5062*** (0.5135) | 0.1239 | 0.6190 | 19,654 |
| PITinOR | -0.5912*** (0.0619) | 44.6919*** (2.1650) | 0.0898 | 0.6042 | 19,755 |
| EduExp | 0.3122*** (0.0698) | 13.0230*** (2.4546) | 0.0311 | 0.5786 | 19,922 |
| TREinOR | 0.3021*** (0.1001) | 15.7757*** (2.7270) | 0.0163 | 0.5722 | 19,962 |
| CITinOR | -1.1873*** (0.2673) | 25.7728 (0.3982) | 0.0155 | 0.5719 | 19,964 |
| CapRev | 0.2288*** (0.0491) | 22.5334*** (0.3154) | 0.0134 | 0.5710 | 19,970 |
| EUfunds | 0.0053*** (0.0015) | 23.2692*** (0.2092) | 0.0107 | 0.5698 | 19,977 |
| Models for the group of socio-economic factors | | | | | |
| AgingIndex | -0.3408*** (0.0297) | 57.9107*** (2.9551) | 0.1798 | 0.6433 | 19,478 |
| UnempRatio | 1.8357*** (0.1653) | 15.1478*** (0.7975) | 0.1684 | 0.6383 | 19,515 |
| BusinDen | -1.2566*** (0.1140) | 52.4357*** (2.5785) | 0.1548 | 0.6324 | 19,558 |
| Pre-WorkAge | 3.4281*** (0.5240) | -46.8214*** (10.8269) | 0.0618 | 0.5920 | 19,836 |
| UrbanPop | 0.1441 (0.1325) | 20.3494*** (3.3609) | 0.0015 | 0.5658 | 20,002 |
| Model for the political factor | | | | | |
| DistElect | 1.2497*** (0.4329) | 23.2541 (0.2597) | 0.0014 | 0.5657 | 20,002 |

Note. (1) ***, ** and * denotes statistical significance at 1%, 5% and 10% levels respectively, (2) clustered standard errors in parentheses (...), (3) estimated single-factor models with random effects revealed the same signs of the parameters on explanatory variables; in addition, the variable 'UrbanPop' was statistically significant in the model with random effects.

Source: author's own study.

Although the influence of the factor: *per capita* revenues from EU funds is statistically significant on the Debt Ratio in the municipalities, its predictive power is relatively low ('Within R^2 ' is 0.0107) in comparison to other ratios. As far as the single-factor models for socio-economic factors are concerned, the highest predictive power has 'AgingIndex' ('Within R^2 ' is 0.1798), whereas 'Within R^2 ' for the single-model with Unemployment Ratio is 0.1684. In addition, there is the high predictive power of the number of companies per inhabitant in mobile age ('BusinDen'), i.e., 'Within R^2 ' is 0.1548 (Table 2). The outcome of the single-factor model for the political factor shows that the forthcoming elections put pressure on the growth of the Debt Ratio in the analysed public units. To sum up, the indebtedness is affected by the structure of the spendings, i.e., the higher share of investment activity or the share of rigid expenditures the higher the Debt Ratio. On the other hand, the municipalities, in which the share of PIT and CIT in the own revenues is higher, reduce their indebtedness. This is in line with the local economic condition since lower unemployment and higher entrepreneurship affect a decrease of the borrowing needs. The high share of the pre-working age population in comparison to post-working age population determined the higher indebtedness. This affected the greater spendings on education, which are less flexible due to the strict regulations.

Table 3.

Indebtedness predictors on municipalities of Wielkopolska Region in 2010-2021 – estimation results of the panel models with fixed effects

| Factor | Coefficient | Clustered standard errors | p-value | 95% conf. interval | | VIF |
|----------------|-------------|---------------------------|---------|--------------------|-------------|--------|
| | | | | Lower bound | Upper bound | |
| Model 1 | | | | | | |
| InvestExp | 0.3589 | 0.0365 | <0.001 | 0.2870 | 0.4308 | 1.0684 |
| WagExOp | 0.5050 | 0.0903 | <0.001 | 0.3270 | 0.6830 | 2.2302 |
| CITinOR | -0.4788 | 0.1941 | 0.014 | -0.8614 | -0.0962 | 1.0281 |
| AgingIndex | -0.1360 | 0.0354 | <0.001 | -0.2058 | -0.0662 | 2.3087 |
| UrbanPop | 0.2612 | 0.1072 | 0.016 | 0.0499 | 0.4724 | 1.0057 |
| Intercept | 8.0865 | 6.9958 | 0.249 | -5.7004 | 21.8735 | - |
| Model 2 | | | | | | |
| InvestExp | 0.3694 | 0.0366 | <0.001 | 0.2972 | 0.4415 | 1.0568 |
| WagExOp | 0.4122 | 0.1015 | <0.001 | 0.2121 | 0.6123 | 3.4997 |
| CITinOR | -0.4838 | 0.1907 | 0.012 | -0.8596 | -0.1079 | 1.0380 |
| UnempRatio | 0.6657 | 0.2140 | 0.002 | 0.2439 | 1.0875 | 3.0301 |
| BusinDen | -0.2145 | 0.1201 | 0.076 | -0.4512 | 0.0223 | 2.5478 |
| UrbanPop | 0.2657 | 0.1138 | 0.020 | 0.0415 | 0.4899 | 1.0068 |
| Intercept | -0.7999 | 3.9798 | 0.894 | -12.6591 | 11.0593 | - |
| Model 3 | | | | | | |
| CITinOR | -1.1675 | 0.2604 | <0.001 | -1.6807 | -0.6543 | 1.0005 |
| EUfunds | 0.0056 | 0.0015 | <0.001 | 0.0026 | 0.0086 | 1.0241 |
| DistElect | 1.7319 | 0.4471 | <0.001 | 0.8508 | 2.6129 | 1.0244 |
| Intercept | 23.9214 | 0.5723 | <0.001 | 22.7934 | 25.0493 | - |

Cont. table 3.

| Goodness of fit measures | | | | | | | | |
|--------------------------|-----------------|------------------------|--------------------------|-----------------|------------------------|--------------------------|-----------------|------------------------|
| Model 1 | | | Model 2 | | | Model 3 | | |
| Within $R^2 =$ 0.2799 | AIC = 19,139 | LSDV $R^2 =$ 0.6869 | Within $R^2 =$ 0.2791 | AIC = 19,144 | LSDV $R^2 =$ 0.6865 | Within $R^2 =$ 0.0286 | AIC = 19,933 | LSDV $R^2 =$ 0.5776 |
| RMSE = 8.0780 | | | RMSE = 8.0840 | | | RMSE = 9.3791 | | |

Source: author's own study.

Using the described scientific procedure and the set of the indebtedness predictors and debt to revenues ratio (%) as the dependent variable (Table 1), three regressions were estimated (Table 3). The results of the Wald test, the Breusch-Pagan test and the Hausman test (Table 4) indicated to apply models with fixed effects, whereas the outcomes of the Modified Wald test, Breusch-Godfrey test and Pesaran test resulted in the application of clustered standard errors (Table 4). In each model the indebtedness predictors are statistically significant (Table 3), and their coefficients' signs comply with the outcomes in the single-factor models (Table 2). These models show that both fiscal and socio-economic factors should be combined to explain the changes in municipal debt (Table 3). According to the 'Model 1' a 1 percentage point (pp) increase of the share of the capital expenditures in the total ('InvestExp') affected the growth of the Debt Ratio by 0.3589 pp, *ceteris paribus* (Table 3). In turn, a 1 pp increase of the share of wages in current expenditures ('WagExOp') influenced an increase of the Debt Ratio by 0.5050 pp, *ceteris paribus*. Similar relationships were confirmed by the 'Model 2'. In addition, 'Model 1' shows that predictors: 'CITinOR' and 'AgingIndex' have inverse relationships with Debt Ratio. Furthermore, according to 'Model 2', a 1 pp increase of the Unemployment Ratio affected a growth of the Debt Ratio by 0.6657 pp. An increase of the indebtedness was also positively affected by the share of Urban Population ('UrbanPop'). On the other hand, the higher the number of companies per inhabitant in mobile age ('BusinDen') the lower the Debt Ratio (Model 2). In turn, a lower 'Within R^2 ' of 'Model 2' indicates that an exclusion of certain indebtedness predictors concerning expenditures, demographic structure, or the local economic conditions, influenced the decrease of the predictive power of the empirical model, i.e., 'Within R^2 ' of 'Model 3' is 0.0286 in comparison to 0.2799 in 'Model 1' or 0.2791 in 'Model 2'. However, 'Model 3' shows that forthcoming elections put pressure on the growth of Debt Ratio in the municipalities (Table 3).

Table 4.

Diagnostic tests for estimated models

| Diagnostic Test | Model 1 | | Model 2 | | Model 3 | |
|----------------------|------------|-----------------|------------|-----------------|------------|-----------------|
| | Statistics | <i>p</i> -value | Statistics | <i>p</i> -value | Statistics | <i>p</i> -value |
| Wald test | 19.24 | <0.001 | 19.83 | <0.001 | 14.59 | <0.001 |
| Breusch-Pagan test | 5,079.20 | <0.001 | 5,036.02 | <0.001 | 3,863.51 | <0.001 |
| Hausman test | 25.66 | <0.001 | 56.71 | <0.001 | 28.87 | <0.001 |
| Modified Wald test | 25,623.27 | <0.001 | 22,249.90 | <0.001 | 91,450.07 | <0.001 |
| Breusch-Godfrey test | 985.72 | <0.001 | 999.70 | <0.001 | 997.67 | <0.001 |
| Pesaran test | 16.46 | <0.001 | 14.45 | <0.001 | 123.86 | <0.001 |

Source: author's own study.

The results of the ‘Within R^2 ’ for ‘Model 1’ and ‘Model 2’ imply that almost 28% of the variation in the applied dependent variables within the municipalities are captured by these models. The levels of LSDV R^2 s show that these models explain 68.69 (‘Model 1’) or 68.65 (‘Model 2’) of the variation of the Debt Ratio in the analysed units, taking into account the fixed effects.

Table 5.

Moran’s Index and the spatial relations for the debt ratios in the municipalities in 2010-2021

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|--------|--------|--------|--------|--------|--------|
| Moran I | 0.0277 | 0.0584 | 0.0235 | 0.0319 | 0.0386 | 0.0236 |
| p -value | 0.2260 | 0.0760 | 0.2660 | 0.1830 | 0.1690 | 0.2690 |
| Spatial relations - no. of the municipalities | | | | | | |
| High-High | 2 | 3 | 2 | 3 | 2 | 3 |
| Low-Low | 10 | 8 | 3 | 3 | 4 | 7 |
| Low-High | 6 | 8 | 7 | 7 | 6 | 8 |
| High-Low | 3 | 6 | 4 | 7 | 3 | 4 |
| Not Signif. | 201 | 197 | 206 | 202 | 207 | 200 |
| Year | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
| Moran I | 0.0182 | 0.0460 | 0.1098 | 0.1192 | 0.1157 | 0.1175 |
| p -value | 0.2980 | 0.1290 | 0.0130 | 0.0050 | 0.0060 | 0.0050 |
| Spatial relations - no. of the municipalities | | | | | | |
| High-High | 3 | 5 | 14 | 10 | 12 | 13 |
| Low-Low | 10 | 11 | 7 | 12 | 11 | 11 |
| Low-High | 7 | 8 | 7 | 5 | 10 | 7 |
| High-Low | 2 | 3 | 2 | 1 | 2 | 5 |
| Not Signif. | 200 | 195 | 192 | 194 | 187 | 186 |

Source: author’s own study.

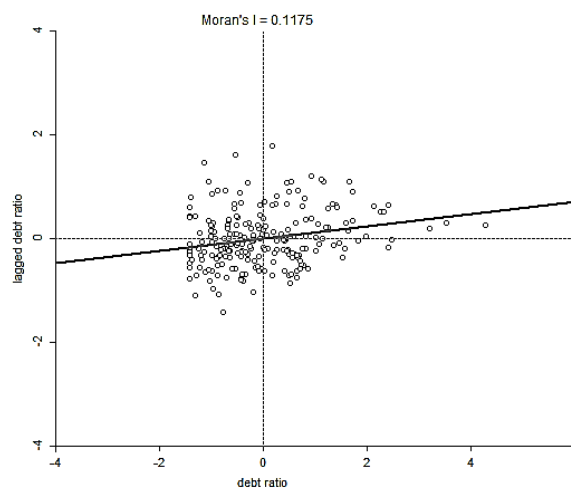
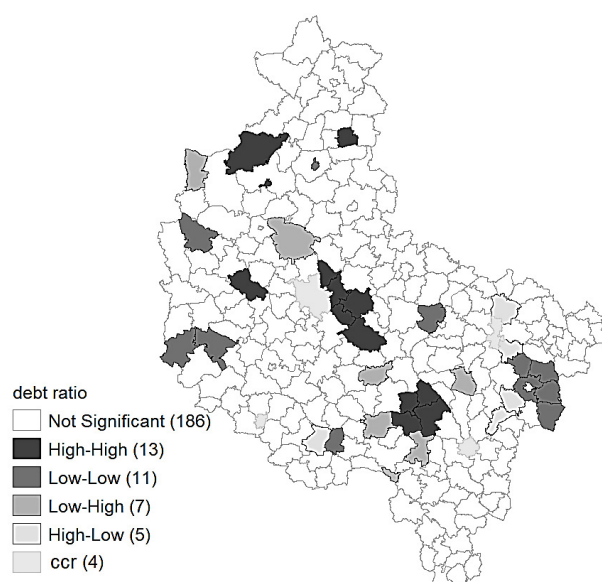


Figure 2. Moran’s I scatterplot for the debt ratio in 2021 of the municipalities.

Source: author’s own study.

Analysing the spatial correlation of the Debt Ratios of the municipalities in 2010-2021, this was not significant between 2010 and 2017 (Table 5). In turn, in 2018-2021 the estimation of the Moran’s I disclosed a very weak, positive, and a significant association (p -value below 0.05, Table 5). In 2021, this statistic was 0.1175 (Figure 2). Hence, after 2017 neighbours are the units with similar values of the Debt Ratio. According to the analysis of local indicators of

spatial autocorrelation for the Debt Ratio, after 2017 in the range from 10 to 14 a high indebtedness of the municipality affected a high Debt Ratio in the neighbouring unit (Table 5). On the other side, after 2017 in the range from 7 to 12 localities a low value of Debt Ratio affected the low value of this indicator in the neighbours. In the above cases/municipalities the local authorities somewhat imitated the policy regarding the size of the indebtedness, adopting specific patterns of behaviour in the process of incurring debt in neighbouring units. Therefore, among significant cases there were mainly both ‘hot spots’ and ‘cold spots’. In 2021, five municipalities created a ‘High-High’ cluster near the largest metropolitan city (Poznan) in this region, and two ‘hot spots’ were localized in the centre of the Wielkopolska Region, between three cities with county rights (Figure 3). In addition, in some significant cases, e.g., in 2021 in 7 ‘Low-High’ and 5 ‘High-Low’, there were different Debt Ratios and relations among the neighbouring locations. In these units there were a disparate approach to the indebtedness policy. Hence, there is relatively low level of spatial outliers in the field of the Debt Ratio. However, in most of the units, the analysed spatial relations were insignificant (Table 5).



Note. Number of the units in the parentheses; ccr - cities with county rights.

Figure 3. LISA cluster map for the debt to revenues ratio (debt ratio) of the municipalities in 2021.

Source: author's own study.

It is worth emphasizing that in 2018 among the analysed municipalities the median increased and the ‘range within 1.5IQR’ extended (Figure 1). In this year there were introduced the changes in the individual debt limit calculation and a principle of the balanced budget. Furthermore, in the budget resolution for 2018, for the first time a new chapter was used concerning the providing to pupils the free access to textbooks, educational and exercise materials (Statistics Poland, 2019, pp. 20-22). In addition, the new educational regulations increased the school period, from the beginning of the September 2017, in the primary schools from six to eight years (Statistics Poland, 2018, p. 23). This reform concerned the functioning

of the analysed municipalities as the lead authorities of the primary schools. Simultaneously, the estimated regression showed that an increase of the share of the spendings on education in the total resulted in an increase of the Debt Ratio (Table 2).

5. Conclusions

The indebtedness of municipalities is driven by a certain set of fiscal, socio-economic, and political factors. Thus, it is affected by the budget structure in the field of revenues and expenditures. Demography and the intensification of economic activity combined with the situation on the labour market also play a significant role in the debt creation. The indebtedness of municipalities is also determined by the spatial structure in the region. Their proximity to each other may contribute to adopting the specific pattern on the debt policy.

According to the findings there is a direct relationship between the share of PIT and CIT in own revenues and the indebtedness of the municipalities. This refers to the outcomes that a fall of unemployment ratio and the growth of the business density contributed to the decrease of the Debt Ratio in the analysed local public units. Thus, both the hypothesis 1 (H1) and the hypothesis 5 (H5) were positively verified. This impact of the unemployment ratio was also revealed by Veiga and Veiga (2014, pp. 18, 31), in contrast to Feld et al. (2011, pp. 60-61), who did not show significant impact of this ratio on the debt. However, the direct influence of the unemployment ratio on the indebtedness results from the fact the unemployment may increase the deficit in both the short and long run (Cifuentes-Faura et al., 2022, p. 1). Simultaneously, the share of PIT to own revenues has the highest predictive power in comparison to other analysed factors in the field of budget own revenues. Analysing the expenditure side of the budget it is seen that an increase of the investment activity, the share of spendings on wages as well as expenditures on education affected the growth of the Debt Ratio in the municipalities. In addition, the share of the expenditures on wages had the highest predictive power in explaining the level of the Debt Ratio in the units. Hence, both the hypothesis 2 (H2) and the hypothesis 3 (H3) were positively verified. These types of spendings influence the rigidity of the expenditures composition and the possibility to adjust the budget to the changing economic circumstances. Therefore, additional delegation of tasks in the field of education, without securing funds from the central budget, may result in a growth of the debt. The investment activity was also driven by the access to non-refundable EU funds, the absorption of which was conducive to an increase in the debt ratio. It was also noticed by Medve-Bálint and Bohle (2016, p. 22). In addition, there is a direct relationship between the indebtedness of local government and the share of pre-working age population, which is in line with the findings of Wassmer and Fisher (2012). This population influences the expenditures on education, often capital spendings, which are determined by central regulation and make the

expenditures structure more rigid. Hence, the hypothesis 4 (H4) was positively verified. An involvement of the pre-working age population in the Aging Index results in a high predictive power of the ratio of the post-working age population to the pre-working age population. It is worth noting that the election cycle also determined the Debt Ratio, however, it was not a decisive factor, what was also disclosed by Delgado-Téllez & Pérez (2020, pp. 233-239).

As far as the spatial structure is concerned there are significant spatial relationships, which influence Debt Ratios in the municipalities. However, in the analysed period they turned out to be significant since 2018. In this year there were implemented crucial changes in the educational system. Consequently, in 2018-2021 the territorial proximity affected the weak, positive correlation of the Debt Ratio between the municipalities, which led to the positive verification of the hypothesis 6 (H6). Thus, an increase in the Debt Ratio in the unit may influence such increases in the neighbouring entities. These ties may result from similar revenue structure, combined with the demographic composition, which imposes the obligation to deliver certain social services due to the devolution of public tasks between the central and the local government. Furthermore, the cluster of high indebted municipalities was localized in the neighbourhood of the metropolitan city. In turn, the regressions disclosed the direct relationship between ratio of the urban population and the indebtedness. Hence, urbanization processes affected the borrowing policy in the municipalities.

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IRREGULARITIES IN UNIVERSITY PROCESSES CONCERNING THE LEAN MANAGEMENT TYPOLOGY. THE PILOT STUDY RESULTS

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Purpose: Identify the attitudes regarding key irregularities in university activities of universities referring to *muda*, *mura*, and *muri* from the perspective of two groups of stakeholders - academic teachers and administration/service personnel.

Study design/methodology/approach: A pilot quantitative study using a questionnaire containing 48 statements regarding six categories of irregularities assessed according to the 5-point Likert scale. We asked two research questions:

Q1. Is the questionnaire used in the study reliable for assessing attitudes regarding irregularities that occur in connection with work at the university?

Q2. Which categories of irregularities most often accompany work at the university, and how is their nuisance assessed?

Findings: The reliability of the research tool was statistically confirmed. Respondents represent an attitude close to indifference regarding the perception of most categories of irregularities. The most often indicated by both groups of respondents is "Unused creativity of employees." Respondents consider all types a "nuisance" to a greater than moderate degree.

Originality/value: We propose an original tool to assess irregularities in higher education institutions and apply it in the Polish and possibly international environment. These studies constitute an initial stage of the planned in-depth original research aimed at using the classification of irregularities/losses in surveys of the opinions of all higher education stakeholders (e.g., students, employers), indicating the critical causes of problems and directions of improvement activities.

Keywords: higher education, Lean Management, irregularities, quantitative study.

1. Introduction

Universities, like other organizations belonging to the public sector, following the concept of New Public Management or New Public Governance, more and more willingly use ideas known from the business sector to improve processes, including the concept of Lean Management (LM). The precursors of LM, Womack, and Jones (1996) emphasized that organizations providing services usually have more irregularities and areas for improvement than production firms. Higher education tasks and processes are open to more than acquiring and generating knowledge in times of globalization, uncertainty, and the obsolescence of paradigms that have recently been eagerly invoked. They should shape the ability to predict and reflect on the effects of decisions in the sense of global responsibility (Barth et al., 2007). One of the first publications containing theoretical considerations on using LM in HEIs was an article published in 2000 by Dahlgaard and Østergaard (2000) entitled “TQM and lean thinking in higher education”. In 2005, the term “Lean University” was used by Comm and Mathaisel (2005) to refer to sustainable development. Balzer (2010) introduced the name Lean (in) Higher Education (LeanHE, LHE). According to Cudney et al. (2020), the first works related to practical applications of LM elements in HE should be attributed to Emiliani (2004). In 2013, the idea to create the Lean HE Hub was born. In 2016 it was renamed Lean HE (<http://www.leanhehub.ac.uk/home>).

Based on a systematic review of the literature, Gómez-Molina and Moyano-Fuentes (2021) argue that the number of scientific studies on LM in universities is gradually increasing. However, Antony et al. (2012) indicated that interpreting the LM in HE can be challenging. The fundamental difficulty is related to the lack of awareness of the potential benefits of Lean in HEIs. Hines and Lethbridge (2008) noticed that universities constitute an unfavorable environment for introducing LM due to the typical reluctance, mainly of the scientific community, to introduce quick changes. The idea of leanness is unclear to senior university leaders (Mathaisel, Comm, 2000). Other obstacles arise from the lack of process thinking and visionary leadership in HEIs (Douglas et al., 2015).

We believe that one of the most frequently indicated aspects symbolizing the essence of the LM concept - irregularities categorized by three Japanese words: *muda*, *mura*, and *muri*, can be an important factor motivating the use of this concept in the context of improvement activities in universities. Waste (*muda*) results from resource consumption without creating the value expected by a specific stakeholder (organization or person). The waste division most frequently indicated covers seven categories: overproduction, waiting, unnecessary transportation, over-processing, excessive inventory, unnecessary motion, errors, quality defects of products, and their correction. Unevenness (*mura*), i.e., undesirable variations, fluctuations, and unreasonableness, overburden (*muri*), most often associated with undesired overload, are considered sources of waste (*muda*) (Eaton, 2013).

Those irregularities for natural reasons should be identified and eliminated by people who play key roles in these activities. This applies to such university stakeholders as academic teachers, administration, and service employees or students.

This would contribute to real support for "bottom-up" initiatives, active participation of all groups of employees in activities improving university processes. The results of our previous research confirm that the management and employees of Polish universities expect it (Grudowski, 2020).

Dahlgard and Østergaard (2000) defined eight categories of losses in higher education institutions including uncoordinated teaching, coaching, and examination activities, poor logistic planning and designing of courses, and support activities that do not meet the needs of stakeholders.

Bicheno (2008) indicated 14 types of irregularities in service, administration, and office activities (office wastes). According to Douglas et al. (2015), four general categories of waste occur in the processes of higher education institutions. The first is waste concerning human potential - it occurs when universities do not fully use the knowledge and intellectual capital of employees and other key stakeholders. Process losses refer to shortcomings in designing, implementing, supervising, and improving university processes. Information loss arises when the information available to the right people needs to be more sufficient to support university processes effectively and efficiently. The fourth category, waste of material resources, refers to losses arising when the university does not use its resources efficiently.

Only these three examples clearly show that when classifying irregularities concerning the activities of universities, it is necessary to directly refer not only to the *muda* category, but also to the other two categories, *mura*, and *muri*. Therefore, an accurate example of the classification of irregularities regarding the operation of universities is the following division proposed by Hicks (2007):

1. Too much information.
2. Waiting.
3. Additional processing.
4. Redundancy of activities and/or their results.
5. Unnecessary movement of people and unnecessary meetings.
6. Defects arising from the service process.
7. Variability of implementation times.
8. More use of employees' potential and systems supporting education is needed.

The main purpose of the study presented in this article was to identify the respondents' attitudes regarding irregularities in the activities of universities referring to *muda*, *mura*, *muri* from the perspective of two groups of stakeholders - academic teachers and administration/service personnel. The research questions that we adopted in the study are as follows:

- Q1. Is the questionnaire used in the study reliable for assessing attitudes regarding irregularities in connection with work at the university?
- Q2. Which categories of irregularities most often accompany work at the university and how is their nuisance assessed?

2. Research methodology and research tool

We started the stakeholder opinion research with pilot studies. A pilot study is a preliminary study using a selected survey technique. The tool is verified for its suitability to deliver the information the researcher expects. The pilot study results provide researchers with information on whether a particular element of the main study would need to be changed. It is carried out on a relatively small sample not to generate additional costs. The pilot study results are not intended to verify hypotheses, but to provide information on the quality of a structured research plan (Blatch-Jones et al., 2018).

The classification proposed by Hicks (2007) was used to develop the first version of the questionnaire. The draft questionnaire was submitted for opinion by experts, researchers representing four Polish academic centers, and university administration employees holding managerial positions. Among academics, there were people with at least a PhD degree specializing in quality management (6 persons), marketing research (3 persons), and those closely involved in higher education (3 persons). As a result of suggestions and discussions with the respondents, **the names and number of categories of irregularities and the accompanying statements were modified.**

The first part of the modified questionnaire included questions about the group of employees to which a respondent belongs, the academic position the managerial position, and the seniority of the university. The central part of the survey (Table 1) consisted of 48 statements divided into six categories, accompanied by a 5-point Likert scale. The rating scale was supplemented with a request **to assess the nuisance of a given irregularity for respondents who selected items 4 or 5 on the scale.** Concerning nuisance, three states were defined: 1- low, 2 - moderate, and 3 - high. Thanks to this, it was possible to obtain information about the fact that the respondent noticed a given irregularity and how they perceived its negative impact on the performed work.

Table 1.

Categories of irregularities in university processes with the statements that define them and the scale used to express attitudes

| Irregularity/ loss category | Statements: (Rating scale: 1 – I strongly disagree; 2 – I disagree; 3 – yes and no; 4 – I agree.; 5 – I strongly agree – that a given type of irregularity/problem/ loss occurs in connection with my work) | 1 | 2 | 3 | 4 | 5 |
|---|---|----------------|---|---|---|---|
| | | Mark with X | | | | |
| 1) Excessive/un necessary activities | 1.1 Production/excessive printing, copying of documents, reports | | | | | |
| | 1.2 Participation in meetings that result in nothing | | | | | |
| | 1.3 Unnecessary on-site meetings instead of online meetings | | | | | |
| | 1.4 Too many required approvals in some processes | | | | | |
| | 1.5 Moving things between departments, rooms unnecessarily | | | | | |
| | 1.6 Redundant activities/movements due to arrangement, planning, lack of integration of activities | | | | | |
| 2) Waiting | 2.1 Waiting too long for supervisors' decisions | | | | | |
| | 2.2 Waiting too long for administrative/student service actions | | | | | |
| | 2.3 Waiting too long for the purchase/repair of equipment needed for work | | | | | |
| | 2.4 Waiting too long for assignments | | | | | |
| | 2.5 Excessive free period between classes ("time windows") | | | | | |
| 3) Excessive resources including information | 3.1 Too many documents for ongoing storage | | | | | |
| | 3.2 Employment in administrative/service positions too high concerning the actual needs | | | | | |
| | 3.3 Too high employment in the position of academic teachers concerning the actual needs | | | | | |
| | 3.4 Excess of rooms/space necessary for the implementation of didactic and research tasks | | | | | |
| | 3.5 Excess of office supplies | | | | | |
| | 3.6 Excess of equipment | | | | | |
| | 3.7 Records and documents stored for too long | | | | | |
| | 3.8 Excess of local and general regulations/provisions | | | | | |
| | 3.9 Excess of teaching aids | | | | | |
| | 3.10 Purchase of books that are not used | | | | | |
| | 3.11 Purchase of journals that are not used | | | | | |
| | 3.12 Excess emails and attachments in emails | | | | | |
| | 3.13 Excess of messages, announcement | | | | | |
| 4) Unbalance d workload for employees and infrastructure | 4.1 Unequal workload of employees during semesters in the academic year | | | | | |
| | 4.2 Periodic overload and underload of employees | | | | | |
| | 4.3 Overloading employees with work on a task whose effects are not used | | | | | |
| | 4.4 Unused but purchased equipment | | | | | |
| | 4.5 Uneven occupancy of rooms | | | | | |
| | 4.6 Wrong priorities for action | | | | | |
| 5) Errors, faults | 5.1 Mistakes/inconsistencies in documents | | | | | |
| | 5.2 Lack of service/communication standards concerning customers | | | | | |
| | 5.3 Outdated documents/information in use | | | | | |
| | 5.4 Mistakes in class schedules and student lists | | | | | |
| | 5.5 Lost documents, despite their posting/handing over | | | | | |
| | 5.6 Incomplete information concerning requirements | | | | | |
| | 5.7 Mistakes in financial documents | | | | | |
| | 5.8 Mistakes in labeling, identification of equipment, places, cases, processes | | | | | |
| | 5.9 Erroneous, imprecise, inconsistent decisions of superiors | | | | | |
| | 5.10 Errors in information systems and e-mail operation | | | | | |
| 6) Unused creativity of employees | 6.1 No clear, agreed incentive system | | | | | |
| | 6.2 Underestimating the achievements, underestimating the efforts of employees | | | | | |
| | 6.3 There are no appropriately differentiated consequences of employees' appraisals | | | | | |
| | 6.4 Failure to consider employee proposals when designing improvements | | | | | |
| | 6.5 Omitting employees from rewards | | | | | |
| | 6.6 Incompetent, inexperienced employees in managerial positions | | | | | |
| | 6.7 Employees are not doing the job they know best | | | | | |
| | 6.8 No consultation or gaining opinions on the introduced changes | | | | | |

Source: own elaboration.

Pilot studies were conducted in June 2022. The CAWI method (computer-assisted web interview) was used. The survey form was developed in the Microsoft Forms application. The research questionnaire was addressed to all academic teachers (118 persons) and all administration/service employees (40 persons) of the Faculty of Management and Economics of one of the largest Universities of Technology in Poland - Gdansk University of Technology.

The study was open for 2 weeks. A total of 61 questionnaires were obtained. This number included 50 questionnaires completed by academic teachers and 11 by administration/service employees. The research involved 13 professors, 32 assistant professors, and 5 assistants. Ten people were holding managerial positions in the sample. The STATA SE16 software was used for statistical data analysis.

3. Results and discussion

3.1. Questionnaire reliability

The first research question we wanted to answer (Q1) was about the **questionnaire quality** used in the pilot studies. The measure of quality in the case of the assessed questionnaire was its reliability. For this purpose, exploratory factor analysis (EFA) supported by principal component analysis (PCA) was used. To determine the reliability of the scale used in the study, the coefficient of α -Cronbach's was calculated. It is generally accepted that a scale is considered reliable if the α -Cronbach coefficient is at least 0.7 (Stadler et al., 2021). Table 2 presents the key results of the application of these methods. In the case of category 1 - "Excessive/unnecessary activities," to improve the α value, it is possible to eliminate one of the statements (i.e., 1.3) whose factor loading is slightly too low. In the case of category 3, the result of the PCA application indicates the possibility of splitting this category into two separate categories, one defined by statements 3.1, 3.6, 3.7, 3.8, 3.9, 3.12, 3.13 and the other defined by 3.2, 3.3, 3.4, 3.5, 3.10, 3.11. However, a detailed analysis shows that the benefits of such corrections would not be significant.

Table 2.

The results of data analysis related to the reliability of the research tool

| Irregularity/ loss category | Cronbach's alfa |
|---|------------------------|
| 1. Excessive/unnecessary activities | 0.6570 |
| 2. Waiting | 0.762 |
| 3. Excessive resources including information | 0.748 |
| 4. Unbalanced workload for employees and infrastructure | 0.770 |
| 5. Errors, faults | 0.829 |
| 6. Unused creativity of employees | 0.922 |

Source: own elaboration using STATA SE16 software.

Based on the analysis of the α -Cronbach coefficient, it can be concluded that the questionnaire is a **reliable and internally consistent tool** ($\alpha > 0.7$).

3.2. Irregularities in university processes from the perspective of employees

To find the answer to the second of the research questions (Q2), it is necessary to analyze the general attitude of the respondents toward particular categories of irregularities, both in terms of their perception (Table 3) and the nuisance associated with these irregularities (Table 4). As a result of the data presented, all respondents and the group of academic teachers represent an attitude close to indifference about the perception of the six categories of irregularities (average grade close to 3). This confirms the observations of Hines and Lethbridge (2008).

In the case of both populations, irregularities belonging to **category 6 – Unused creativity of employees” are most often indicated**. Similar conclusions can be drawn from the research by Klein et al. (2021). These authors show that the loss of knowledge related to the lack of respect for people is one of the universities' most serious management problems. The reason for such a state of "indifference" may be that the irregularities listed in the questionnaire presented both as individual cases (statements) and aggregated in the form of a given category, are perceived as something natural in the university's conditions and are not treated as a problem to be solved.

Table 3.

Occurrence of irregularities (means; 5-point Likert scale)

| Irregularity/loss category | All | Academic teachers |
|---|--------------|-------------------|
| 1. Excessive/unnecessary activities | 3.146 | 3.202 |
| 2. Waiting | 2.929 | 2.956 |
| 3. Excessive resources including information | 2.394 | 2.363 |
| 4. Unbalanced workload for employees and infrastructure | 3.111 | 3.086 |
| 5. Errors, faults | 2.681 | 2.669 |
| 6. Unused creativity of employees | 3.267 | 3.290 |

Source: own elaboration using STATA SE16 software.

Regarding the views on nuisance (Table 4), respondents consider all categories to be "nuisance" to a **more significant than a moderate degree** (2 on the scale). Also in this case, **category 6 obtained the highest average value in the group of all respondents**. These results may confirm the common belief in Polish universities that university management is not interested in employees' opinions on process improvement. This causes the staff to adopt passive attitudes and apathy, demonstrated by the "silence at the workplace" (Vemuri, 2019). It is also a poor prognosis for the success of any future initiatives. An obvious remedy is to change the management attitude to one that makes employees see the sense of their participation and mobilizes internally to a creative approach to the tasks performed. Among academic teachers, only a slightly **higher score was obtained in category 2 - 'Waiting'**. It means university employees value their time and suffer from wasting it due to poor work organization.

Table 4.
Nuisance of irregularities (means; scale 1-2-3)

| Irregularity/loss category | All | Academic teachers |
|---|--------------|-------------------|
| 1. Excessive/unnecessary activities | 2.433 | 2.437 |
| 2. Waiting | 2.432 | 2.459 |
| 3. Excessive resources including information | 2.133 | 2.057 |
| 4. Unbalanced workload for employees and infrastructure | 2.424 | 2.449 |
| 5. Errors, faults | 2.297 | 2.251 |
| 6. Unused creativity of employees | 2.469 | 2.449 |

Source: own elaboration using STATA SE16 software.

Due to the natural limitations of these pilot studies, a more cautious approach should be taken, *inter alia*, with the interpretation of the information on the differences in assessing the occurrence and nuisance of the six categories of irregularities by the administration/service staff and academics. Table 5 presents the test results on the significance of differences in the mean values of the scores for the two groups mentioned above. As the table shows, **at the significance level of $\alpha = 0.05$, there are no significant differences in the evaluation of both these aspects by two groups of university employees.** However, this critical information from the point of view of the selection and implementation of the university process improvement strategy should be verified in research involving a much larger number of respondents.

Table 5.
The significance (p-values) of differences in attitudes between the groups of academic teachers and administrative/service employees concerning the occurrence and nuisance of the category of irregularities

| Irregularity/loss category | Administration vs. Academic teachers | |
|---|--------------------------------------|----------|
| | Occurrence | Nuisance |
| 1. Excessive/unnecessary activities | 0.098 | 0.947 |
| 2. Waiting | 0.464 | 0.559 |
| 3. Excessive resources including information | 0.287 | 0.056 |
| 4. Unbalanced workload for employees and infrastructure | 0.685 | 0.195 |
| 5. Errors, faults | 0.761 | 0.359 |
| 6. Unused creativity of employees | 0.584 | 0.826 |

Source: own elaboration using STATA SE16 software.

4. Conclusions

4.1. Findings

As a result of our research, the proposed questionnaire should be considered a reliable tool for measuring respondents' attitudes towards the occurrence and nuisance of irregularities in the processes taking place at the university. This does not mean that minor modifications to this tool are not worth considering.

All respondents and the group of academic teachers represent an attitude close to indifference regarding the perception of the six categories of irregularities (average grade close to 3). This attitude shows management's lack of commitment to persuading employees to improve processes. It may also confirm the fear of employees expressing their opinion.

The originality of our study stems from the fact that we propose a tool to assess irregularities in HIE and apply it to the Polish environment. So far, this type of research has yet to be conducted.

The selected remarks concerning the occurrence and nuisance of the irregularities presented can be considered typical in the academic environment. However, they require appropriate awareness and reaction from the university management, as they cause frustration and passivity of employees, which is the main barrier to the university's development.

Small participation in the survey of administration/service employees means that comparisons of attitudes (significance of differences in assessment) of this group with the group of academic teachers should generally be treated as something other than a reliable basis for inference. This aspect should be considered a limitation of our research. Although controversial, treating all respondents as a homogeneous research sample allows one to conclude the reasons for the attitudes displayed concerning a given category of irregularities. Therefore, in future research, on a larger sample of respondents, we will try to get an answer to the following question: Does the assessment of the occurrence of these irregularities and their nuisance by academic teachers and administration/service employees differ significantly? Furthermore, future research will be expanded to include academic centers outside of Poland, allowing for identifying cultural differences in the perception of irregularities.

4.2. Implications

Our questionnaire for measuring respondents' attitudes towards the occurrence and nuisance of irregularities at the university would support the decision-makers in diminishing losses and enhancing processes efficiency. Measurement results can help properly allocate and effectively use key assets, including human resources. Our proposal also contributes to science by indicating a tool other researchers can use for comparative purposes.

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AN ADVERSARY OR AN ALLY? PERCEPTIONS OF INTERNAL AUDITORS. A NARRATIVE ANALYSIS

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Purpose: The paper aims to present the image of internal auditors and its effect on internal audit effectiveness based on the results of a qualitative analysis of internal auditors' and auditees' narratives.

Design/Methodology/Approach: in the article a critical literature review and a qualitative analysis of auditees' and internal auditors' narratives were performed. The research method used was a content analysis of narratives. The analysis was conducted on 2114 responses: 953 from auditees and 1161 from internal auditors. The theoretical framework for the study design was contingency theory.

Findings: The theoretical part provides a critical review of studies on the perception of internal auditors and its bearing on their work and organisational status. The empirical part discusses the results of author's research, revealing a mostly negative image of internal auditors among auditees and their negative attitudes towards the profession. The internal auditors attributed this mainly to employees' fear of being audited, managers' reluctance to internal audit, and misunderstanding of the purpose of internal audit. The results of the study indicate that more efforts should be made to dispel auditees' negative perceptions of internal auditors and create a more collaborative environment between them.

Research limitations/implications: The study has several limitations related to the use of purposive sampling resulting in non-representativeness of the sample and possible misinterpretations of respondents' narratives. Therefore, its findings need to be confirmed by a study using different research methods and a larger sample of respondents representing various internal audit stakeholders.

Originality/Value: Despite its limitations, the study may benefit current and aspiring internal auditors by giving them more insight into the psychosocial challenges of this profession.

Keywords: internal audit, image of internal auditor, internal audit effectiveness, attitudes towards internal auditors.

Category of the paper: research paper.

1. Introduction

*The typical auditor is a man past middle age, spare, wrinkled,
intelligent, cold, passive, non-committal, with eyes like a coldfish;
polite in contact but at the same time unresponsive,
calm and damnably composed as a concrete post or a plaster of Paris cast;
a petrification with a heart of feldspar and without charm of the friendly germ,
minus bowels, passion, or a sense of humor.
Happily they never reproduce and all of them finally go to Hell*

Elbert Hubbard, as quoted in: Reves, 1946, p. 83

The Institute of Internal Auditors Standards for the Professional Practice of Internal Auditing (also IIA Standards) defines internal audit as a control and advisory activity and internal auditors as professionals responsible for providing executives, the audit committee, and the board of directors with objective, unbiased, and forward-looking information about the effectiveness of risk management, control, and governance processes in the organisation. Impartiality, independence and objectivity mean that internal auditors may not cater for internal audit stakeholders' expectations or other circumstances that might breach the ethical standards of their profession when preparing their reports (IIA Standards; De Beelde, 2002).

Despite its history of about 100 years, internal audit is still surrounded by misunderstandings and misconceptions that not only show its public image but also reveal stakeholders' limited knowledge of its nature and purpose (Chambers, 2021).

Employees' criticism of internal auditors is widely attributed to their special status in organisations, perceived association with control activities, and the belief that they little contribute to organisational performance, but internal auditors' workplace image has been relatively rarely studied compared with, for instance, that of external auditors (Nordin, 2022). Little evidence has been gathered so far on how they are actually perceived by other employees. This area deserves more exploration as the image of internal auditors in organisations certainly influences their effectiveness, increasing it when positive and decreasing it when negative (cf. Grzesiak, 2021). Consequently, it plays an important role for an organisation's ability to improve its business processes and corporate governance.

This qualitative study was prompted by diverse and inconsistent results of research on the perception of internal auditors, particularly by the paucity of studies investigating their image in Polish organisations. It aimed to determine auditees' perceptions of internal auditors and their work and the perceptions' influence on internal audit effectiveness, as well as factors contributing to the emergence of negative perceptions and the ways of preventing their occurrence or mitigating them.

In order to answer the questions, a critical literature review and a qualitative analysis of auditees' and internal auditors' narratives were performed.

In this study, *an auditee* should be understood as an executive, a manager, or an employee of any auditable unit in an organisation, and *an internal auditor* as a member of an internal audit team with an employment contract. The results of the analysis were compiled into a thick description (Geertz, 2003) illustrated with excerpts from respondents' responses. They were analysed using an interpretive paradigm which views truth as an intersubjective construct reflecting respondents' individual perspectives. The theoretical framework for the study design was contingency theory (cf. Donaldson, 2001; Otley, 2016), according to which each organisation and its setting are unique and organisational activity depends on a diversity of internal and external factors, so it is not possible to find solutions appropriate for each organisation.

2. Literature review

The IIA Standards define internal audit as “an independent, objective assurance and consulting activity designed to add value and improve an organization's operations [which] helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes”. Its effectiveness is usually measured in terms of the value it adds to an organization and the improvement in its operations and processes it achieves by removing inefficiencies, bottlenecks, and wasteful activities (Dittenhoffer et al., 2011). The responsibility for providing the top management with information they need to keep the organisation competitive has earned internal auditors the nicknames of “the eyes and ears of management” (Sawyer, as quoted in: Chambers, 2019b).

The internal auditor has a crucial role to play in the organization, related to the control and the advisory functions. Internal auditors discover, learn, and penetrate the audited areas in the course of their work. They reflect not only on what the auditees do, but also on their own behavior and provide a fresh perspective on the audited area by identifying opportunities for improvement where it appears they no longer exist, and by analyzing the information available at that time.

An internal auditor's first task, according to Reves (1946, p. 84), is to convince other employees of the organization that he or she is not looking for faults and irregularities, but rather is motivated to help and make constructive comments. Many people, however, believe that an effective internal auditor is one who criticizes the auditees, is harsh, and mean to them (Reves, 1946, p. 82). Lange (2016) has observed that while textbooks and theory refer to internal auditors as the guardians of management system coherence, analysts, and advisers who deserve praise and respect, co-workers have a less favourable opinion of them, labelling them as snitches, spies, and informants. According to Ma'ayan and Carmeli (2016),

who referred to Allen (1996), are not always seen as those who contribute value to organisations value added. Their role appears to be misunderstood and undervalued (Cheskis, 2012) and the popular view paints them as boring, grey people (Picard et al., 2014).

Auditees do not have a friendly attitude toward internal auditors, since internal auditors are perceived as criticizing operations. Internal auditors are seen as a threat to the status quo, as they are tasked with finding any problems or inefficiencies in the company's operations and suggesting solutions. This can lead to resistance and reluctance to accept the auditor's suggestions, which can lead to a negative attitude towards them (Sawyer et al., 2003).

Internal auditors are also awarded epithets such as “backstabbers”, “SS troops”, “company sneaks”, “corporate goons”, “snakes”, or “scum of the earth” (Wilson, Wood, 1989; Daily Mail, 1990, as quoted in: Vinten, 1994), which refer to their allegedly deceitful and untrustworthy nature (Bastable, Collins 1976). According to Reves (1946), the emergence of the terms is at least partially understandable after employees’ frequent encounters with inquisitive, harsh and sometimes unfair internal auditors. Referring to a 1965 study by Churchill and Cooper, Blakeney et al. (1976), noted that less than 25% of the respondents commented positively on internal audit. Paresi and van Kuijk concluded their study on internal auditors with an observation that they were unaware of how auditees and managers perceived them, and Sawyer et al. (2003) reported that auditees tended to ignore them or even accuse them of unprofessional conduct. There is also research evidence that some auditees withhold information from internal auditors or otherwise try to manipulate their reports (Dittenhofer, 1994).

The internal auditors often adopt a self-deprecating attitude that undermines their own value (Chambers, 2019). They see themselves in various roles that dictate their behavior in accordance with those roles. This attitude can lead internal auditors to not challenge the status quo, which can prevent them from uncovering potential issues within an organization. It can also lead to them not recognizing the value they bring to the organization, which can lead to their work not being taken seriously. This can lead to a lack of self-confidence and reluctance to challenge existing procedures and processes. Over time, this can lead to a situation where the internal auditor is not seen as a valuable asset to the organization. This can lead to a lack of respect for the role (Dittenhofer et al., 2011). Discussing internal auditors’ self-images, Sarens et al. (2016) noted that few of them thought that the phrase ‘governance watchdogs’ appropriately captured their function, and that they tended to describe themselves in negative or overly modest terms, or overstated their contribution to organizational governance. In the survey by Kabalski and Grzesiak (2017), most internal auditors preferred to see themselves as navigators or guardians rather than police officers or watchdogs. This seems to challenge the view that most internal auditors adopt a self-defeating attitude (Chambers, 2019a), and they perceive themselves in a variety of roles (Dittenhofer et al., 2011).

Given auditees' unfavourable perceptions of internal auditors, it is unsurprising that the relations between the two groups tend to be difficult and tense, seriously impeding their cooperation (Blakeney et al., 1976; Bastable, Collins 1976). It is even more difficult when internal auditors behave like police officers (D'Onza, Sarens, 2018) and obstinately seek breaches of procedures and rules (Dittenhofer et al., 2011). Such behaviour is not infrequent, as many internal auditors wrongly believe that by wielding authority they will be able to obtain auditees' cooperation. As internal auditors still struggle with managing their perception and image in organizations, "(...) internal audit runs the risk of becoming a marginalized function without the ability to play a significant role (...)" (PwC, 2013, p. 4).

The phrase "internal auditor" has already created a negative image of the internal auditor in the minds of many people. This is likely due to the fact that the internal auditor is seen as a policing figure, whose job is to find errors and make sure that the organization is compliant with regulations. This view of the internal auditor can create a sense of distrust between the internal auditor and the organization (Bastable, Collins 1976). Auditees tend to adopt and maintain a preconceived image of internal auditors that is difficult to change (Morin, 2003).

The noted literature gap relates to the lack of studies on internal auditors' image in the Polish context of the functioning of organizations. The author researched the Polish context because she wanted to see if internal auditors' image differs and shows peculiarities compared to other countries. An additional argument is that some time has passed since the introduction of internal auditing into Polish law (cf. Skoczylas-Tworek, 2013, p. 60), Poland's historical experience shows that internal auditing (like other control activities) is not received "with enthusiasm" in organizations (cf. Grzesiak, 2021). In addition, the profession of "internal auditor" does not appear in rankings of professions, which adds to the difficulty of assessing perceptions of their work.

The existing research gap prompted this study on the association about the perception of internal auditors and their work and the effectiveness of internal audit. The research problem was analysed based on the following four research questions:

RQ1: How do auditees perceive internal auditors?

RQ2: What factors shape their perceptions?

RQ3: How do auditees' perceptions influence the effectiveness of internal audits?

RQ4: What are the consequences of auditees' negative image of internal auditors?

The above analysis of the literature shows that internal audit and internal auditors are not always perceived by organizational members as an activity that benefits the organization.

3. Methodology

To develop the theoretical part, a critical review of the literature was conducted. It began by formulating the review topic, establishing search criteria and qualifying studies for the review, and searching for publications in databases. Studies were searched in the following databases: Scopus, Science Direct, EBSCO, Web of Science, and Bazekon. The keywords such as: "image of internal auditor", "image of internal audit", "perception of internal audit", "perception of internal auditor", "stereotype of internal auditor", and "stereotype of internal audit" were used. Publications were analyzed using full texts. The author also searched for publications using the snowball technique (backward and forward). The purpose of the critical analysis of the literature was to analyze the existing research in the field of the subject under consideration, to ascertain the state of the research and to identify the gaps that exist in the field. The author prepared a report on the literature review, and presented the results from its analysis in a paper while indicating the current state of knowledge in the field.

To develop the empirical part, the quality study was conducted. In order to answer the research questions (RQ1-RQ4), a survey of auditees and internal auditors was conducted to collect their narratives, which were subsequently subjected to a qualitative analysis. Narratives are frequently used in social sciences as they help identify the sources of cultural and social patterns and offer an insight into how people see the world around them (Hatch, 1996; Czarniawska, 1998, 2004; Kulas, 2014). In this study, a narrative analysis was applied because it was expected to reveal more about auditees' views on internal auditors and their interactions in workplaces than observation or interviews (c.f. Llewellyn, 1999, Nordin, 2022).

The study was conducted with both auditees and internal auditors to determine whether they had different perceptions of internal auditing and internal auditors and whether the differences might hinder their cooperation (c.f. Blakeney et al., 1976). In this research, internal auditors and auditees represented different organizational contexts from private sector and public finance institutions.

Between November 3, 2021, and February 1, 2023, invitations with a link to questionnaires were dispatched via LinkedIn to a total of 3,704 respondents (2,500 auditees and 1,204 internal auditors). The study stretched over a period of 15 months due to problems with compiling a sufficiently large group of auditees. Many of those contacted refused to talk about internal audit for various reasons. As a result, respondents to the sample were selected on a purposeful basis.

The auditee questionnaire contained a question aimed to determine whether the respondent had already been involved in an internal audit („Have you ever been audited?") and an open question about the respondent's opinion about internal auditors (“What is your view of the internal auditors and their work? – please tell your story"). A total of 1,001 responses were

obtained, of which 48 were disqualified as the respondents had no experience of internal audit, and the remaining 953 were included in analysis.

Respondents were further encouraged to tell their story in the questionnaire instructions. Most of the respondents (1876) told such stories in their statements. This gave the researchers more insight into the experiences of the respondents and provided a better understanding of the overall survey results. The questionnaire for internal auditors contained one screening question aimed to confirm respondent's eligibility ("Have you ever worked as internal auditor?") and two open questions ("How does the perception of internal auditors influence the effectiveness of internal audits?" and "How can the negative image of internal auditors be improved?"). Of the 1178 responses received, 17 were rejected because their authors failed to indicate their professional status. As a result, analysis was performed on 1161 responses from internal auditors.

The section below presents the results of the analysis of 2114 responses obtained from all respondents. They are described using a thick description to capture differences between their perspectives and interpretations (Geertz, 2003) and determine thought categories used by the auditees and auditors to describe each other (Geertz, 2003). "Geertz (1973) describes thick description as an ethnographic method in which researchers write as they immerse themselves within the context of a certain culture, noting specific, detailed references about social actions and behaviors of participants" (Clark, Chevrette, 2017). In other words, a thick description was to reveal the meanings the respondents gave to the elements surrounding objective truths rather than the truths themselves.

All responses were assigned codes by qualitative data analysis software (Nvivo). Data categories were defined based on the grounded theory methodology with successive iterations. The numbers and letters "IA" or "A" next to the responses in the Results section denote the respondent and his or her status (internal auditor or an auditee), respectively. The characteristics of the respondents have not been included as irrelevant to the purpose of the study.

A content analysis showed that they concerned three main themes: (1) typical responsibilities of internal auditors, (2) the attributes and characteristics of internal auditors, (3) the significance of their work. The responses are discussed below in the same order, starting with those that were given the most frequently. Let us note that many responses concerned more than one theme and did not distinguish between internal auditors (persons) and internal audit (a function).

The section below presents verbatim statements from the respondents. Due to the limited volume of the article, only selected respondents' statements are presented. For presentation in the article, those most representative of a given thread and analytical category were selected. The quotations were intended to give an idea of the reality of the research area, for sampling in interviews refers not only to the selection of people for the study, but also to the selection of interview excerpts from the collected research material (Flick, 2010). Placing the respondents'

statements in an appropriate context, as well as providing them a readable yet authentic form, is considered the greatest challenge for the researcher (Flick, 2010).

4. Research results

For a better presentation of the results, this section has been divided into two subsections, presenting the narratives of auditees and internal auditors, respectively.

4.1. Auditees' narratives

Most auditees had a low opinion of the internal auditor's job, associating it with administrative, financial, and accounting work and meticulous processing of large amounts of data and numbers, an unappealing and discouraging vision for creative people preferring teamwork. What they seemed to dislike most about the profession was its control aspect, which made most of them reject the possibility of becoming an internal auditor.

- *Internal auditors are almost entirely focused on the financial context of the organization – they are responsible for ensuring the reliability and accuracy of financial reporting in the organisation (...), and its conformity with pertinent laws and regulations. They also review operational procedures so that the organization's resources are used efficiently (293 A).*
- *An internal auditor deals with invoices and other documents (...). This is a boring and repetitive tasks that involves little or no thinking at all; the internal auditor's job is tedious (...) and bureaucratized and strictly regulated by rules, standards and laws (14 A).*
- *[internal auditors] have unimaginative, emotionless, and wet-blanket personalities and prefer online communication over face-to-face meetings. They are self-centred characters who quietly enjoy their status (3 A).*
- *I wouldn't become a friend with an IA. Never-ever (151 A).*

In sharing their perspectives on internal audit, the auditees pointed to its indispensability but also mentioned the risks it involved and the strategies for coping with them. Most auditees considered internal audit a nuisance disrupting the daily pattern of their work, which never delivered bad news and yielded impressive but useless results. Almost all references to internal audit they made had a subtle but palpable undertone of sarcasm.

- *Internal auditors always seek shortcomings (...). They are like a hawk keeping a watchful eye on its prey, ready to swoop on and exploit any misstep (...). They are the kind of people that you can't have a normal conversation with (...). There is no way I could become an auditor. In addition, there are few opportunities of professional development in internal audit and the profession lacks prestige (501 A).*

When discussing internal auditors' attributes and characteristics, the auditees indicated that they were mostly negative. In their view, internal auditors were emotionless, inquisitive, and stiff figures, always asking questions and challenging the established ways of doing things, which the auditees interpreted as a manifestation of mistrust in their competence.

- *The image of internal auditors is entirely negative. It would be great to get rid of our internal auditor, he's nothing but a problem and a burden. It is simply beyond him to take an objective stance and see the positive aspects. He takes a negative perspective on everything and readily red-flags issues (...). Internal auditors are nothing but a management' tool that's useless for the organization and individual employees; they spy on employees rather than help them be more successful (29 A).*
- *Most internal auditors are unattractive and unapproachable men with sour, bespectacled faces. Martinets looking at things through a magnifying glass held in white-gloved hands. [...] They have their ways to make me feel uneasy and insecure, to fill me with fear (15 A).*

Some auditees appreciated internal auditors for their work as advisers. They described them as trusted consultants who had an objective view of the organization and its operations and made insightful comments and suggestions on how to remove flaws and bottlenecks from processes and systems to make them more efficient.

- *[internal auditors] offer assistance and information (...). In my opinion, they do a great job providing an unbiased and independent assessment of organization's activities and are always helpful and open-minded. They are also experts in identifying risks and suggesting solutions for improving the organization's performance (444 A).*
- *I believe that internal audit is one of the most useful functions. It's like having a doctor at hand – necessary to keep things run smoothly and spot any irregularities before they turn into serious issues (229 A).*

Regarding other positive attributes of internal auditors, auditees pointed to their being hard-working, intelligent, and incorruptible experts, enthusiastic about their work, and aware of their duties. In particular, they strongly emphasised internal auditors' fairness and integrity.

- *Our internal auditor tries to show us where risks are (...). He is a hardworking and creative professional who is dedicated to his job, listens patiently, monitors processes and gives advice on them (...) (144 A).*
- *[My] image of internal auditors is entirely positive (...). They were trained to consider all business aspects of the organization without prejudice to find room for improvement. They provide valuable service to the organization and its stakeholders owing to their knowledge and experience, so they are highly respected (758 A).*

Some auditees admitted that their interactions with internal auditors made them change their opinion about them, sometimes for the better and sometimes for the worse. Internal auditors should, therefore, realise that how they behave towards other employees in the workplace will

have a long-term effect on whether they will be seen as allies or adversaries and, consequently on their performance and ability to carry out effective internal audit.

- *My image of an internal auditor was marred by the first auditor we had [in our organisation]. It was impossible for me to have a normal talk with him. He was insensitive to others, mean and cold, as if he were the only one to know the truth. The auditor who replaced him was a committed guy (111 A).*
- *It was a blessing that my previous internal auditor was still in training. Because of his dedication, I saw an internal auditor as an activist, as a firefighter with the lion heart – someone dedicated to the cause and ready to solve problems. The internal auditor we have now has spoiled the image; it seems that his life's purpose is to find where I went wrong; I feel like he tries to pick on me and find a reason to criticise me and my work rather than help me find ways to improve it. As a result, I have developed a negative perception of internal auditors and their role (740 A).*

4.2. Internal auditors' narratives

The responses sent by internal auditors indicated that they were aware of the criticism against their profession and their work. Almost all of them believed that the image they had required reparatory measures, which should be implemented by internal auditors with financial and non-financial support from the management.

- *Internal auditors' image of troublesome and disruptive persons may hinder the efforts to make them look more trustworthy (...). I think, however, that trying to fix their negative image is worth the time, as it can damage organizational morale and increase the risk of frauds. Employees with an adversarial attitude to internal auditors may be less likely to report suspicious activities (333 IA).*

Among the negative consequences of their unfavourable image in organisations, the internal auditors pointed to limited effectiveness of internal audits, reduced job motivation and satisfaction, increased risk of burnout, thinking of leaving the job, depressive moods, and other psychological problems. Four respondents in this group knew of internal auditors who were bullied to the verge of suicide by co-workers.

- *As well as making internal auditors less effective, negative perceptions of them also erode their credibility and trust in their work. Therefore, the benefits of our work for organisations and the value of our contribution should be promoted (14 IA).*
- *(...) our profession suffers not only from the bad attitude shown by some internal auditors but also from the inadequacy of their social and interpersonal skills. More emphasis should be given to their social competencies, and the selection for this profession should be more careful (289 IA).*

- *Internal audit and the profession of internal auditor should be gently promoted to fix their negative image. It should be reshaped and managed, especially by placing more emphasis on internal auditors' social competences (15 IA).*

In the opinion of many internal auditors in the survey, the unpopularity of their profession had three main sources: employees' fear of being audited, managers' reluctant attitude to internal auditors, and misunderstandings surrounding internal audit. The unprofessional behaviour of some internal auditors and cases of misconduct among the non-members of the Institute of Internal Auditors (IIA) were indicated as secondary but significant reasons for the criticism against internal auditors.

- *Despite the IIA's consistent efforts to improve the professional image of internal auditors, is still marred by auditors who are not its members. Their 'I'm omnipotent approach' thwarts IIA's efforts to bring the profession in line with international standards. They markedly contrast with the IIA members who work to develop their profession and consolidate the reputation and recognition of their association (14 IA).*
- *There are two types of internal auditors: the IIA members and those who have not joined the IIA but claim to know answers to all questions, frequently dismiss other people's opinions and ideas, and do not want to learn (11 IA).*

The results of the study show that internal auditors' effectiveness may depend on the amount of trust they can gain from auditees. To be trusted, they need to be able to create a respectful and open atmosphere in which others will see them as partners rather than adversaries. They should also promote themselves as approachable professionals readily supporting auditees in solving their issues.

5. Discussion

The research seek to answer the following research questions:

RQ1: How do auditees perceive internal auditors?

RQ2: What factors shape their perceptions?

RQ3: How do auditees' perceptions influence the effectiveness of internal audits?

RQ4: What are the consequences of auditees' negative image of internal auditors?

Public perceptions and attitudes towards various professions arise from stereotypes (Navallas et al., 2017). Negative stereotypes of professions may inhibit their development by discouraging people from entering them (Bartlett et al., 2016). According to Burton et al. (2014), one of such professions is internal audit. Wood and Wilson (1989) found experienced internal auditors to be more likely to respond to job advertisements promising a promotion to a managerial position after a short stint in internal audit or emphasising the consulting profile of the job while understating its assurance aspect. Wood and Wilson (1989) explained the

phenomenon in terms of negative stereotypes surrounding internal audit. Burton et al. (2015) observed that job advertisements marked as intended for internal auditors attracted fewer applicants than advertisements containing similar job descriptions without specifically mentioning internal audit. Finding qualified and talented recruitments for a profession attracting such unfavourable publicity may be problematic unless measures are taken to improve its image. Without them, **organizations may have serious problems trying to fill internal audit vacancies long into the future** (c.f. Wardayati et al., 2021).

This study surveyed a group of auditees and internal auditors from private sector organisations and public finance institutions to learn more about how internal auditors are perceived in their workplaces, what influences auditees' perceptions of them, how the perceptions relate to the effectiveness of internal audits, what are the consequences of the negative image of internal auditors, and how their image can be improved.

The image of internal auditors that emerged from auditees' opinions was predominantly negative. The metaphors the auditees used to describe them were at best neutral, but the majority of them, referring to the control function of the profession, were negative ("a guard", "a controller", and "an investigator") or even derogatory ("a corporate policeman", "a spy", and "a snitch") and reflected the auditees' perception of internal auditors as intrusive, authoritarian, and mistrustful figures. Pursuing a career in internal audit was not an option for the surveyed auditees, as they regarded the job as uneventful, repetitive, boring, and tedious in addition to offering few opportunities of professional development and involving little prestige.

Internal auditors were also described as obsessively scrupulous, 'nit-picking' bureaucrats disrupting the auditees' daily work routines. The opinions, objectively untrue, indicate that the function and profession of internal auditing are still misunderstood. Although the results of the study are preliminary and do allow broader generalisations to be drawn, they suggest that more needs to be done to promote internal auditing as a function protecting organisations from inefficiencies, irregularities and errors and thus contributing to job safety in organisations. This perspective on the role of internal auditors might help employees revise their attitude to these professionals.

According to the surveyed internal auditors, their negative image in organisations was determined by three factors: employees' fear of being audited, managers' reluctance to internal audit, and misunderstanding of the purpose of internal audit. A survey of Polish non-economics students conducted by Gorący (2013) revealed that they had very limited knowledge of internal auditing and as much as 60% interpreted it as a control activity. Consequently, Gorący (2013) concluded that only a small portion of Polish public were familiar with internal audit purposes. Similarly, Lange (2016), a former internal auditor, observed that while organisations officially demonstrate their appreciation of and respect for internal audit, their everyday attitude to it tends to be negative.

Efforts to improve the image of internal auditing should also give more emphasis on explaining its role, goals, and benefits for organisations, their shareholders and the general public. Setting the profession in a positive context could raise internal auditors' self-esteem and improve organizations' understanding of internal auditing. As a result, more of them may want to have the function in their structures. Measures improving internal audit stakeholders' perceptions will certainly need time to take effect but they are certainly worth the effort.

The results of this study can benefit a wide range of recipients, including internal auditors (aspiring and current), executives, educators, and training institutions, and educators.

Regarding internal auditors, they can help them develop more effective strategies for communication and cooperation with their stakeholders and design audit plans and methods better addressing auditees' needs and defusing their negative perceptions. By providing an insight into the aspects of being an internal auditor, they can also allow professionals considering the career of an internal auditor to make an informed decision about whether or not to pursue it.

For executives, the results of the study can be an inspiration for developing measures improving communication between internal auditors and other employees and laying foundations for a cooperative environment of trust that organisations need to achieve their goals.

With regard to training institutions and educators, the conclusions from the study can be instrumental in creating training programmes for internal auditors, which in addition to imparting to them the specialist knowledge of their future profession will also help them realise its challenges and assess their suitability for it. According to Grzesiak (2020), the existing programmes do not place sufficient emphasis on developing internal auditors' social competencies, in spite of such competencies being required by employers and many internal auditors perceiving them as more relevant to their performance than technical competencies (cf. Grzesiak, 2021).

The auditees' reluctance to choosing the career of an internal auditor revealed by the study reflects the unpopularity of the profession and suggests that organisations may have problem recruiting qualified and experienced internal auditors. This prompts an interesting line of research on whether the image of internal auditors has an effect on students' decisions to work as internal auditors. The future research could use quantitative methods to build a statistical model of factors influencing students' decisions.

The contribution of the paper can be based on a model derived from the results. Further research can be conducted based on the findings of this study. This study results can be used to examine a statistical model of the impact of internal auditors' perceptions on internal audit effectiveness. The model would enable us to better understand the relationship between the internal auditor's perception and the internal audit effectiveness. Based on the results of this research, research hypotheses can be formulated.

A valuable source of information about how the public perceives internal auditing and internal auditors for use by qualitative research seems to be visual images and jokes. To the author's knowledge, jokes, which are very telling about the popular image of various social phenomena and can serve as reactive indicators of what society and popular culture believes in (cf. Humke, Schaefer, 1996; Farrell, 1998; Costa et al., 2011) have not yet been used to explore opinions on internal auditors (Chambers, 2014).

The study has several limitations, including the non-representativeness of the sample of respondents preventing the generalisations of its findings and the use of self-completed online questionnaires involving the risk of the respondents misinterpreting questions and the study yielding biased results as a consequence (cf. Babbie, 2013). There was also a risk of the researcher understanding respondents' answers differently than intended.

Internal auditors' and auditees' statements seem linked in two main places. The first is the importance of first experience with internal audit. Auditees indicated that often their first contact with an internal audit/auditor was spoiled by the internal auditors' lack of professionalism, mannerisms, or their negative attitudes toward the auditees. Auditees noted that internal auditors often had an attitude called by them as "I know better, I'm the internal auditor". There is a possibility that the image of the internal auditor may be damaged by their unprofessional behavior. The internal auditors surveyed also noted this problem. They said that often the reason for such unprofessional and dysfunctional behavior of some internal auditors is their lack of association in the IIA and lack of concern for the image of the internal audit profession and the internal audit community. Internal auditors' perception is conditioned by the emotions associated with internal auditing, especially fear of internal auditing. For the auditees surveyed, internal audit is not a natural activity in organizations. This means that internal auditors may be less likely to adhere to professional standards or to be as thorough in their work, since they don't feel any sense of connection to their work or to the internal audit profession. This can lead to unprofessional and dysfunctional behavior, which can be detrimental to the organizations they are auditing.

6. Summary

The paper presents a qualitative study, which was conducted as part of a larger project studying internal audit effectiveness in terms of human capital and social contexts. Its theoretical part containing a review of studies on the image of internal auditors is followed by the analysis of the results of a survey of auditees and internal auditors, who were selected using purposive sampling. The aim of the survey was to collect respondents' narratives about internal auditors based on their personal experiences and popular opinions. There is evidence that a narrative approach can be useful in the study of internal audit (cf. Nordin, 2022).

The analysis of the narratives resulted in a thick description of how internal auditors and their activities are perceived in workplaces. Study subject was the content (narratives) received from respondents.

The study revealed a relatively high level of auditees' reluctance towards internal auditors, consistent with the results of earlier studies. It also indicated that the negative image of internal auditors in their workplaces was probably associated with many auditors adopting an overly strict and 'prosecutive' attitude to auditees, creating an atmosphere of intimidation and discomfort.

The study has a number of practical implications. It adds to the existing information about the psychosocial aspects of being an internal auditor and re-emphasises the need to develop and implement strategies aimed at repairing the image of internal auditors in organisations. Burton et al. (2014) observed that negative perceptions of the profession might be reduced by the change in internal auditor role. It also gives more insight into the perceptions of internal auditors and highlights factors influencing internal audit effectiveness. By exposing the causes of the reluctance surrounding internal auditors, the results of the study can help create measures increasing auditees' trust in internal audit and making them feel more comfortable in interactions with internal auditors, thus contributing to greater effectiveness of their activities. Hence, this study will benefit both theoreticians and practitioners as extended previous science research in this subject.

The study analyzes issues related to the perception of their work - the article deepens knowledge of the psychosocial conditions and realities of internal auditors' work in Poland. The study broadens the perspectives of internal auditor's work and shows new areas worthy of research exploration (such as the first experience of internal auditing in organizations or the determinants of negative image). Thus, the study conclusions call for more in-depth research in the future. Furthermore, the findings provide an opportunity to gain a better understanding of the complexities of the internal auditor's role, paving the way for a more comprehensive, holistic approach to the psychosocial aspect of internal audit. The study is likely to provide a broader view of internal auditors' work and the difficulties they face doing it. Perhaps the article will become a guideline for internal auditors in working with auditees. The image of internal auditors requires further scientific investigation.

There is still some truth in Ramamoorti's statement (2003) that internal audit professionals continue to face the challenge of developing a strong understanding of their value proposition and managing their image and perception within their organization. Victor Z. Brink observed that "It is the first task of the auditor to ... convince the employees that he is not a detective, that instead he is motivated by sincere objectives of helpful and constructive service" (Reves, 1946, p. 84).

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INVESTIGATION PROCEDURE REGARDING THE INTRODUCTION OF DIETARY SUPPLEMENTS INTO THE MARKET IN POLAND

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Purpose: The purpose of the paper is to describe and graphically visualise the investigation procedure carried out by the Chief Sanitary Inspector (GIS) as part of an entity's introduction of foodstuffs, especially dietary supplements into the market in the Republic of Poland.

Methodology: The basis for the paper was a study of the legislation governing the investigation procedure carried out by the Chief Sanitary Inspector in Poland. In addition, it involved an analysis of the comments to the current legislation and of the subject literature available in international and domestic reference databases.

Findings: The conducted study resulted in the development of a visualisation of the investigation procedure for dietary supplements' notification in Poland. A criticism of the aforementioned procedure and issues that require regulation are included in the paper.

Practical implications: The developed procedure provides a useful visualisation of the legal requirements in the aforementioned area.

Social implications: The presented discussion is intended to draw attention to the legal provisions that are important in terms of the life and health of consumers of dietary supplements.

Originality: The procedure of introducing foodstuffs, especially dietary supplements into the market in the Republic of Poland is described in legislation. Similarly, legislation also describes the investigation procedure for non-compliances occurring during the notification of dietary supplements. Nevertheless, the authors proposed a description and visualisation of the procedure by analysing its legal conditions in detail. Furthermore, they drew attention to the provisions' ambiguity and the resulting formal doubts.

Keywords: dietary supplements, investigation, the Chief Sanitary Inspector, Poland.

Category of the paper: research paper.

1. Introduction

The notification of dietary supplements for introduction into the Polish market is governed by relevant rules of law (Act of 25 August 2006; Ordinance of the Minister of Health of 23 March 2011). In Poland, the body with competence to accept a notification of an entity's intention to introduce a dietary supplement into the market is the Chief Sanitary Inspectorate (GIS).

From a formal perspective, the day on which the notification, signed with a qualified electronic signature or a handwritten signature, is sent by the notifying entity to GIS is the day on which it is possible to commence the sale of dietary supplements in the market (Hys, 2018, 2020; Hys, Koziarska 2020, 2021). Importantly, the notification service is free of charge. The exception is when the notification of the intention to introduce a supplement into the Polish market is filed by the entity's proxy. The notifying entity may then incur additional fees related to the proxy service (Resnik, 2018).

In general, the notification procedure involves sending by the notifying body of an official document stating its intention to market the dietary supplement in Poland (Report NIK, 2017; Wróbel et al., 2022). The notification process thereby consists of sending a formal notification which, according to the legislation, contains specific data (Figure 1).

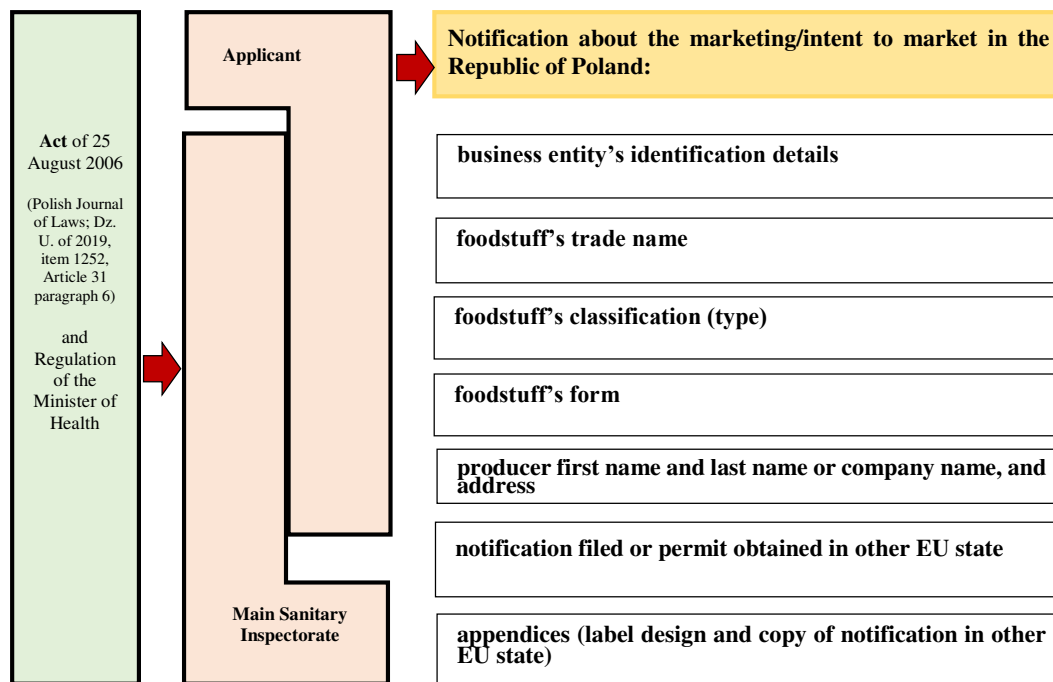


Figure 1. Dietary supplement's notification procedure in Poland.

Source: own study.

The contents of the notification for the introduction of a dietary supplement into the market is governed by the provisions of the Ordinance of the Minister of health of 23 March 2011 *on the draft notification form on products introduced into the market of the Republic of Poland* (Regulation of the Minister of Health of 23 March 2011).

The information that the notifying entity must include in the notification pursuant to the provisions of the aforementioned Ordinance must especially include the following:

- the form in which the dietary supplement will be sold,
- the dietary supplement's content, i.e. precise quantitative and qualitative composition,
- the draft label (packaging) along with all marks and warnings for consumers.

Although the information contained in the notification is declaratory, it is noted that it should be marked in accordance with the facts. The issue is to adhere to both formal and substantive guidelines. Otherwise, the Chief Sanitary Inspectorate's employees have legal tools at their disposal, with which they can temporarily suspend the trade of a given dietary supplement or completely remove it from the market.

Due to the possible need for the GIS to verify the notification filed by the notifying entity, the paper addresses the issue of the investigation procedure governed by legislation and applied to foodstuffs, especially dietary supplements (hereinafter referred to as dietary supplements) that are being introduced into the market of the Republic of Poland (Regulation of the Minister of Health of 29 May 2007; Regulation of the Minister of Health of 21 December 2019).

2. Metodology

An analysis of the subject literature was the basis for the study carried out in this paper. The analysis particularly included a review of the current legislation on the investigation procedure carried out by the GIS and of the available literature in the subject matter (Figure 2).

The literature review became the basis for an analysis of the current knowledge on the subject, ultimately enabling the development of a graphical visualisation of the procedure used in the aforementioned procedure.

The review of subject literature was carried out through the following activities: data collection (relevant subject literature identification), data validation, the investigation procedure establishment, visualisation of the aforementioned procedure and presentation of final conclusions, with particular emphasis of the criticisms of the aforementioned procedure.

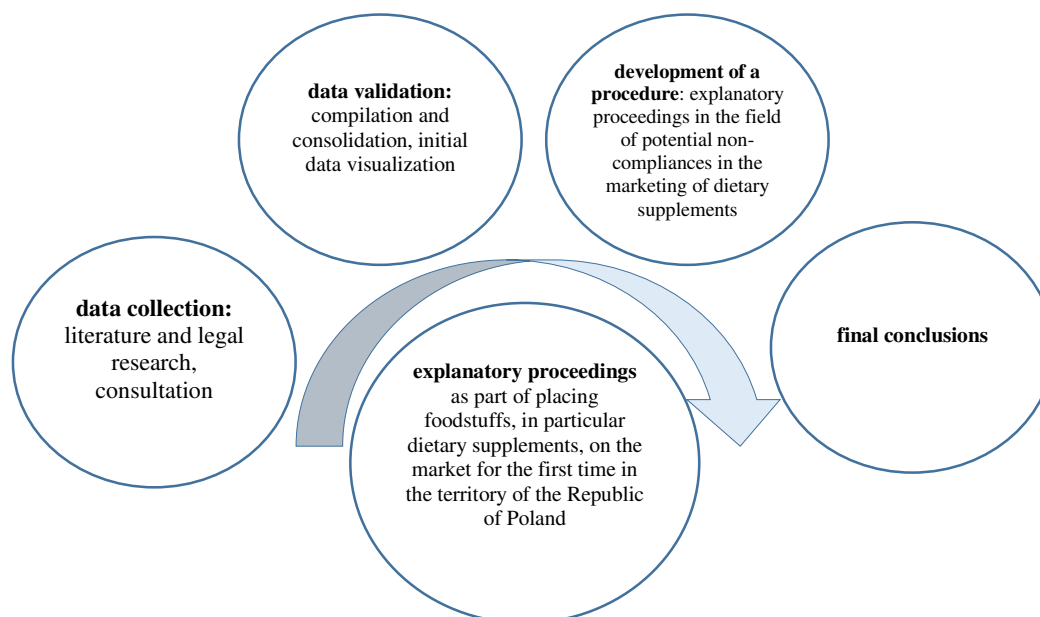


Figure 2. Subject literature review methodology.

The subject literature analysis allowed for developing a graphic visualisation of the investigation procedure carried out by GIS against an entity that filed a notification about its intent to introduce dietary supplements into the market in the Republic of Poland.

3. Result and discussion

The Chief Sanitary Inspector may carry out an investigation procedure upon receiving a notification about the introduction of or the intent to introduce dietary supplements into the market in the Republic of Poland, aimed at clarifying whether the notified product meets the requirements set out in the Act (Polish Journal of Laws; Dz.U. 2006, no. 171 item 1225; Polish Journal of Laws; Dz.U. 1960, no. 30 item 168; Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004; Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017). Importantly, the GIS may carry out an investigation, but does not have to and does not carry out such an investigation for every notification submitted, unless it considers it appropriate to do so. The investigation procedure is governed in Poland by relevant legal provisions, with the individual stages of its implementation recorded in the form of a flowchart (Figure 3).

If the GIS decides that it is necessary to initiate an investigation procedure against an entity that filed a notification of its intent to introduce a given dietary supplement into the market, the aforementioned investigation is carried out to a specific extent.

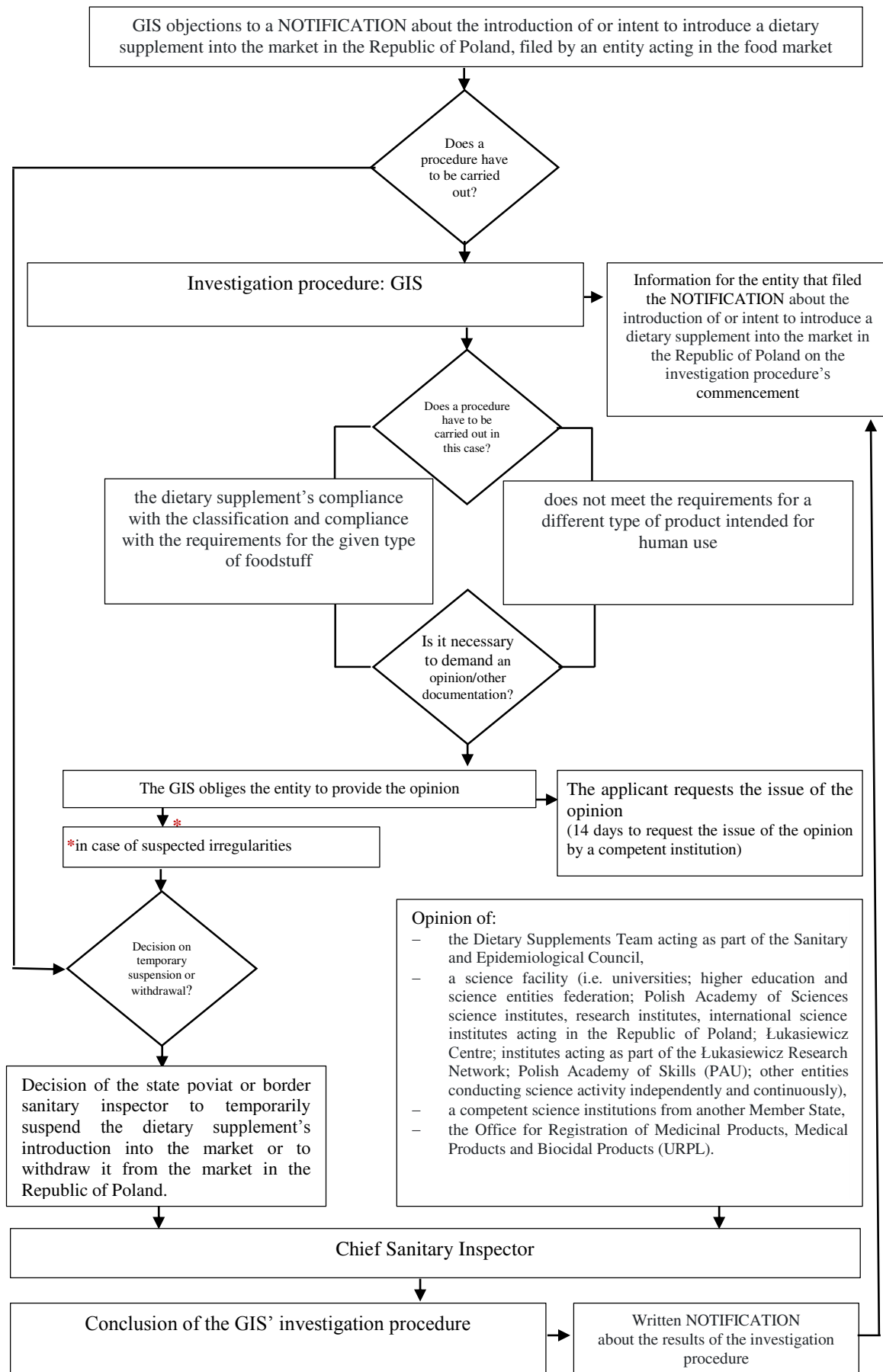


Figure 3. The investigation procedure carried out by the GIS.

It is the primary responsibility of the GIS to inform the entity without delay that an investigation procedure has been undertaken against the notification concerning the dietary supplement in question.

The investigation procedure is to provide an answer on the following issues, i.e. whether the given product (Article 30 paragraph 1 points 1-2):

- is a foodstuff according to the classification proposed by the entity acting in the food market and whether it meets the requirements for the type of foodstuff in question (especially in terms of its composition, properties of individual ingredients and the intended use of the dietary supplement in question, or
- does not meet the requirements of another type of product intended for human use (especially a medicinal product - within the meaning of the pharmaceutical law; a cosmetic product - within the meaning of the cosmetic products law; a medical device - within the meaning of the medical devices law).

The statutory deadline for the GIS to carry out an investigation is 60 days. However, additional time (if necessary) should be added to the period of the procedure to document that the entity filing the notification has met the requirements.

The costs of documenting compliance with the requirements (so-called opinions) shall be borne by the entity filing the notification to the GIS. The opinion may be issued by the Dietary Supplements team acting as part of the Sanitary and Epidemiological Council, science facilities, the Office for Registration of Medicinal Products, Medical Products and Biocidal Products (URPL) or by competent science institutions of another Member State.

If irregularities are suspected in the notification filed by the entity, it is possible to temporarily suspend the dietary supplement's introduction into the market or to completely withdraw the product from the Polish market. The decision is made by the state poviast or border sanitary inspector.

Once the investigation procedure has been completed, the GIS informs the notifying entity in writing about the results of the investigation.

4. Conclusion

The investigation procedure concerning the dietary supplement notified for trade was presented graphically based on the analysis of the subject literature. Nevertheless, despite the seemingly unambiguous procedure, literature features many critical references about the procedure's ambiguity.

The authors raise criticisms of the investigation procedure carried out by the GIS, with regard to, among others, the following (e.g. Zboralska, 2011; Szymecka-Wesołowska, 2014; Van Regnault et al., 2021):

- the timing, scope and mode of the inspection carried out by the GIS with regard to, among others, the following issues (Supreme Audit Office's Report):
 - a) dietary supplements are subject to testing as part of official food inspections only after they have been introduced into the market and only to a selected extent,
 - b) the notification is not verified before the dietary supplements are introduced into the market,
 - c) the commencement of an investigation procedure does not halt the distribution of dietary supplements in the market,
- the prerequisites for commencing an investigation procedure are not clarified,
- the timing and legal form of commencing an investigation procedure are not clarified,
- the opinions of science facilities, the URPL and other indicated entities on the following:
 - a) the notifying entity's inability to challenge a provision requiring it to submit an opinion,
 - b) the notifying entity's inability to challenge an opinion issued by the indicated opinion-making facilities, because the GIS is bound by this opinion (Balicki),
- the legal form of the investigation procedure's conclusion; there is no administrative decision (only an obligation to notify the entity in writing of the investigation's results, but no legal form of this notification, which results in doubts as to the legal effects of such an act, or the possibilities of appeal),
- there are no regulations concerning the notification procedure's conclusion,
- there are no regulations concerning the corrective notification.

Hence, the authors point out that, in the context of so many doubts articulated in the subject literature concerning the mode of the investigation procedure, it is necessary to start a discussion and take steps to clarify the legal provisions allowing for the regulation of the aforementioned issues.

The authors of this paper have developed a visualisation of the investigation procedure that can be commenced by the GIS regarding dietary supplements to be sold in the market of the Republic of Poland. The procedure and its description are useful and represent a new form of presentation of the relevant legal provisions. At the same time, references to the subject literature allow for a direct reference to the relevant legal regulations.

Acknowledgements

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SELECTED ISSUES OF USING LEAN MANAGEMENT IN UNIVERSITY MANAGEMENT

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Purpose: The aim of the article is to present an analysis of selected elements of Lean Management - barriers in management systems and methods of improvement on the example of public universities in Poland.

Design/methodology/approach: The article is a theoretical and empirical study presenting selected results and an analysis of the survey results. The study was conducted on a group of 58 public universities in Poland in 2021-2022.

Findings: The analysis of the research results presents the characteristics of selected barriers in the management systems of the analyzed universities. The answer to the existing barriers is the presentation of selected methods of improvement undertaken by the managers of the surveyed universities in order to minimize or eliminate them.

Research limitations/implications: The limitations relate to the conducted study and result from the selection of selected barriers in university management systems for the study and the ways of improving these systems. Therefore, some of the barriers or ways of improvement may have been omitted, which will be taken into account in subsequent research and articles.

Practical implications: The results of the study show the barriers in management systems in the surveyed universities, which are often a source of waste and other problems. As part of the study results, university managers indicated which improvement methods they take to counteract the existing barriers.

Originality/value: The added value of the article is a study conducted on a group of public academic universities in Poland in the field of implementation of selected elements of Lean Management.

Keywords: Lean Management, university, improvement.

Category of the paper: Research paper.

1. Introduction

The analysis of the literature on the subject and research conducted in Poland and around the world indicates a fundamental tension in the development of university management, related on the one hand to the expansion of management ideas and methods, and on the other hand to

resistance to their application. The development of management concepts and methods can be illustrated by both at the level of solutions concerning academic governance and management within the universities themselves. On a macro scale, in more and more countries, higher education systems and universities are developing towards entrepreneurial universities, moving further and further away from the idea of a traditional Humboldt university. Manifestations of this transformation may be, for example, trends in the growing importance of the market and competition in science and education, commercialization of research, professional university management moving away from the model of "academic self-governance". On the micro and mezzo scale, there is a rapid increase in the importance of management concepts and methods within the universities themselves, which can be exemplified by the functional areas of strategic management, financial management, quality and process management, as well as the areas of marketing and human resources management. The challenge for Polish universities striving to improve their academic activity is the effective implementation of management concepts and methods that have been developed in many good universities around the world (Sułkowski, 2017, p. 11). One of them is Lean Management (Lean, LM).

Lean Management is a business strategy and not a toolset. Lean is the willingness on each hierarchical level to question one's own behavior, to learn from mistakes and to continuously develop new solutions towards waste-free processes. Lean stands for permanent customer-focused and value-adding thinking and acting. Lean has mainly been developed for and applied in the area of manufacturing. However, various activities have shown that the idea of Lean can be applied in the administrative service sector as well. However, how can it be applied in a very special service sector, that of higher education? Everywhere, and thus also in higher education, we are confronted with an increasing degree of complexity. In the past, universities were able to focus on their core competencies: research and teaching. However, today, universities are competing in a global market, with a declining number of potential students, and staff members who would gain much higher salaries in the private market. As a consequence, universities now need to become "decahletes" with ten different skills: excellence in teaching, excellence in online distance learning, excellence in research and development, excellence in gaining research funds, excellence in providing service to students, excellence in managing international partners, excellence in alumni management, excellence in cooperation with companies and knowledge transfer, excellence in ranking management and accreditation and excellence in self-marketing (Höfer, Naeve, 2017, pp. 64-65).

The article is a theoretical and empirical study on the analysis of selected elements of Lean Management at public universities in Poland. The theoretical part of the article presents selected information regarding the concept in question, primarily meaning of Lean Management in Higher Education.

The research part of the article presents selected results and analysis of the results of the survey, which was conducted on a group of 58 public academic universities in Poland in 2021-2022. As part of the analysis of the results of the survey, the barriers present in the management

systems of the surveyed universities were presented, as well as the improvement methods undertaken by the managers of these universities as a response to the barriers.

2. Meaning of Lean Management in Higher Education

In order to use the large scientific and didactic potential of many Polish universities, it is necessary to improve the management of academic organizations. Many organizational solutions used in good universities around the world are innovative and based on a continuous process of learning and improvement. Polish universities should use such benchmarks and implement their own innovations in this area, using good international models. Development strategies may depart from the traditional planning form and move towards an evolutionary approach. The organizational structures of universities can be transformed from hierarchical, often ossified linear solutions, towards flexible solutions, taking the matrix, tensor or network forms. Changing academic cultures can move from traditional Humboldtian university values to entrepreneurial and innovative cultures (Sułkowski, 2017, pp. 11-12; Dyrdał Solbrenke, Sugrue, 2020; Jakubiec, 2021).

Lean Management constitutes a management concept that has been successfully implemented by enterprises and organizations around the world. In Poland, an increasing number of organizations can boast of successful implementations of this concept. The concept of Lean Management is of Japanese origin. It derives from the Lean Thinking philosophy, implemented in the terminology of economics and management by J.P. Womack'a, D.T. Jones'a and D. Roos'a, scientists representing the Massachusetts Institute of Technology (Womack, Jones, Roos, 1990; Womack, Jones, 1996). It should be added, however, that the first term of lean production was used by J. Krafcik, who in 1988 published a work entitled *Triumph of the Lean Production System* (Krafcik, 1988, pp. 41-52). The concept of Lean Management has been developed in Toyota Motor Company as part of the Toyota Production System and has been used and developed over the years in the production plants of this brand (Lisiecka, Burka, 2011, p. 14; Lisiecka, Burka, 2016, p. 15; Bhasin, 2015). The core of the Lean Management concept is the production process, but it is now being used successfully in the service sector.

Recently organizations are more and more recognizing the potential of Lean Management for different services and industries, resulting in new approaches for and adaption to the respective area, with Lean Management serving as a basis. It is transferable to a wide variety of industrial areas, for example to higher education – Lean Higher Education (LHE). LHE refers to the adaption of Lean thinking to higher education for the benefit of improving academic and administrative operations (Pötters, Szedlak, Leyendecker, 2019, p. 1725). According to W.K. Balzer'a "LHE is a problem-solving framework used to increase the value and

performance of university processes. Grounded in the principles of continuous improvement and respect for people, the successful application of LHE will meet the expectations of those served by processes, engage and develop of employees who deliver the processes, and enhance the efficiency and effectiveness of the university” (Balzer, 2020, p. 16; Balzer, Francis, Krehbiel, Shea, 2016, pp. 442-462).

Thanks to use of Lean in area of education the Lean House in Higher Education has been created (transformation of the components of the so-called Toyota Production System House), figure 1 (Höfer, 2016, pp.189-208; Dyrdal Solbrekke, Sugrue, 2020; Grudowski, Wiśniewska, 2019, pp. 49-61; Hines, Lethbridge, 2008, pp. 53-56; Kucheryavenko, Chistnikova, Thorikov, Nazarova, 2019, pp. 687-705).

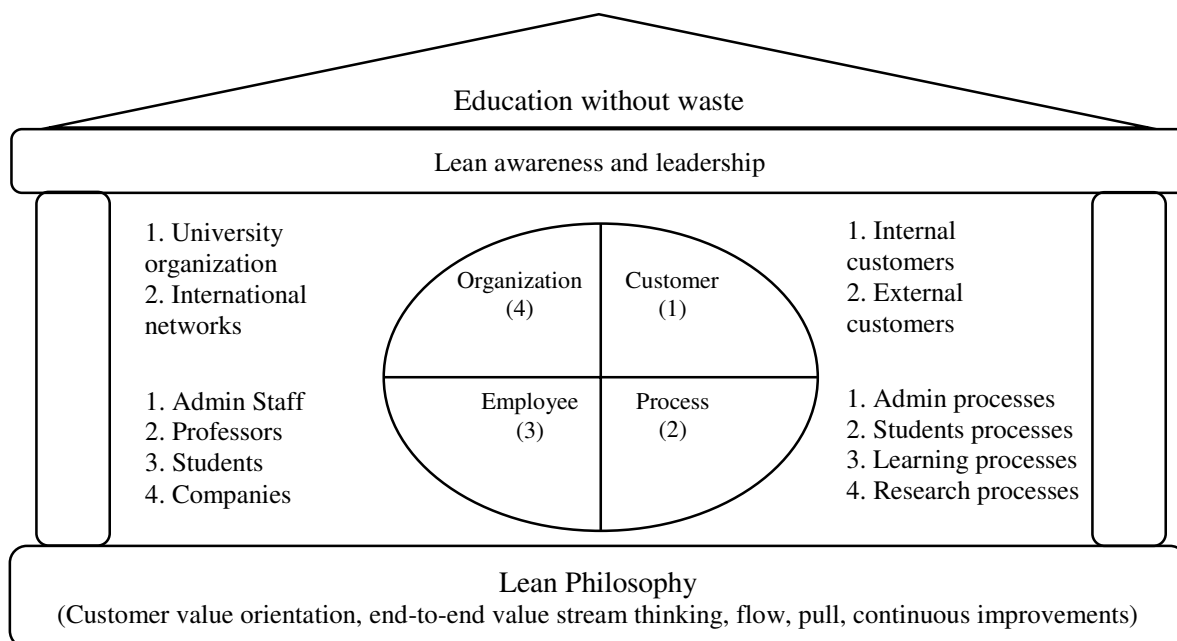


Figure 1. The Lean House in Higher Education. Adapted from: “The application of Lean Management in Higher Education” by S. Höfer, J. Naeve, (2017).

Lean House calls for a change in philosophy and organizational culture in university management. It is important to properly understand the requirements of the internal (employees, students, doctoral students) and external (candidates for studies, co-operators and stakeholders), orientation on the process approach and implementation of process management, as well as continuous improvement, which means, among others, the use of a number of management instruments such as tools for quality management and improvement.

Lean management is the expression of the willingness on each hierarchical level of a higher education institutions to question one’s own behavior, to learn from mistakes and to continuously develop new solutions towards waste-free processes. It stands for permanent customer-focused and value-adding thinking and acting. Lean management is a humanistic concept of management based on profound self-reflection on organizational, technical, and cultural conditions of a university. It is based on two fundamental values that are close to the traditional academic ethos: respect for people and constant striving for perfection.

In the operational dimension, the implementation of these values is manifested through actions aimed at increasing the value created for the school's stakeholders (students, employees, scientists, lecturers, etc.) by simultaneously minimizing or eliminating all sources of waste (Thomas, Francis, Fisher, Chilton, 2013, p. 43; Vukadinovic, Djapan, Macuzic, 2016, pp. 35-50).

The fundamental features of the Lean Management concept are striving to improve the broadly understood quality, minimize costs and shorten the time of process implementation as a result of the systematic elimination of waste as part of management based on a flat organizational structure. Lean Management stands for process-focused management. Properly implemented principles of process management may be a factor supporting the adaptation of the Lean Management concept. Process management, aimed at achieving the synergy effect to achieve the goals of an organization, has become the basis for "lean management" for the comprehensive improvement of the management system. The key goal of process management and the Lean Management concept based on it is the elimination of rigid functional structures. Instead of this ineffective model, the Lean Management concept introduces a flattened and horizontal organizational structure that focuses on processes and knowledge accumulation, while decomposing the strategic goals into the goals of processes and individual positions along the value chain. Process management in the Lean Management concept concerns not only operational processes, but also auxiliary processes, without which the proper functioning of an organization would not be possible (Wiśniewska, Grudowski, 2014, pp. 34-38; Wolniak, 2014, pp. 157-166).

The implementation of Lean Management means the implementation of five fundamental principles on which the concept is based. These principles are (Litvaj, 2023, p. 17):

1. Identification of the value stream – value must be specified for the product from the customer's point of view.
2. Elimination of waste (Muda) – cancelling of all identified and unnecessary waste like activities, tasks, processes, etc.
3. Ensuring the flow of activities in the processes – make value flow without interruption along the value stream.
4. Process control by means of a pull system – an organization must establish pull and let the customer pull value from the supplier/producer.
5. Constant pursuit of the perfection – an organization must strive for the perfection.

Lean Management creates a new approach for HEIs. It raises both concerns and hopes.

Lean Management is an effective, comprehensive methodology aiming for the reduction of nonvalue adding activities. Defining value, mapping and redesigning processes in order to provide continuous improvement, eliminate waste and to focus on customer expectations are among the major principles of Lean (Grudowski, Wiśniewska, 2019, p. 52; Balzer, Francis, Krehbiel, Shea, 2016, pp. 442-462).

3. Research method and results of analysis

This part of the article presents selected fragments of the research carried out in 2021-2022 at public academic universities in Poland. The analysis of the research results presents the characteristics of selected barriers in the management systems of the analyzed universities. The answer to the existing barriers is the presentation of selected methods of improvement undertaken by the managers of the surveyed universities in order to minimize or eliminate them. Fifty-eight public universities took part in the study. The return of completely and correctly completed questionnaires was received from 38 universities, which gave a return of 65%. Table 1 presents the assumptions related to the conducted study.

Table 1.

Assumptions of the research

| Items | Description |
|---------------------|--|
| Research goals | Theoretical: Presentation of selected information regarding the concept in question, primarily meaning of Lean Management in Higher Education. Practical: Analysis of the barriers in the management systems of the surveyed universities, as well as the improvement methods undertaken by the managers of these universities as a response to the barriers. |
| Research method | Survey study. |
| The interviewees | The Rectors and other managers and employees suggested by the rectors of 58 public academic universities in Poland. |
| Date of realization | Two years: 2021-2022. |

Source: personal elaboration.

The characteristics of selected research results began with the identification of barriers in the management systems of the surveyed universities. The following barriers were identified for the study:

1. Constant changes in the law, forcing a change in management directions of the university.
2. Large formalization and bureaucratization of management.
3. Poor integration of employees with the organizational unit.
4. Employees avoiding responsibility and self-solving problems.
5. Disapproval of the academic community to changes in the concept of management.
6. High independence of employees, especially the habilitated.
7. Focus on tasks, not processes.
8. Lack of implemented management through processes.
9. Implementation of often contradictory goals by organizational units/departments/groups/employees.
10. Lack of ongoing monitoring of the achievement of goals.
11. Application of corrective actions, lack of risk estimation, and thus, none taking preventive measures.

12. Not seeing the right client (student, doctoral student) and not creating value, for both the client and the individual.
13. Failure to identify the causes (sources) of waste/problems.
14. Waste of many resources, such as money, time, office supplies, etc.
15. Supply orientation in terms of the educational offer (focus on resources, not on market requirements).

During the study, the respondents were asked for an assessment on a scale of 1 to 5, what impact the barriers have on the university management system. The analysis of the response results includes the averaged impact forces of individual barriers (figure 2).

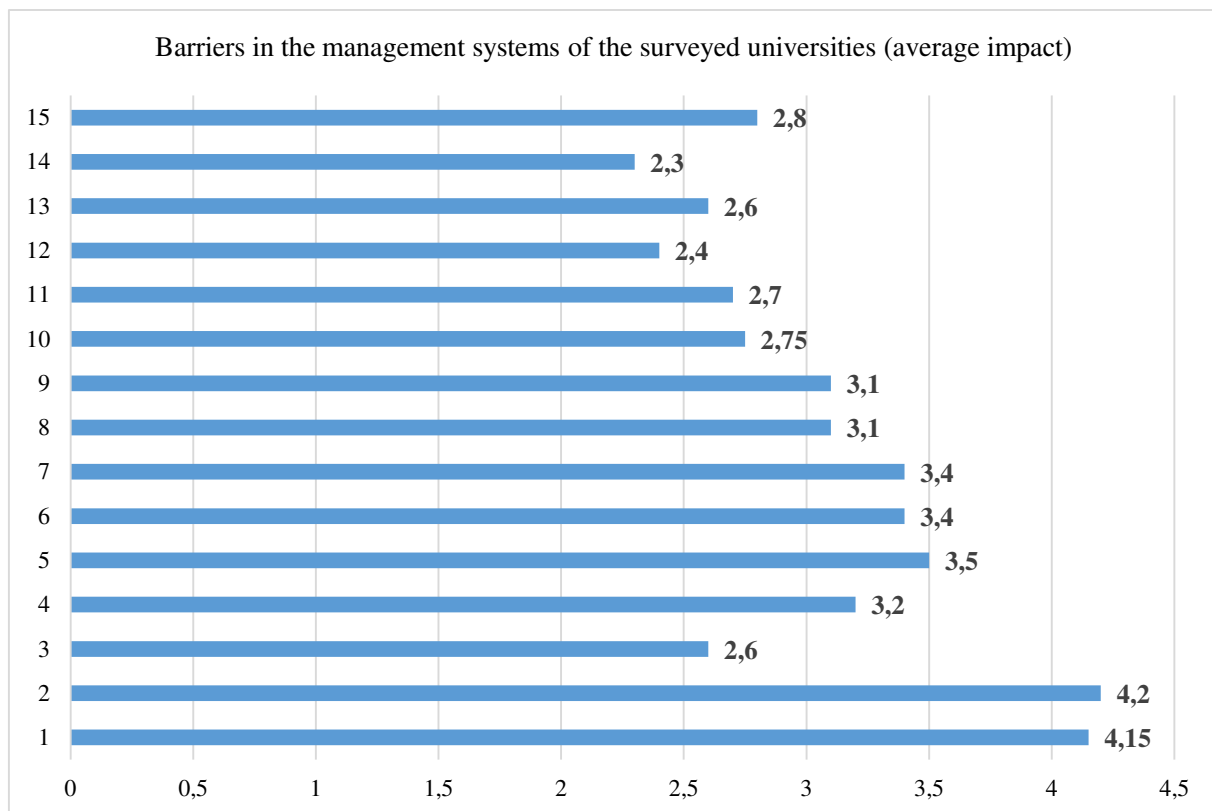


Figure 2. Barriers in the management systems of analyzed universities.

Source: Personal elaboration based on research results.

On the basis of the study, it was found that the average impact strength of barriers in university management systems for all 38 surveyed universities was 3.08. In view of such a result, for analytical purposes, an average impact force of 3.0 was adopted as the limit value, which should be considered high. As a general conclusion, it can be noted that eight barriers present in the management systems of the analyzed universities affect these systems in a strong and very strong way. These are the following barriers, taking into account the strength of their impact:

1. Large formalization and bureaucratization of management (4,2).
2. Constant changes in the law, forcing a change in management directions of the university (4,15).
3. Disapproval of the academic community to changes in the concept of management (3,5).
4. High independence of employees, especially the habilitated (3,4).
5. Focus on tasks, not processes (3,4).
6. Employees avoiding responsibility and self-solving problems (3,2).
7. Lack of implemented management through processes (3,1).
8. Implementation of often contradictory goals by organizational units/departments/groups/employees (3,1).

Next, barriers with an average impact force were specified:

1. Supply orientation in terms of the educational offer (focus on resources, not on market requirements) (2,8).
2. Lack of ongoing monitoring of the achievement of goals (2,75).
3. Application of corrective actions, lack of risk estimation, and thus, none taking preventive measures (2,7).
4. Poor integration of employees with the organizational unit (2,6).
5. Failure to identify the causes (sources) of waste/problems (2,6).
6. Not seeing the right client (student, doctoral student) and not creating value, for both the client and the individual (2,4).
7. Waste of many resources, such as money, time, office supplies, etc. (2,3).

Identifying barriers in university management systems is essential for their proper functioning. Referring the identification of barriers to Lean Management, it is a contribution to the use of specific methods of improvement and the use of various instruments of the concept.

The analysis of the results of the study in terms of existing barriers shows that the barriers with the highest impact strength are the barriers that have been a problem for Polish universities for many years. Changes in the law, and thus the constant bureaucratization and formalization of management, combined with the unfavorable attitude of some of the academic community to changes, create barriers to the implementation of solutions such as Lean Management. Process orientation is also necessary. This is difficult to implement, but not impossible. The processes at universities are formalized to some extent, for example through education quality assurance systems. It is important to transfer this to the faculty level and then to the whole university. Management through processes is the next step to broadly understood improvement. Thanks to process management, it is possible to delegate responsibilities and powers more effectively, properly define internal and external customers, monitor goals on an ongoing basis, as well as reduce resource consumption depending on processes and take actions to prevent the occurrence of barriers.

It is also important to convince employees that the changes are right. There is a need for training, motivational meetings and awareness of the effects that can be achieved thanks to the implementation of Lean Management assumptions. This should also affect the relations and attachment of employees to the organizational unit.

A detailed analysis of the answers to this question showed that the greatest number of barriers were identified in universities and technical universities, the least in the group of economic universities.

The occurrence of barriers in management systems causes specific problems in the implementation of processes, tasks or the functioning of individual university units. Therefore, in this context, specific ways of improvement should be undertaken as a response to emerging barriers and allowing to eliminate them or minimize the effects of their occurrence. In the course of the study, selected methods of improvement were analyzed and their application was assessed, also on a scale from 1 to 5.

As part of the study, the following ways of improvement were analyzed:

1. Implementation of management through processes.
2. Ongoing monitoring of process implementation.
3. Establishing responsibility for individual processes.
4. Flattening the organizational structure - appointing ad hoc teams to implement processes (solving problems).
5. Implementation of the so-called Continuous Improvement - use of available Lean Management instruments.
6. Better identification of internal and external customer needs.
7. Involving the external client in the implementation and improvement of processes.
8. Identification of causes (sources) of waste.
9. Reducing the waste of resources.
10. Reducing bureaucracy at universities.
11. Implementation of management through quality - orientation towards a learning organization myself.

Figure 3 presents the average assessment of the application of individual improvement methods.

The average degree of application of selected methods of improvement in the surveyed universities from all 38 analyzed surveys was 2.73. As the limit value of the average degree of application of the analyzed methods of improvement, 3.0 was adopted and considered sufficient. The results of the study show that only two methods of improvement exceed this value: flattening the organizational structure - appointing ad hoc teams to implement processes (problem solving) - (3.25) and identifying causes (sources) of waste (3.05). The remaining 9 analyzed methods of improvement should be considered as methods with a low degree of application.

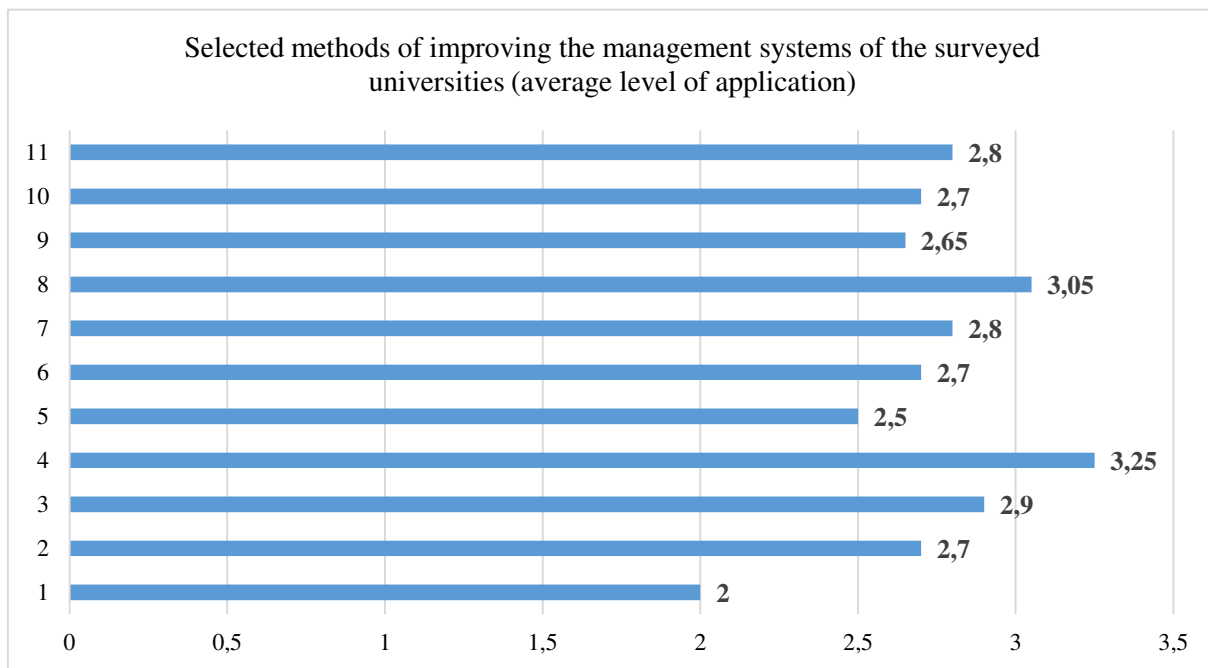


Figure 3. Methods of improving used by surveyed universities. Personal elaboration based on research results.

In the author's opinion, the results of this study are quite surprising. They show relatively low marks for the degree of application of selected methods of improvement, and two methods that are above the 3.0 mark, despite the fact that they constitute the assumptions of Lean Management, do not emphasize other important assumptions, such as proper identification of internal and external customers at the university and the inclusion of him in the implementation of processes. The analysis of selected ways of improvement draws attention to the fact that taking the right ways of improvement is the answer to emerging barriers. In this area, one can see the need for further education in the field of management quality and improvement of management quality by undertaking appropriate improvement methods. The implementation of appropriate methods of improvement by universities may contribute to more effective achievement of the assumed goals and organizational improvements across the university.

It should be emphasized that the implementation of a significant part of improvement methods that have received a low degree of application depends directly on the rector or other persons from the management of the university. These are e.g., ways of improvement such as: implementation of management through processes, implementation of continuous improvement and the use of Lean Management instruments, reduction of waste or less bureaucracy of universities. The methods of improvement mentioned above refer to the assumptions of Lean Management and their adoption will undoubtedly contribute to the increase in the importance of the concept and its application.

4. Summary

The article is a theoretical and empirical study presenting selected results of a study carried out on a group of public academic universities in Poland. The subject of the study concerned the analysis of the Lean Management concept in terms of its assumptions, elements of the concept culture and Lean improvement instruments.

As part of the presentation of selected research results, reference was made to the most common barriers in the management systems of the surveyed universities. As a response to emerging barriers, ways of improvement undertaken by university managers were presented.

The analysis of the survey results showed that among the barriers with the greatest impact, the following were indicated: high formalization and bureaucratization of management, constant changes in the law, forcing changes in the directions of university management, unfavorable attitude of the academic community to changes in the concept of management, high independence of employees, especially independent scientists, concentration on tasks, not on processes, employees avoiding responsibility and solving problems on their own, lack of implemented management through processes and the implementation of often conflicting goals by organizational units/departments/groups of employees. This is not a closed catalog, but only an indication of those barriers that appear as typical problems in the functioning of the surveyed universities.

As a response to emerging barriers, the surveyed universities implement methods of improvement with the use of Lean Management instruments. However, the assessment of the use of selected methods of improvement in the surveyed universities was low. The assessment was made on a scale from 1 to 5. The assessment level of 3.0 was considered sufficient. Only two methods of improvement exceeded this level: flattening the organizational structure - appointing ad hoc teams to implement processes (solving problems) and identifying causes (sources) of waste. The above results regarding the methods of improvement show that the surveyed universities still undertake actions that are not adapted to the emerging problems. In this regard, it is crucial that the methods of improvement allow to eliminate or minimize the effects of existing barriers. It is justified to continue educating and raising awareness of the managers of the surveyed universities in this regard.

In the summary of the article, it should also be mentioned that the study in general terms contributed to an increase in awareness among the managers of the surveyed universities regarding the assumptions of the concept in question. This fact may be a turning point for a wider application of the concept.

The possibilities of further and wider use of the assumptions of Lean Management and its instruments in the surveyed universities and other universities depend on the awareness and need for broadly understood improvement of the university management system, processes and services. It is important to verify emerging problems and barriers in university management on

an ongoing basis and to undertake improvement methods in response to the above, using specific Lean Management instruments. It is also necessary to strive for greater implementation of the elements of the Lean Management culture, resulting from such assumptions as the process approach or the appreciation of the role of human capital.

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CHALLENGES IN THE AREA OF GREEN ECONOMY AND GREEN TRANSFORMATION IN REGARD TO THE DEVELOPMENT OF ENVIRONMENTAL TECHNOLOGIES

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Purpose: The research objective of this paper was to define the lines of the environmental technologies development in the context of the transformation of the economy towards green growth. The discussion focuses on the challenges accompanying the transformation processes and the implementation of sustainable technological changes. The research results allowed identifying the prospective lines of technological development regarding the transformation towards green growth as well as the future research areas.

Design/methodology/approach: The study was based on the analysis of the development trends strictly connected with environmental technologies. The adopted methodology involved a comprehensive literature review and quantitative research using the CAWI technique combined with complementary qualitative research using an expert panel.

Findings: The analyses allowed distinguishing the most important trends and placing them within the process of the Silesia Province green transformation. The dominating importance was attributed to energy generation, storage and decarbonization (CCS and CCU) technologies.

Research limitations/implications: The paper highlights the green transformation issues and the technological changes within the transition process while searching for a model approach enabling to delineate the development determining factors, especially environmental technologies.

Practical implications: The study results can be used to formulate development scenarios and conduct analyses that involve these green economy components which determine the development of chosen technological areas.

Originality/value: In the coming years, green economy will constitute a significant area of regional and international development incorporating resource management, RES, energy and material efficiency, clean technologies, CSR, biodiversity protection or the models of sustainable consumption and production. However, there is no research on how green economy is to be implemented in areas undergoing transformation, particularly, which technologies and factors should be considered.

The identification of the challenges concerning the transition towards green economy and environmental technologies may prove critical for the Silesia Province, a region heavily affected by transformation processes, to formulate its 2030 *Green Silesia* Strategy and the development of its regional specialization.

Keywords: green economy, environmental technologies, transformation.

Category of the paper: research paper.

1. Introduction

Green economy constitutes one of the key areas of contemporary development both in the regional and international scale. The notion of green economy is strictly connected with the concept of sustainable development. Introduced in 2008 as an initiative of the UNEP (United Nations Environment Programme – a UN environmental agency), it was considered to be a method to address the economic crisis. Green economy owes its current position to the 2012 United Nations Conference on Sustainable Development (or Rio+20) held in Rio de Janeiro which focused on the idea of the transition towards green economy. The conference debates were centered on the themes of shaping a new model of socio-economic growth and on comparing the brown economy with the green one. It was reiterated that environmental protection constitutes an issue of key importance and that it should prevail in the new paths of growth. The brown model of economy which was still being applied at that time and which relied heavily on the use of fossil fuels and non-renewable resources was to be replaced with a new pro-ecological approach. The differences between the two models are presented in Table 1 below.

Table 1.
Brown Economy vs. Green Economy, a comparison

| Brown Economy/Excess Economy | Green Economy/Moderation Economy |
|---|---|
| Unrestricted economic growth | Decoupling natural resource use from economic growth |
| Fossil fuels | Renewable Energy Sources |
| Energy and resource intensity | Energy and resource efficiency |
| Greenhouse gas emissions | Clean production, curbed emissions |
| Generation of waste | Protection of biodiversity |
| Food waste | Sustainable consumption |
| Biodiversity destruction | Local economy |
| Global social inequality | Sustainable transportation |
| Overconsumption | Inter-generational and inter-regional justice |
| Business as usual | Corporate social responsibility of businesses and investors |
| Lack of corporate social responsibility | Social trust |
| Weakened social trust | |

Source: Ryszawska, 2013.

In recent years, the European Commission as well as a number of international organizations have started to incorporate green economy in their strategies on a more regular basis. Even though the very term ‘green economy’ falls under numerous definitions, in general, it refers to a low-emission economy which effectively uses natural resources and ensures social growth. According the European Environment Agency (EEA) a *‘green economy’ is one in which environmental, economic and social policies and innovations enable society to use resources*

efficiently, thereby enhancing human well-being in an inclusive manner, while maintaining the natural systems that sustain us. The EEA also underlines the fact that the majority of green economy definitions inextricably connect the elements of ecosystems, economy, human well-being and the accompanying issue of capital. In the light of the above, this approach poses such challenges as (i) ensuring ecosystem resilience of the natural systems that sustain us, (ii) improving resource efficiency (and reducing the environmental impacts of our actions). The graphic representation of the above mentioned interconnections is demonstrated in Figure 1.

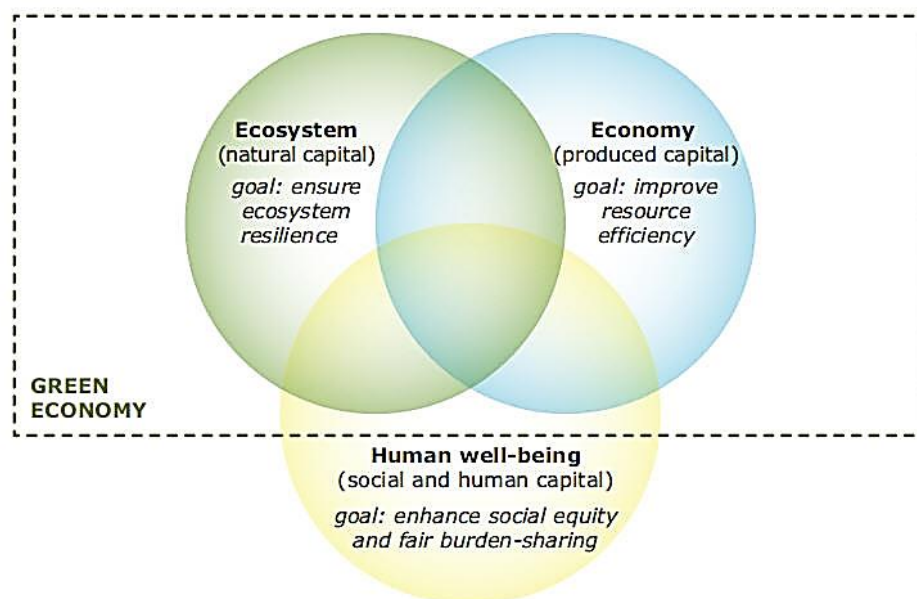


Figure 1. Green Economy processes.

Source: European Environment Agency.

Being a politically oriented concept, green economy is characterized by a broad meaning with sustainable development as a common denominator lying at its foundations. Within this context, one can assume that the basic definition of green economy is the one adopted by the European Commission; namely, it is *the economy which may generate growth and development improving at the same time the human well-being, ensuring jobs, limiting inequalities, eradicating poverty and preserving the natural capital upon which our long-term survival depends.* (Commission Communication “Rio+20: towards the green economy and better governance” COM (2011) 363 adopted on 20 June 2011).

The global trend of accentuating the environmental element was conducive to the introduction of new notions and concepts; for instance, green skills and green jobs, green projects, green growth, or inclusive green growth which favors social inclusiveness (Kasztelan, 2015). What is important, in the case of inclusive green growth, the notion should not be considered as a synonym of the concept of green economy; even though certain relationship between the two exists, they are supposed to be treated as mutually complementing rather than synonymous. Figure 2 presents the result of the European Commission effort to unify the approaches to the concept of inclusive green economy. This model reiterates the key assumption

that a standardized path towards green economy does not exist. As a consequence, the process of green transformation must be adapted to the specific context of each targeted area.

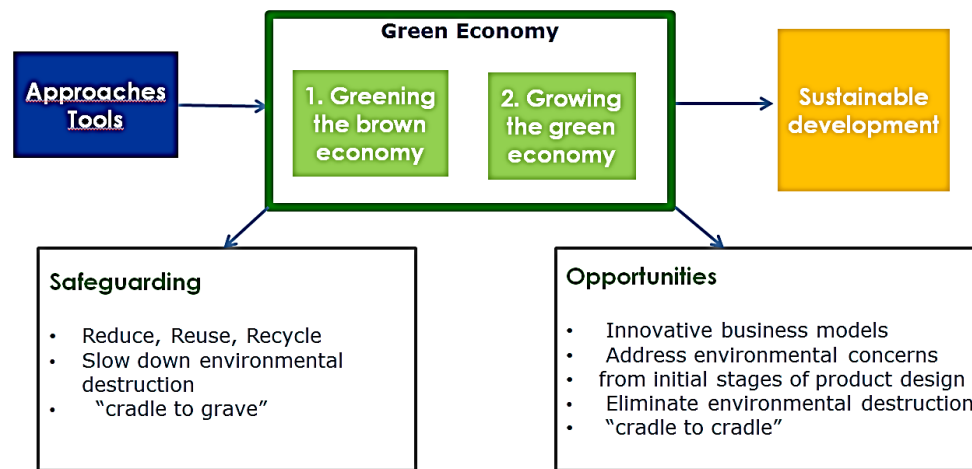


Figure 2. Inclusive Green Economy processes.

Source: The Switch to Green Facility, 2017.

Based on the presented approaches, green economy is predominantly aimed at realizing the principles of sustainable development, not at replacing it but rather constituting its more specialized scope. Quoting the research study by Adamowicz (2021), green economy may be understood as a set of principles, objectives and activities which involve the following:

- adhering to the principles of sustainable development, i.e. the rational use of resources in order to achieve economic and social targets by the present generation without compromising the interests of the future ones,
- using the natural and social capital in a sustainable manner by means of applying different tools such as the internalization of external costs or ecological accounting,
- comprehensive programming of resource use as well as the production and consumption processes, calculating the total and step-by-step costs of product life cycles, optimizing the management of manufacturing and consumption,
- adapting the economic systems to macroeconomic targets and global trends by means of creating green jobs, eradicating poverty, increasing competitiveness and developing the key sectors of the economy.

Currently, green economy is considered as a political concept and as a growing economic sector which has recently become a priority in the development strategies of states, international organizations or businesses.

The rising interest in the transformation towards green economy results from the critical debate on the decoupling of the economic growth from the ever increasing use of natural resources. The unrestricted rise of production, consumerism as well as lack of moderation in using the non-renewable components of the environment, including the nature's values seriously threatens the existence of our civilization. Therefore, it has become necessary to pursue such solutions which would ensure synergy between the economic activities and the ecosystems.

In his paper, Söderholm (2020) makes a reference to the challenges which emerge during the implementation of sustainable technological changes within the context of green economy; in particular, (i) dealing with the dispersed and increasingly global threats to the natural environment; (ii) the achievement of radical, as opposed to incremental, feasible technological changes; (iii) ecological capitalism and the uncertain scenarios of the business-as-usual; (iv) the role of the state and the appropriate politics combinations; and (v) coping with problems and distribution effects. The author emphasizes the importance of the multi-disciplinary research projects regarding the thorough understanding of the socio-technological transformation as well as the necessity to translate the environmental and technical challenges into actions and social changes.

Another interesting approach to the issue of sustainable technological development with relation to green economy is presented in the paper of R. Tulsiram (2022). While discussing the green economic strategies, the author underlines the need to consider both the development and the application of sustainable technologies as strategic priorities. In a similar manner as in the work by Söderholm, Tulsiram focusses her considerations on the defined challenges which determine the transformation processes and create the future research areas, i.e. (i) the management of the dispersed and increasingly global environmental threats; (ii) the achievement of radical, but not incremental, feasible technological changes; (iii) green capitalism as well as uncertain business scenarios; (iv) the role of the state and the design of relevant political packages; and (v) addressing the problems and sectoral impacts.

2. Theoretical background

The 2030 Development Agenda entitled “Transforming our World: the 2030 Agenda for Sustainable Development” adopted on the 15 of September, 2015 and binding all the 193 UN Member States to undertake efforts to achieve the 17 Sustainable Development Goals (SDGs) constitutes a significant document of international footprint (The United Nations, 2015).

Within the framework of our research, Goal 7 of the Agenda (SDG7) calls for a special attention. The SDG7 is meant to “ensure access to affordable, reliable, sustainable and modern energy for all.” In order to achieve the Goal, it is required to undertake comprehensive and orchestrated activities which focus on decarbonization as well as the expansion and upgrade of renewable energy systems. To large extent, it will involve the implementation of modern technologies which are critical for the development of pro-ecological energy sources and which minimize the environmental impact of their production and distribution. The transition to a sustainable energy system is connected with a combination of new challenges and opportunities. IRENA, the International Renewable Energy Agency, is an intergovernmental organization which supports states to promote the widespread adoption of renewable energy systems. It performs research on the technological solutions aiming to overcome the challenges

and recommending the best available practices. The proposed solutions include the following technologies:

- carbon capture, i.e. technologies enabling to capture, transport and store CO₂ which comes from the combustion of fossil fuels before it is released into the atmosphere,
- critical materials, i.e. the resources that are necessary for the production of the energy transformation technologies, including wind turbines, solar panels, electric vehicle batteries and electrolyzers. It is of key importance to ensure that they are available and affordable,
- energy storage, i.e. the energy storage technologies (for example batteries, fly wheels, pumped storage power plants) which offer a significant potential of flexibility for the energy systems in the transition period,
- hydrogen, i.e. ecological hydrogen technologies, production paths and products which create the possibility of limiting transport emissions, the emissions generated by sectors that are difficult to eliminate or of combining sectors,
- technology and infrastructure, i.e. solutions within the scope of renewable energy technology and infrastructure supporting climate change mitigation activities and resilient energy systems, especially in small developing member states as well as the least developed countries.

Sustainability” to Regeneration.

The transformation which is currently taking place in essence constitutes a structural change of the economy encompassing both some radical changes of the production systems and the patterns of consumption. The research studies (Raczewska, 2013, 2016) confirm that the implementation of green economy is increasingly affecting the creation of new sectors, employment, or the competitive advantage of businesses. Being a new trend growing within the pro-climate transformation of global markets, green economy contributes to the creation of new jobs requiring specific competences, which is to compensate the decreasing employment rates in the sectors generating high emissions. Green economy is developing rapidly all over the world, which creates the need for implementing novel technological solutions as well as modernizing the existing industrial infrastructure. As an alternative to the currently dominating economic systems, it should ensure fast and dynamic socio-economic growth and thus delineate the paths of economic development and at the same time minimize the negative impact on the natural environment. In light of the above, the creation of modern environmental technologies which build an innovative ecosystem and adhere to the principles of sustainable development plays a significant role. It will require the remodeling of strategic skills at the state and regional levels taking into consideration their specific needs. Consequently, the growing importance of green economy as a tool to pursue sustainable development made it necessary to initiate research studies on the prospects concerning the development of environmental technologies within the area of green economy and green transformation.

3. Methods

The research objective was to define the lines of the environmental technologies development in the context of the transformation of the economy towards green growth. For the purpose of this study, we chose the Province of Silesia as a model analytical area due to its active and multivariate participation in the energy transformation processes.

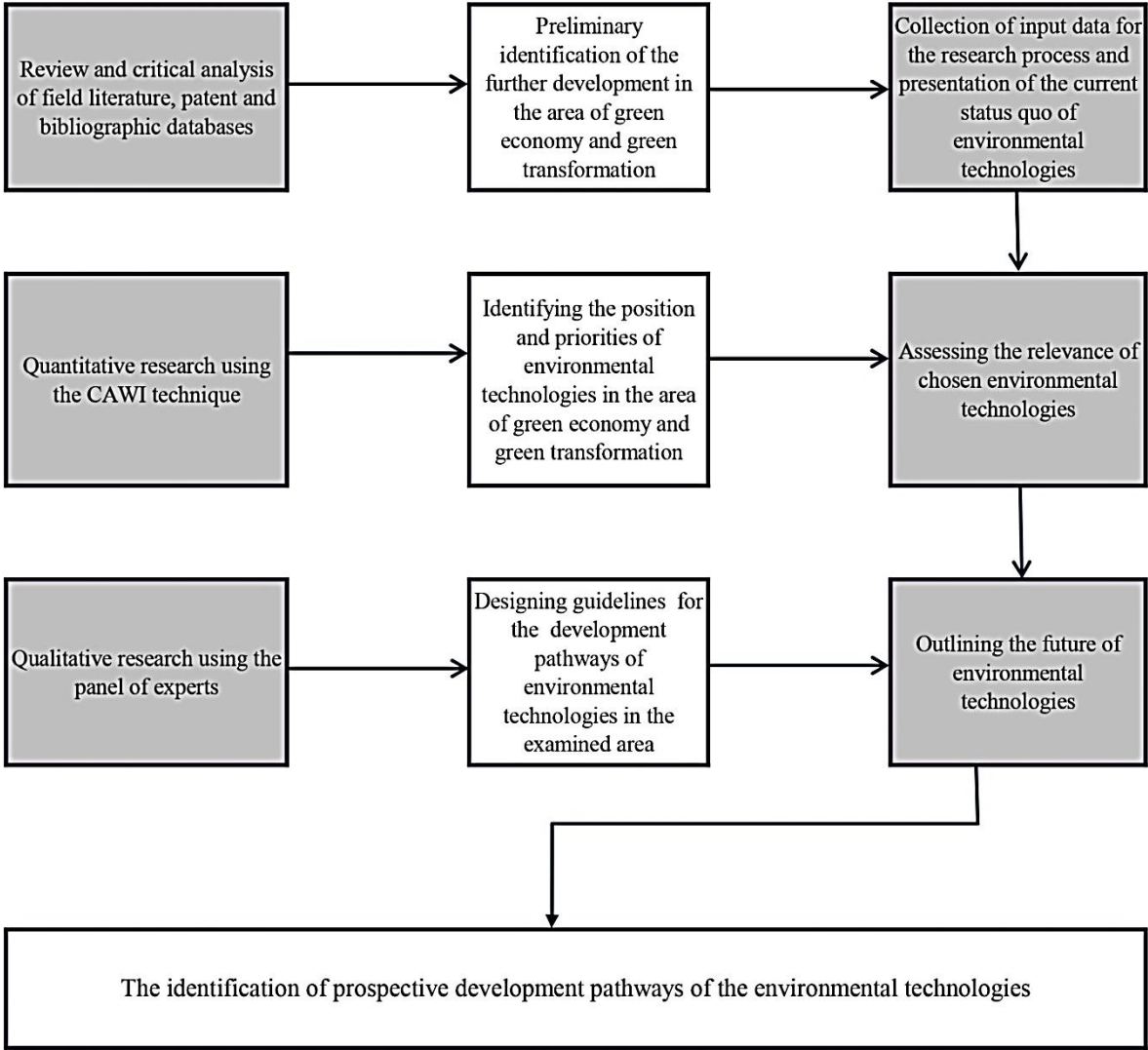


Figure 3. Research process.

Source: own elaboration.

Figure 3 presents the model of the research process which was adopted within the course of the study. The model considers free major research stages including: review and critical analysis of field literature, CAWI research and expert panel. Their selection allowed for a multi-faceted approach to the topic, presenting different views and opinions in the research area.

4. Results and discussion

4.1. Review and critical analysis of field literature, patent and bibliographic data bases

The selection of literature sources for the analyses was justified by the research objective. The following sources were subject of the critical review of the field literature:

- peer review research papers concerning the examined area of research,
- strategic and program documents developed on the state and regional levels, popular science studies, methodological studies, etc.,
- trade magazines,
- public statistics documents, reports, analyses,
- databases of patent data including *inter alia* WIPO statistics database or the European Patent Office (EPO),
- technological projects databases from the International Energy Agency (IEA), regional platforms for technology transfers or academic centers of innovations.

In the initial stage of the research, a comprehensive review of patent databases was performed in order to assess the current status of the development of environmental technologies.

4.1.1. EPO database

European Patent Office (EPO) examines European patent applications enabling to obtain the protection of inventions in up to 44 countries within the framework of a centralized and unified procedure. The organization collects and processes data concerning patent applications. Polish patent applications are presented in Table 2 below.

Table 2.

European patent applications in Poland in 2020 and 2021

| Origin | 2020 | 2021 | % change 2021 vs. 2020 | Share of total applications in 2021 |
|---|---------|---------|------------------------|-------------------------------------|
| POLAND | 478 | 539 | 12.8% | 0.3% |
| EPO states: the 38 member states of the European Patent Organization including the 27 EU states | 81 531 | 83 775 | 2.8% | 44% |
| All countries | 180 417 | 188 600 | 4.5% | |

Source: EPO, 2022.

The analysis of European patent applications indicates only a slight share of Poland accounting for 0.6% compared to the remaining EPO member states and 0.3% in comparison to the rest of the world. In the case of the statistics including the ranking according to the number of applications per 1 million inhabitants, Poland with its 539 applications occupies the 33rd position, while Switzerland which has 8442 application is on the first one. In addition, the platform allows obtaining information about the number of European patent applications according to the technological areas from which they originated (Table 3).

Table 3.

European patent applications including direct European applications and international (PCT) applications that entered the European phase during the reporting period

| TECHNOLOGY FIELD | 2020 | 2021 | 2021/2020 |
|---|------|------|-----------|
| Medical technology | 38 | 65 | 71.1% |
| Pharmaceuticals | 35 | 39 | 11.4% |
| Transport | 21 | 38 | 81.0% |
| Thermal processes and apparatus | 49 | 34 | -30.6% |
| Other special machines | 19 | 33 | 73.7% |
| Civil engineering | 24 | 30 | 25.0% |
| Measurement | 18 | 23 | 27.8% |
| Mechanical elements | 8 | 23 | 187.5% |
| Computer technology | 22 | 18 | -18.2% |
| Handling | 14 | 18 | 28.6% |
| Chemical engineering | 6 | 16 | 166.7% |
| Organic fine chemistry | 16 | 15 | -6.3% |
| Electrical machinery, apparatus, energy | 19 | 14 | -26.3% |
| Other consumer goods | 23 | 14 | -39.1% |
| Digital communication | 6 | 13 | 116.7% |

Source: EPO, 2022.

The analysis takes into account data concerning the key technological areas within the framework of which the patent potential in Poland is built. Medical technology is at the top of the list followed by Pharmaceuticals and Transport. Only the fourth place is occupied by Thermal processes and apparatus, an area connected with environmental technologies.

4.1.2. WIPO statistics database

The World Intellectual Property Organization (WIPO) is a UN agency which coordinates and shapes the rules governing the IP protection systems and creates the PATENTSCOPE data base enabling the access to international applications within the framework of the Patent Cooperation Treaty. The collection of data regarding patents, trademarks and industrial designs includes the applications filed by IP offices from the 190 member states. The analysis of the WIPO data allowed to categorize the number of patents according to technological areas (Table 4).

Table 4.

Patent grants by technology

| Field of technology | Patent grants by technology | Field of technology | Patent grants by technology |
|--------------------------------|-----------------------------|---|-----------------------------|
| Total | 2283 | 17 - Macromolecular chemistry, polymers | 71 |
| 14 - Organic fine chemistry | 160 | 27 - Engines, pumps, turbines | 54 |
| 35 - Civil engineering | 158 | 18 - Food chemistry | 53 |
| 23 - Chemical engineering | 153 | 21 - Surface technology, coating | 44 |
| 29 - Other special machines | 136 | 33 - Furniture, games | 44 |
| 20 - Materials, metallurgy | 135 | 34 - Other consumer goods | 33 |
| 19 - Basic materials chemistry | 126 | 11 - Analysis of biological materials | 24 |
| 10 - Measurement | 120 | 28 - Textile and paper machines | 23 |

Cont. table 4.

| | | | |
|---|-----|---|----|
| 32 - Transport | 103 | 22 - Micro-structural and nano-technology | 20 |
| 16 - Pharmaceuticals | 99 | 9 - Optics | 15 |
| 26 - Machine tools | 96 | 12 - Control | 15 |
| 30 - Thermal processes and apparatus | 87 | 6 - Computer technology | 12 |
| 1 - Electrical machinery, apparatus, energy | 82 | 8 - Semiconductors | 9 |
| 31 - Mechanical elements | 82 | 2 - Audio-visual technology | 7 |
| 24 - Environmental technology | 81 | 5 - Basic communication processes | 7 |
| 15 - Biotechnology | 80 | 3 - Telecommunications | 4 |
| 13 - Medical technology | 73 | 7 - IT methods for management | 3 |
| 25 - Handling | 72 | 4 - Digital communication | 2 |

Source: WIPO, 2022.

The data show that environmental technologies are on the 14th place considering the number of the granted patents.

4.1.3. Patent data bases

Within the course of the field literature review, we identified and classified environmental technologies aligned with the principles of green economy and green transformation. The classification of the maturity of environmental technologies constitutes an added value of the study (Table 5).

Table 5.

A list of selected environmental technologies offered in the patent data bases

| No. | The name of the technology | TRL | The creator of the technology | Source |
|-----|---|---|--|---|
| 1 | Cryogenic capture, a refrigeration-based system of CO ₂ separation | TRL 4 Early prototype (Prototype proven in test conditions) | Kujawy Cement Plant, Lafarge Poland Holcim Group) | (The International Energy Agency website, 2022) |
| 2 | Zero-emission hydrogen technologies | TRL 5 | SES Hydrogen S.A. | (Platforma transferu technologii ARP, 2022) |
| 3 | 3D Photovoltaic panel | TRL 5 | Rafał Stajniak | (Platforma transferu technologii ARP, 2022) |
| 4 | MTT (Microwave Thermal Treatment) + MOS (Microwave Oxidation System) | TRL 9 | Jakub Lis | (Platforma transferu technologii ARP, 2022) |
| 5 | PEM (Polymer Electrolyte Membrane) fuel cell technologies | TRL 7 | AVL Software and Functions GmbH Sp. z o.o., Poland | (Platforma transferu technologii ARP, 2022) |
| 6 | KLINOTECH RMO, molecular recycling of waste | TRL 6 | Klinika Nowych Technologii Energetyki Środowiskowej Sp. z o.o. | (Platforma transferu technologii ARP, 2022) |
| 7 | KLINOTECH CR – thermo-catalytic cracking of polyphilic waste plastic | TRL 9 | Klinika Nowych Technologii Energetyki Środowiskowej Sp. z o.o. | (Platforma transferu technologii ARP, 2022) |

Cont. table 5.

| | | | | |
|----|--|---|---|------------------------------|
| 8 | NanoBioCell technology for biodegradable, antibacterial and antiviral filters for innovative protective bionanocellulose masks | TRL 8 | The Department of Technology and Chemical Engineering, West Pomeranian University of Technology, Szczecin | (Baza technologii ZUT, 2022) |
| 9 | Preparing activated carbon for the absorption of CO ₂ using common stinging nettle as a raw material | In the current stage of the research, the technical solution proves to be effective for the production of activated carbon for the CO ₂ absorption based on common stinging nettle as a raw material | The Faculty of Technology and Chemical Engineering, West Pomeranian University of Technology, Szczecin | (Baza technologii ZUT, 2022) |
| 10 | Innovative biodegradable packaging for different sectors | Mature technology | The Faculty of Food Sciences and Fisheries West Pomeranian University of Technology, Szczecin | (Baza technologii ZUT, 2022) |
| 11 | Water purification in a reactor with a replaceable photo-active filter | The stage of research and development | The Faculty of Technology and Chemical Engineering, West Pomeranian University of Technology, Szczecin | (Baza technologii ZUT, 2022) |
| 12 | Technology for amber waste management | TRL 4, in transition to TRL 5 | Warsaw University of Technology | (CZIITT, 2022) |
| 13 | HABITARS, teledetection for the ecology | TRL 6 | Warsaw University of Technology | (CZIITT, 2022) |
| 14 | REWARD, water purification | TRL 9 | Warsaw University of Technology | (CZIITT, 2022) |
| 15 | Graphene shield protection against infra-red radiation | TRL 3 | Warsaw University of Technology | (CZIITT, 2022) |
| 16 | SAFEDAM, advanced technologies for the prevention of flood hazard | TRL 9 | Warsaw University of Technology | (CZIITT, 2022) |

Source: own elaboration.

4.1.4. Critical review of field literature and trend analysis

The analysis of field literature enabled to distinguish the observations, guidelines and statements connected with the development of environmental technologies in the context of the on-going transformation processes of the Silesia Province. The selected technological trends and market prospects are presented in the compilation below.

- Energy generation, metallurgy, chemical industry, machine industry, mineral industry or transport industry constitute sectors which are characterized by greatest technological challenges; at the same time, they are high-emission and energy-intensive sectors with relation to the just transformation of the region (Województwo Śląskie, 2022a).

- A development of modern technologies will take place within the framework of the SMART-CITY concept with a special emphasis put on the management of urban water, waste and energy infrastructures as well as medical services with the use of robots and virus detecting and neutralizing drones to hamper the development of pandemics in the future.
- The development of distributed generation with RES, especially in terms of an organizational area understood as an integrated ecosystem (small renewable energy producers) is of key importance within the context of mining sub-regions and balanced energy generation based on alternative sources.
- The construction, logistics and transport are rapidly developing sectors which have convergent requirements concerning the qualifications of workers leaving the mining industry (Województwo Śląskie, 2022a).
- The development potential of the creative businesses and the nano-technology sector will be strengthened in order to foster market investments in mining regions (Strategia Rozwoju Miasta Katowice 2030, 2016).
- The closure and restructuring of coal mines as well as phasing out the outdated power units will contribute to the deployment of the existing infrastructure for implementing energy storage technologies including the pumped storage power plants and battery energy storage systems.
- The decarbonization of industries will induce the development of hydrogen technologies, for example electrolyzers for the production of green hydrogen generated in the process of electrolysis using RES electricity to be used in hydrogen filling stations or in the industry (Polskie Stowarzyszenie Energetyki Wiatrowej, 2021).
- The energy storage, the implementation of intelligent energy networks, electromobility, as well as highly efficient and energy saving technologies constitute the priority areas of the development (Ministerstwo Aktywów Państwowych, 2019).
- In order to address the need to deploy the chemical energy of the gas obtained in the process of coal seams de-methanation, the development of innovative methods of production using methane fed co-generation installations will take place (Tauron, 2019).
- Within the framework of the transformation process, projects connected with the so called circular economy will be fostered; in particular, those which involve the prevention of waste generation, the energy and transport infrastructures as well as decarbonization, i.e. energy efficiency or RES.
- The growth of hydrogen economy through the employment of renewable, low-emission hydrogen will take place (Zespół ds. Rozwoju Przemysłu OZE i Korzyści dla Polskiej Gospodarki, 2020).

- The aging high-emission coal based power units will be replaced with nuclear plants as a zero-emission reliable source to guarantee energy security and low costs of electricity generation. The transition will be achieved using large scale Generation II(+) pressurized water reactors (Ministerstwo Klimatu, 2022).
- An effective decrease in the CO₂ concentrations in the atmosphere and the introduction of innovative energy generation technologies including the development of geothermal energy solutions is considered to be a priority (Ministerstwo Środowiska, 2019).
- The natural resource potential of the Silesia Province will be exploited by means of an increased utilization of industrial waste and the development of municipal waste management technologies as well as a more efficient use of waste energy (Ministerstwo Rozwoju, 2017).
- The use of ICT will pose another challenge within the scope of Industry 4.0 (Silesia Province, 2022b).
- The elimination of the broadly understood negative environmental impact of mining activities will require developing new environmental technologies to mitigate the effects of the above mentioned activities including decontamination of post-industrial lands, remediation, rehabilitation or regeneration (Województwo Śląskie, 2022b).
- Due to the negative impact of mining on the aqueous environment, activities supporting water retention will be promoted.
- Special emphasis will be put on the restoration of degraded land (circular management) and its rehabilitation, which will require the development of relevant technologies.
- The use of no-smoke low-emission fuels will be widespread.
- The green economy will gradually encompass new value chains, for example technologies used for exploiting the potential of marginal soils, including the contaminated ones, to create the value chains in terms of biomass or phyto-technology.
- Along with the green transformation, the demand for mineral resources will rapidly increase. The global community must make sure that all the resources are fully exploited; therefore, new technologies as well as research and development activities are needed.

A wide range of environmental technologies, as well as the intensification of changes taking place in the area of transition and the climate and energy policy framework, indicate how strongly these trends are affecting economic practice. This is directly reflected in the implemented solutions spreading a pro-environmental approach and based on innovative engineering solutions/ ideas, reducing environmental impact or achieving a more efficient and responsible use of natural resources, including energy.

4.2. Quantitative research using CAWI technique

In order to perform the CAWI survey and to design the questionnaire we referred to a set of chosen environmental technologies based on the proprietary review of sources including the on-going Entrepreneurial Discovery Process and the National Center for Research and Development Program – New Energy Technologies, 2020. The survey performed by means of the CAWI technique involved a test sample of Silesia Province enterprises from the sector which undergoes the transformation process and the municipalities qualified for receiving financial support from the Just Transition Fund. The objective of the survey was to assess the relevance of the selected environmental technologies. The questionnaire included the following questions:

- Which of the following technologies do you consider as the most relevant for the transformation of the Silesia Province? Please select the rank-order 1-5, where 1 – not relevant at all, 5 – very relevant.
- Which technologies, while implemented, do you think may have the greatest impact on the effectiveness of the transformation of the Silesia Province? Please select the five which are most important.
- Which activities should be undertaken to stimulate the development of the environmental technologies within the process of the transformation of the Silesia Province? More than one answer may be selected.

The results of the conducted survey are presented in Tables 6-8 and in Figure 4.

Table 6.

The results of the ranking of the environmental technologies relevant in the context of Silesia Province transformation in the area of Regional Innovation Strategy – Green Economy

| Regional Innovation Strategy – Green Economy | Rank |
|---|-------------|
| Technologies of ecological, safe and effective waste management | 4.00 |
| Technologies limiting the emissions of pollutants into the atmosphere | 3.97 |
| Sustainable transport technologies | 3.88 |
| Environmental protection and land rehabilitation technologies including energy technologies and bio-geochemical engineering | 3.82 |
| Environmental technologies of different sectors of the industry | 3.79 |
| Technologies supporting the management of the natural environment | 3.76 |
| Bio-technologies for environmental protection | 3.71 |
| Water treatment and separation technologies, water retention and purification technologies | 3.68 |
| Technologies for the construction sector | 3.24 |

Source: own elaboration.

The technologies compiled in Tables 6 and 7 were taken from the Silesia Province Regional Innovation Strategy 2030, a program document highlighting the commitment of the Province to pursue an intelligent transformation of the region based on the regional ecosystem of innovations. The energy and green economy technologies presented in the tables constitute priority solutions for the sustainable development of the Silesia Province. The scope of the technologies was identified on the basis of a foresighting process and complementary activities

connected with the design of the Technology Development Program for the Province of Silesia 2010-2020.

Table 7.

The results of the ranking of the environmental technologies relevant in the context of Silesia Province transformation in the area of Regional Innovation Strategy – Energy Generation

| Regional Innovation Strategy – Energy Generation[2] | Rank |
|--|-------------|
| Technologies of energy generation from waste and alternative fuels | 4.00 |
| High-efficiency energy generation technologies limiting the emissions of GHGs and other pollutants | 3.94 |
| Energy storage technologies | 3.94 |
| Energy generation from renewable sources and the improvement of efficiency | 3.91 |
| Technologies of intelligent networks and inter-system connections | 3.88 |
| Combined Heat and Power generation, cogeneration and polygeneration | 3.85 |
| Fuel cells technologies | 3.85 |
| Prosumer energy generation | 3.82 |
| Intelligent and energy-efficient construction | 3.76 |

Source: own elaboration.

The intelligent regional specializations of the Silesia Province concerning the area of green economy and energy generation were highly ranked in terms of their relevance for the transformation process of the said region. The technologies of energy generation from waste and alternative fuels as well as the technologies of ecological, safe and effective waste management were particularly distinguished. This means that these technological solutions are of key strategic importance for the Province because they are region-specific and address the emerging challenges associated with the transformation process.

Table 8.

Results of the survey concerning the impact of implementing chosen environmental technologies on the effectiveness of the transformation process of the Silesia Province

| Region specific environmental technologies with respect to different industry sectors | Share |
|---|--------------|
| Energy storage technologies including pumped storage power plants and battery energy storage systems | 74% |
| Hydrogen technologies including electrolyzers for the production of green hydrogen generated in the process of electrolysis using RES electricity to be used in hydrogen filling stations or in different sectors of industry | 71% |
| Technologies for circular economy applications | 59% |
| Energy generation technologies using methane fed co-generation installations | 50% |
| Technologies for mitigating the effects of industrial and mining activities including decontamination, remediation, rehabilitation, etc. | 50% |
| Technologies for the production of no-smoke low-emission fuels | 44% |
| SMART-CITY concept technologies with a special emphasis put on the management of urban water, waste and energy infrastructure as well as medical services | 35% |
| Nuclear energy technologies | 29% |
| Energy storage technologies integrated with RES | 29% |
| Technologies for hydrogen generation and application | 12% |
| Information and communication technologies (ICT) for optimizing the manufacturing processes and logistics, especially with regard to the Internet of Things, Smart Cities and Industry 4.0 | 9% |

Cont. table 8.

| | |
|--|----|
| Waste to energy conversion technologies | 9% |
| Technologies for mobile thermal energy storage facilitating to use waste heat in remote (up to several dozen kilometers) heating installations | 9% |
| Technologies supporting the system management of post-industrial areas | 6% |
| Forrest and agriculture biomass gasification technologies, biodegradable waste included, for the generation of synthesis gas as a potential source of hydrogen and its derivatives (methane, methanol, ammonia, etc.) | 6% |
| Technologies for heat and electricity generation using hydrogen and its derivatives | 6% |
| Integrated energy micro-grids (territorial integration of the sources for generating electricity, heat or cold including energy storage and balance) | 3% |
| Technologies for utilizing the accessible energy sources including the development of geothermal energy | 0% |
| Power-to-x technologies and e-fuels | 0% |
| Technologies for innovative applications of photovoltaic cells in agriculture, construction, transport and other areas | 0% |
| Technologies for the production of high efficiency new generation photovoltaic cells of technical and economical properties exceeding the currently available ones to be applied in the electromobility and construction sectors | 0% |
| Information technologies for supporting the operation of wind farms (Intelligent Wind Farm) | 0% |

Source: own elaboration.

The elaborated set of region specific environmental technologies concerning different sectors of the industry constitutes a result of a proprietary review of sources for the selection of technologies which are most relevant for the on-going transformation process of the Silesia Province and which may have the largest impact on its effectiveness. Within this scope, the CAWI survey indicates that the biggest number of the respondents (over 50% of the participants) attribute this feature (the largest impact of the implementation of a given technology on the effectiveness of the transformation process) to the following:

- energy storage technologies including pumped storage power plants and battery energy storage systems,
- hydrogen technologies including electrolyzers enabling to obtain green hydrogen generated in the process of electrolysis using RES electricity to be used in hydrogen filling stations or in various sectors of the industry,
- circular economy technologies,
- energy generation technologies using methane fed co-generation installations,
- technologies for mitigating the negative environmental impact of industrial and mining activities (*inter alia* remediation, rehabilitation, regeneration, renaturalization, decontamination of post-industrial areas, purification of contaminated surface and underground waters, water retention, etc.).

What is important, solutions encompassing power-to-x, e-fuels, photovoltaic cells or wind farms technologies were completely passed over by the respondents.

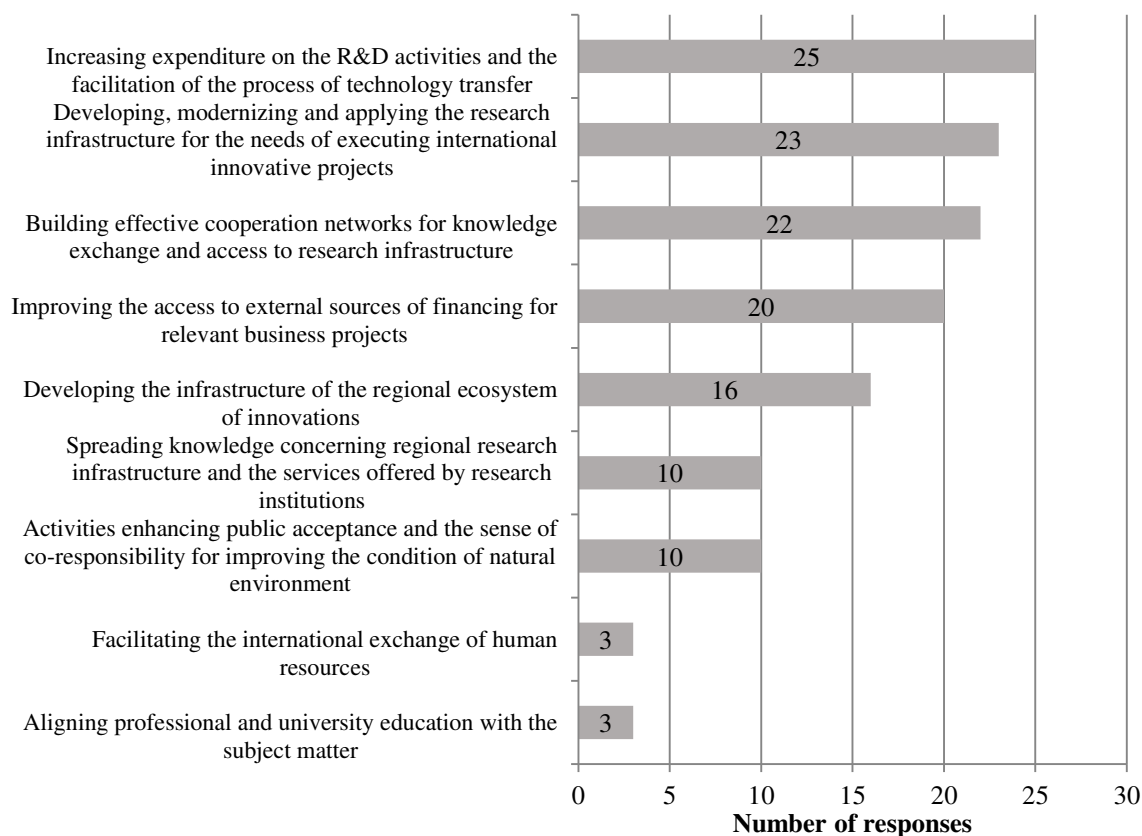


Figure 4. The assessment of activities which should be undertaken to stimulate the development of environmental technologies in the transformation process of the Silesia Province.

Source: own elaboration.

In order to design the scope of activities which should be undertaken within the transformation process of the Silesia Province, the CAWI survey was complemented with a question concerning what should be done to stimulate the development of the environmental technologies (Figure 4). The respondents indicated the need of increasing the expenditure on R&D activities, the development of research infrastructure in the region or the build-up of effective networks for cooperation. The smallest group of respondents signaled the need for international exchange of human resources or the alignment of professional and university education with the chosen subject matter.

4.3. Qualitative research using an expert panel

An expert panel constitutes one of key methods used in foresight research, trend analysis or in building long term visions of the future. In our study, it allowed to systematize the obtained results in relation to the research objectives. Within the course of the discussions on the prospective lines of environmental technologies development, it was agreed that energy, green transformation as well as environmental technologies would become the core pillars of modern economy. This means that the green transformation along with broad implementation and sustainable use of all forms of energy from renewable sources will be economically inevitable as well as environmentally and socially desirable.

In addition, the panel of experts pointed out that plans executed at the EU level, among others, the European Green Deal and EU's Fit for 55 Package, should be taken into consideration because they encompass solutions and ambitious goals which may have a significant impact on different sectors of the economy. The EU green transformation policy initiative may prove conducive to inspire or even necessitate the development of chosen environmental technologies. At this moment, special emphasis should be put to undertake decisive actions to foster a complex just transformation of each of the following sectors: energy generation, transportation, food system. Another critical issue that comes to the forefront is the strong interlinkage of low-emission economy with the construction and cement and concrete industry.

Importantly, the Province of Silesia, the largest mining region in the European Union is facing a tremendous transformational challenge entailing radical changes in the economic, environmental and social areas.

Considering the above mentioned issues as well as the results of the research, the green transformation of the Silesia Province should take place first of all within the area of energy generation technologies including the CCS (*carbon capture and storage*) and CCU (*carbon capture and utilization*). The transformation of local business models along with the regional and national raw material and energy resource base as well as waste management by means of innovative pro-ecological solutions should constitute activities complementary to the process.

5. Summary

The results of the performed analyses enabled to identify the prospective lines of the development of environmental technologies in the framework of the transformation towards green growth as well as to delineate the areas for future research. Within the context of the Silesia Province as the analyzed research area, adjusting the economy of the mining sub-regions to follow the path of green, intelligent as well as digital growth appears as the key challenge to the development. The Province of Silesia which is the most coal-dependent region in the European Union must face not only the urgent energy issues associated with the transformation processes but also the spatial and social challenges. In particular, it means that the system management and the monitoring of economic, technological and social phenomena are necessary within the course of the transition process. Taking into account the enormous scale of the challenges to be addressed, the Silesia Province transition to climate neutral economy will be a demanding multi-dimensional task requiring phased implementation of the changes.

The analyses conducted within the framework of the research enabled to distinguish the most important trends and to place them within the process of the Silesia Province green transformation. The dominating importance was attributed to the energy generation and energy

storage technologies as well as those technologies which are directly connected with decarbonization, i.e. CCS (*Carbon Capture and Storage*) and CCU (*Carbon Capture and Utilization*).

The current challenges induce the necessity to modify the existing local business models as well as the regional and national raw material and energy resource base along a wider application of innovative, pro-ecological solutions in the high-emission and energy intensive sectors. Consequently, the improvement of energy efficiency constitutes a significant area of activities connected with the process of green transformation.

The awareness of the emerging challenges associated with the transition as well as of the future potential enables to make the most of the transformation process and to accentuate all its benefits. In order to be successfully implemented, the current transformation necessitates comprehensive and proven knowledge to build flexible models and the technological know-how which constitute the foundation of sustainable, just and economically efficient low-emission economy.

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THE STARTUPPER PERSONA IN THE POLISH ECONOMIC PRACTICE – DEFINITION BASED ON OWN RESEARCH

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Purpose: Creating the persona of a startupper, a model that would most comprehensively describe the character of a person who decides to establish a business venture referred to as a startup in Polish economic reality.

Design/methodology/approach: The authors employed data from their own research to create the persona of a Polish startupper. In the research process, the authors adopted both quantitative and qualitative approaches. The primary quantitative tool was a survey questionnaire, and the qualitative tool was an interview. The research population consisted of three groups of subjects: Polish startups (N = 346), post-startup companies (N = 24), and startup investment experts (N = 19). The persona concept proposed by Alan Cooper was used to develop the persona of a startupper.

Findings: The persona of a Polish startupper was characterized using 11 categories divided into three areas: operational, aspirational, and experience-related. The operational area includes all the “hard” information defining a startupper. The aspirational area indicates the primary motivators that guide a Polish startupper in establishing and running a startup. The experience-related area characterizes the fundamental knowledge and skills regarding the creation, development, and management of a startup acquired in the process of founding and running a startup.

Research limitations/implications: Adequacy verification of the developed model of startupper persona based on researching other groups of respondents.

Practical implications: The study can provide a point of reference for those who intend to establish a startup business venture or want to verify the reasons for the success or failure of their existing startup ventures.

Originality/value: The article addresses the needs of “young” entrepreneurs who plan to build their businesses. It offers a holistic overview of success factors, competencies, and barriers to the creation and development of startups. The nature of startup ecosystems is different in each country. The developed startupper persona relates to Polish economic practice, which is undoubtedly an added value of the proposed model.

Keywords: innovativeness, startup, startup CEO, startupper persona, polish economic practice.

Category of the paper: Research paper.

1. Introduction

Startups in both science and the Polish economy are a relatively new phenomenon. Due to their growing market share and importance in social life, their role is becoming increasingly significant. Startups contribute to the dynamic growth of the economy and affect the structure of the market. Today, there is a growing dynamism in the economic sphere and numerous changes in the socio-economic reality. Consequently, market players are being forced to adapt to the changing environment by introducing innovations, both imitative and disruptive (Ousghir, Daoud, 2022). Innovation is nowadays a key determinant in the process of building a competitive advantage in the market (Guo et al., 2022). Startups, by their very definition, are entities characterized by a high degree of innovation and operating under conditions of extreme uncertainty (Jucá, Alves, 2022). Their activity is subjected to a high degree of risk, and their unique nature allows few of them to develop a stable business model and become mature enterprises (Haftor, Costa, 2022). This creates the basis for the assumption that startups are a response to changes in the environment – both in the economic and socio-cultural space.

According to modern research¹, intellectual capital is considered the foundation of startups. Intellectual capital consists of three elements: human capital, structural capital, and relational capital (Edvinsson, Malone, 1997). Intellectual capital served as the starting point for developing a startupper persona. The authors noted the need to characterize the individual who decides to establish, build, and manage a startup in Polish economic practice. The article attempts to answer the question of who is a contemporary Polish startupper. The characterization of the startupper included such elements as: the objectives and motives for founding and running a startup in Poland, the barriers a startupper has to face, the tools and techniques they use to build and manage a startup, and the industries they are most likely to choose as their area of activity.

The authors adopted a quantitative and qualitative approach to answer the posed research question. The study included three research populations: Polish startups, post-startup companies, and startup investment experts. The consequence of such formulated question and the adopted research methodology is a model of a persona, which represents the archetype of the startupper in Polish economic practice.

¹ Research conducted by the Startup Poland Foundation and research carried out within the framework of the doctoral dissertation of one of the authors, titled “Determinants of startups’ functioning in Polish economic practice”.

2. Method

The purpose of the research results presented in the article was to create the persona of a startupper, a model that would most comprehensively describe the character of a person who decides to establish a business venture referred to as a startup in Polish economic reality. The presented research is part of a broader study, the main objective of which was to identify and characterize the determinants of startups' functioning at each stage of their life cycle in Polish economic practice².

The authors employed data from their own research to create the persona of a Polish startupper. In the research process, the authors adopted both quantitative and qualitative approaches. The primary quantitative tool was a survey questionnaire, and the qualitative tool was an interview. The research population consisted of three groups of subjects: Polish startups (N = 346), post-startup companies (N = 24), and startup investment experts (N = 19). The persona concept proposed by Alan Cooper was used to develop the persona of a startupper.

In order to define the model of the Polish startupper, it was necessary:

- To characterize Polish startups.
- To characterize the Polish startup ecosystem.
- To identify the determinants relevant to the functioning of startups in Polish economic practice from the point of view of startups, investing entities, and companies that have emerged from the startups.
- To identify barriers relevant to the functioning of startups in Polish economic practice.
- To identify the competencies desirable in people who are originators/owners (acting as CEOs) of startups and in people who are members of startups.
- To identify factors influencing the decision to provide financial support to startups by external investors.

The enumerated activities constituted the specific objectives of the broader study, which made the realization of the main objective possible.

The research was conducted between 2019 and 2021. The methodology adopted for the study included both quantitative and qualitative approaches. In the first approach, the authors used a survey questionnaire consisting of four parts: an introduction containing instructions, a core part, a metric, and a glossary. The core part consisted of 13 questions, including two open, seven semi-open (conjunctive and disjunctive), and four closed questions. The second approach complemented quantitative research. For this purpose, the authors used Computer Assisted Personal Interviews (CAPI). The study was carried out using structured online interview questionnaires, on which responses were annotated by the researcher. In addition,

²The research was conducted by a research team led by Waldemar Jędrzejczyk. The main research stream concerns the issue of competencies, both currently desired and prospective, and in relation to sectors and types of organizations, occupational groups, and key positions in organizations. In the area of startups – the determinants of their success and the competencies of startups – the head researcher was Agnieszka Kulej.

leading questions and in-depth main questions were asked. The interview questionnaire had a structure analogous to that of a survey questionnaire, i.e., it consisted of four parts: an introduction containing instructions, a core part, a metric, and a glossary.

3. Characteristics of startups in the Polish economic space

The term “startup” originated in English, and its original meaning referred to a fledgling business, regardless of its operating form (Breshi et al., 2018). Over time, the term gradually narrowed to refer to ambitious, creative, and technological ventures (Skala, 2018).

To date, on the ground of Polish science, the most popular definition was created by A. Skala. According to this author, the fundamental attribute of a startup is hyperscalability, that is, the potential for rapid growth in multiple segments in multiple markets. Other elements characteristic of startups include (Skala, 2018):

- limited internal resources,
- uncertain or non-existent demand,
- the chance of a disruptive market situation,
- the ability to obtain funding at an advanced stage of development,
- high operational capacity of the team for testing business models,
- strong leadership.

Other attributes distinguishing startups from standard market players include originality, higher risk of failure, and the ability to grow and return on investment above average. The distinguishing characteristics of startups are unique products, services, or solutions that either are not yet on the market or are innovative improvements to existing offerings (Kowalewski, 2020; Grant, 2022).

In Poland, the definition of a startup, which functions primarily in business practice, was developed by the Polish Agency for Enterprise Development (PARP). According to this definition, a startup is a young enterprise that (Wojas et al., 2015):

- was created with the aim of developing new and innovative products or services,
- seeks a stable business model that provides a guarantee of growth,
- has developed a stable of organizational structure,
- is in the phase of development-oriented experimentation,
- is actively seeking new markets.

The Startup Poland Foundation defined a startup as “a venture that has the potential for rapid growth due to a technological advantage or a market niche that has not yet been discovered and developed” (Beauchamp et al., 2017).

Today, the most popular definitions of a startup in Poland and worldwide are those created by S. Blank and B. Dorf, as well as E. Ries. The first defines a startup as a temporary organization searching for a scalable, replicable, and profitable business model (Blank, Dorf, 2013). The second determines a startup as "a human institution designed to create a new product or service under conditions of extreme uncertainty (...) A startup is greater than the sum of its parts; it is an acutely human enterprise" (Ries, 2012).

The cited definitions represent only a minor fraction of how a startup is understood in science and business practice. The term has penetrated everyday language and, as a result of the reflective reconstruction of individual and collective experience, has undergone numerous modifications and transformations. In social life, the frequent misuse of the term is noticeable. According to the authors, in order to better understand what a startup is, it is necessary to explore it from the subjective aspect and ask the question of who is the individual who decides to create and develop a startup under certain socio-economic conditions.

For the purposes of the conducted research, the authors considered a startup a temporary organization with an innovative nature and a high degree of risk, operating under conditions of extreme uncertainty. The adopted perspective was that a startup consists of people striving to build a scalable, replicable, and profitable business model. It is an entity that has been in existence for no more than five years and has a legal personality registered in Poland, uses the legal personality of another entity registered in Poland, or is a natural person with Polish citizenship.

4. Startup market in Poland

The startup market in Poland and worldwide is an essential element of the economy. It features dynamic growth and volatility. According to S. Blank, the intensive development of the startup market in recent times is, firstly, combined with a decrease in expenditures on new product development, followed by the low cost of building a startup. Secondly, it correlates with easier access to external funding. Thirdly, classic management methods applicable to large companies do not work well with managing entities or projects defined as a startup. Due to the high dynamics of changes in the environment and the high risk of startup activity, this type of entrepreneurship has developed methods, techniques, and tools tailored to its needs (e.g., Lean Startup, Business Model Canvas, Customer Development). Fourthly, the increase in the importance of the Internet as a distribution channel for products and services, as well as the speed of customer absorption of new technologies, enabled a startup to become an enterprise with international reach in a short period of time (Blank, 2013). It means that the conditions under which modern startups are built and developed have undergone a favorable transformation.

Since 2015, the most extensive research on the startup market in Poland has been carried out by the Startup Poland Foundation. The eighth edition of the survey on the functioning of startups in Poland was conducted in 2022 and covered 2171 startups ($N = 2171$)³. The survey results indicate that the modern startup market is saturated with young entities operating for no longer than four years (85% of respondents). Among the respondents, 22% declared that they have been running for less than a year. Data relating to the age of Polish startupper show that almost half of the respondents are between 30 and 40 years old (44% of respondents). Slightly fewer, namely 33% of respondents, are in the 20-30 age range. However, an increase in the number of startup owners in the 40-50 age bracket was noted (from 13% in 2021 to 17% in 2022). The legal form of a startup business is most often a limited liability company (77% of respondents). Next, the startup owners choose a simple joint-stock company (7%), a joint-stock company (5%), or a sole proprietorship (5%). Among the respondents, 6% declared a lack of legal personality. More than $\frac{1}{4}$ of the startups participating in the survey employed 4 to 10 people (33% of respondents). Among the respondents, 19% employed from 1 to 3 employees, and 16% employed from 25 to 50 people. Another matter referred to the most startup-dense areas in Poland. The results of the study show that in terms of the number of established startups, in the first place is the Lower Silesia region (Wroclaw), in second place is the Mazovia region (Warsaw), and in third place is the Lesser Poland region (Krakow). Currently, Polish startups are primarily active in such sectors as: AI and machine learning (21%), e-commerce (14%), and analytics-research tools and business intelligence (13%). Respondents declared that their business philosophy is mainly based on models: B2B enterprise (38%), B2B small business (26%), and Marketplace (13%) (Dziewit, 2022).

The startup market in Poland, despite being a relatively young market, shows great potential for developing an innovation-based economy. Startups primarily create new jobs, especially for specialists of narrow specialization. Attention is also drawn to the fact that startups attract foreign investment capital and shape new investors and executives.

5. The persona of a Polish startupper

The creator of the tool that uses persona in the design process (UX Design) is Alan Cooper (2004), who described the process of creating a persona in a book titled "The Inmates Are Running The Asylum. Why High Tech Products Drive Us Crazy and How to Restore the Sanity". A persona is a tool used in the design process. It has the construction of a declarative description of a person who represents the target group. Its purpose is to identify and understand the user and highlight their key characteristics as an audience for whom a product, service, or solution is created (Holzinger et al., 2022; Jansen et al., 2022).

³ The closing of the survey and download of the survey report was on August 31, 2022.

The persona of a Polish startupper was characterized using 11 categories divided into three areas: operational, aspirational, and experience-related. The operational area includes all the “hard” information defining a startupper. The aspirational area indicates the primary motivators that guide a Polish startupper in establishing and running a startup. The experience-related area characterizes the fundamental knowledge and skills regarding the creation, development, and management of a startup acquired in the process of founding and running a startup. The developed model of a Polish startupper is presented in Figure 1.

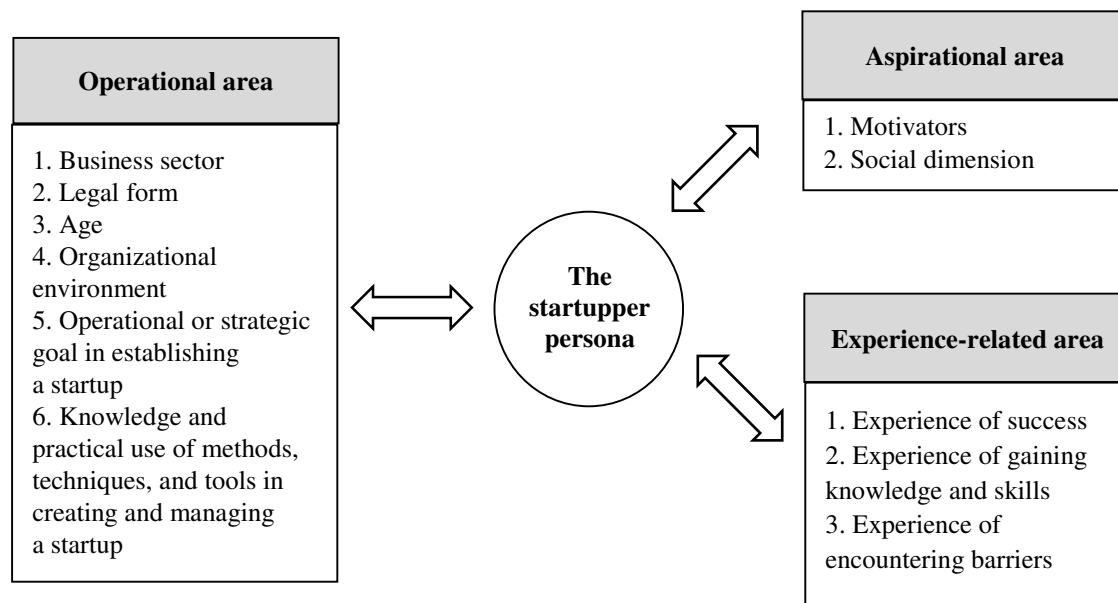


Figure 1. The model of a Polish startupper.

Source: own elaboration.

In the operational area, there are six categories of a startupper persona:

1. Business sector – a person running a startup in Polish economic practice most often chooses a sector related to the latest technologies/IT/ITC, i.e., Internet Business, Medical and Health, Data, Information and Learning, and Business Processes and Finances.
2. Legal form – the most popular legal form adopted by a Polish startupper is a limited liability company.
3. Age – a Polish startupper is a person operating in the field of innovation and high-risk projects for approximately five years. Then they transform into a mature entrepreneur or fail.
4. Organizational environment – such an individual functions in an uncomplicated, flexible, flattened, and informal organizational structure, the main feature of which is interdisciplinarity and informal management of human resources. The emphasis in the area of tasks and processes is based on the individual’s qualities, talents, and competencies, providing opportunities for their development and maximum use in various fields. The individual gives themselves and others permission to experiment, make mistakes, and learn from the conclusions drawn from them.

5. Operational or strategic goal in establishing a startup – among the primary objectives of a Polish startupper deciding to create a startup are building a thriving business, a recognizable brand, and a stable and profitable business model. These objectives are combined with financial goals, which are accompanied by cooperation with an external entity, and targets related to the individual's ambitions, i.e., the introduction of new and innovative solutions or technologies.
6. Knowledge and practical use of methods, techniques, and tools in creating and managing a startup – a Polish startupper is familiar with and most often uses in building a startup such approaches and methods as: Business Model Canvas, Lean Startup, Design Thinking, Customer Development, and Lean Canvas. In order to effectively manage a startup, such an individual most often uses project management methodologies (mainly Agile and Scrum project management) or the concept of management by objectives and Six Sigma.

In the aspirational area, there are two categories of a startupper persona:

1. Motivators – the primary motivators that characterize the Polish startupper are: the desire to realize their business idea, the need to solve a problem perceived in the market, and the desire for independence in financial and nonfinancial aspects, and thus taking responsibility for their own decisions, as well as the need to be the creator of their own life. In addition, such a person is motivated by having a goal in life and realizing their ambitions and dreams related to achieving professional success. Such an individual has passions, shows a desire to develop, and is ambitious.
2. Social dimension – a startupper persona is characterized by multidisciplinary and interdisciplinarity. Such a person is highly committed, intrinsically motivated, and possesses a high degree of self-discipline. They are consistent and professional in their actions. They are characterized by perseverance in pursuit of their goal, which allows them to survive difficult moments in business practice in case of such high-risk ventures. They have highly developed competencies in sales techniques, creating attractive visions, and setting priorities.

In the experience-related area, there are three categories of a startupper persona:

1. Experience of success – an individual who has been successful in running a startup in Polish economic practice has built a stable business model and is profiting from it. That person owns patents, their business is profitable, and they maintain a steady, high level of sales. That person has introduced an innovation to the market, attracted an investor, and obtained a return on investment. They are a leader in the industry in which they operate. Such an individual possesses a certain number of research and development projects, has met set targets, and entered new markets. They have successfully expanded into foreign markets.

2. Experience of gaining knowledge and skills – a startupper persona is a person who, while running a startup, acquires such skills as: presenting an idea, building a business model, raising financial and nonfinancial funds, improving sales techniques, establishing cooperation (cooperation with an investor, cooperation with a client), partnership approach to business, managing a company, managing projects, learning methods and techniques of managing and motivating people, managing finances, managing time, working under pressure, bearing the consequences of their own decisions, setting priorities, setting goals and achieving them, and rejecting taking for granted the primarily adopted assumptions. Such an individual acquires such qualities as: perseverance, patience, self-discipline, treating failure as an experience, entrepreneurship, creativity, creative problem solving, relationality, curiosity about the world and other people, distance to themselves and the business world, distance to the environment, active listening to the customer, empathy, humility, openness to change, resistance to stress, responsibility, and experimenting.
3. Experience of encountering barriers – a startupper operating in Polish economic practice is a person who faces financial and tax obstacles and barriers in their everyday activities. It requires them to possess enough financial capital to run their business (especially in the initial phases), as well as knowledge of tax regulations and the ability to obtain external funding. Other barriers faced by a Polish startupper are legal regulations and extensive bureaucracy. Such a person is heavily obliged to know the laws and procedures, without which they are unable to develop their business. Socio-cultural barriers relate primarily to Polish society's high level of distrust in innovation, low awareness of startup culture and who a startupper is, and what a startup is. As a result, such an individual often has to build their role as a startupper on their own, which is associated with a sense of loneliness and misunderstanding in the business or scientific community.

By analyzing the constructed persona of a startupper operating in Polish economic practice, it can be concluded that this is a person whose business is located predominantly in the technology sector. Such a person has clearly defined objectives, which were set by them when deciding to establish and run a startup. They are highly motivated, know their motivations, and can formulate them clearly. They are familiar with the most popular methods, techniques, and tools used in the startup environment for building, developing, and managing a startup. Such a person is multidisciplinary, quick to adapt to change, committed, and intrinsically motivated. However, such an individual, due to the nature of their business, operating mode, and the risks associated with their decisions, is often misunderstood by those around them and lonely in their actions.

6. Conclusions

The article presents the original model of a startupper persona operating in Polish economic practice. According to the authors, the essence of any startup is an individual who attempts to bring innovation to the market. It is evident both from the numerous definitions of a startup that have been developed so far and from the research conducted by the authors of this article which concerned the determinants of startups' functioning in Polish economic practice.

The startupper persona enables a better understanding of what a startup is and can serve as an introduction to a discourse on changes in various areas of socioeconomic and political reality in terms of startup activity. A startupper is not an ordinary entrepreneur. It is an individual who tries to change the status quo by improving it, which involves a high risk of failure. Such a person must possess specific, properly developed competencies and find a balance in each of the three mentioned areas, i.e., operational, aspirational, and experience-related. Understanding who a startupper is and what they need to successfully develop a startup provides opportunities in terms of creating new educational programs, new methods and techniques of management and making changes in terms of pro-innovation policies, and, above all, minimizing the barriers that such an individual faces in day-to-day operations.

The proposed model can provide a point of reference for those who intend to establish a startup business venture or want to verify the reasons for the success or failure of their existing startup ventures.

The considerations presented in the article do not exhaust the issue. It is recommended to verify the adequacy of the developed model of the startupper persona based on researching other groups of respondents, which can be regarded as a limitation of the presented study.

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USING AUTOMATIZATION AND DIGITIZATION MEASURES TO SUPPORT BUSINESS CONTINUITY OF ENTERPRISES IN THE COVID-19 PANDEMIC

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Purpose: The paper aims to identify how and where elements of digital transformation of activities implemented in enterprises can increase the resilience of the production system to pandemic threats.

Design/methodology/approach: The paper presents the selected results of a survey conducted using the mixed-mode CATI and CAWI on a representative group of 600 manufacturing enterprises in Poland. An analysis of measures used in the case of COVID-19 infections in the company to support business continuity and enhance resilience was carried out. A quantitative evaluation of the collected data, oriented to identify the level of application of emergency response measures, was conducted, including the support of statistical tools (Statistica software).

Findings: The study identified dozens of different measures implemented in manufacturing enterprises. Among the measures studied, there were those related to automation and digitalization of activities in the organization of production processes. The data analysis showed that there were significant correlations between the type of measures used, as well as the characteristics of the enterprises, and the production processes implemented in them.

Research limitations/implications: Future studies should also include companies with a high degree of automation and digitization of production. In addition to descriptive analysis, a quantitative-statistical approach should be used.

Practical implications: On the practical side, it was pointed out how and where elements of digital transformation of activities implemented in enterprises can increase the resilience of the production system to pandemic threats. Digitization and automation measures should be used by managers to support the implementation of production processes also in the context of improving the efficiency of enterprises.

Social implications: Enterprises can use the study results to improve business continuity policies and preparing for threats similar to the COVID-19 pandemic.

Originality/value: The novelty of the survey is the comprehensive assessment of the use of solutions from the ICT area in manufacturing enterprises, analyzed in different cross sections (size, industry, occurrence of the COVID-19 case).

Keywords: business continuity management, production processes automation and digitalization, COVID-19 pandemic.

Category of the paper: Research paper.

1. Introduction

The COVID-19 pandemic forced state governments to put in place various economic and social arrangements to allow various business entities to operate under a sanitary regime. This was aimed at preventing the transmission of the coronavirus, limiting the spread of the pandemic, and maintaining the continuity of economic activity. Mass vaccination was supposed to make it possible to mitigate the pandemic significantly. However, it turned out that due to new mutations of the virus, the vaccines were not as effective as expected. In the future, in similar situations, it may be necessary to use the measures used so far again.

The research presented in the paper focuses on real manufacturing processes carried out in manufacturing companies belonging to various industries. The authors did not identify similar studies in the literature for the manufacturing area and only single research for service enterprises. They included five solutions in the area of production organization that can protect against the development of pandemics: automated transportation, performing quality control in a remote form, digital work instructions, automated collection of production data, and replacing hard copy documentation with digital documentation. The main advantage of these solutions is the digitalization and automation of activities, with the additional benefit of reducing the spread of pathogens. The novelty of the survey also lies in obtaining a wide range of data from a representative sample of enterprises of different sizes and from different industries.

The subject of the study was to identify and evaluate the scope of the application of measures introduced in production enterprises in connection with the COVID-19 pandemic. The paper analyses in detail selected pandemic protection from the area of production process organization, based on automation and digitalization solutions. The paper aimed to analyze and evaluate the solutions implemented to ensure business continuity when faced with COVID-19.

In this context, it became essential to answer ten research questions. The first group of research questions concerns the analysis of the use of automation and digitization measures according to the enterprise size, the industry, and the type and form of production organization. The second group of questions focuses on analyzing the replacement of paper documentation with digital documentation depending on the industry and size of the enterprise, as well as the automation of data collection. The third group of questions focuses on the use of automation and digitization measures depending on the occurrence of COVID-19 in the enterprise and the analysis of their usage at different levels of enterprise maturity. Answering research questions made it possible to verify the three hypotheses set.

The structure of the work is as follows. The introduction presents the objectives of the work and their significance. Then a review of the literature on the subject of the study is presented. After that, the approach to the study is presented, including the design of the survey questionnaire, the selection of the research sample, and the selection of tools for developing the results. The following section presents the results of the study. Finally, the analysis and discussion of the results are presented. Conclusions summarize the results obtained, highlighting the value of this survey and its potential for further development into a repository of good practices for ensuring business continuity under strict sanitary regimes.

2. Literature review and hypotheses development

Guidelines from international and governmental organizations focus on personal and collective protection measures (masks, disinfection, social distance, and separation partitions). The EC-operated European Agency for Safety and Health at Work has published a workplace guide in all official EU languages (OSHA, 2020). The International Labor Organization provides detailed policies for employers to mitigate the severe effects caused by the COVID-19 pandemic in the workplace (ILO, 2020). Based on these recommendations, many countries have developed national guidelines for entities operating in their area, for example in the United States – the International Facility Management Association (IFMA, 2020), in Poland – the Ministry of State Assets, the Ministry of Climate, and the Government Security Centre (MSA/MC/GSC, 2020).

Many sectors of the economy have widely implemented solutions based on remote contact between people – education, administration, and services (banking, insurance, partly health, e-commerce). There have been publications on the organization of remote learning (Feghali, Offiler, 2021; Kucharska, Rostek, 2021; Mishra et al., 2020), and work organizations in healthcare entities (Kruszynska-Fischbach et al., 2021; Özkan et al., 2021). The framework of office work modification towards the use of remote working tools was presented by (How et al., 2021) with the author's prediction that the trend of moving towards remote working will also continue in the post-pandemic period. For example (Lee, 2021), points out that changes in workplace practices during the COVID-19 pandemic have psychological and emotional consequences for employees. However, some sectors of the economy cannot move their activities to the Internet or use remote communication channels in their operations. These include the transportation sector, the construction industry, a large part of health care, and most importantly, the manufacturing industry.

The introduction of advanced technologies and related digitalization in manufacturing is now becoming an important need for enterprises. Their integration is very helpful in improving efficiency, better productivity, process organization, and waste management. Digitalization is

essential, especially in a sustainable manufacturing environment. The continuous improvement of production has influenced technological evolution by introducing advanced information and communication technologies, including digitalization, artificial intelligence, data analysis tools, etc. Automation and robotics complement manufacturing to perform tasks with human input or remotely (Bahrin et al., 2016).

Automation and digitalization are now finding a wide variety of applications in manufacturing. In the context of the issues addressed in the paper, this includes automation of operator training (Pérez et al. 2019), automation of robotic production (Tang et al., 2019), automation of material handling systems including material delivery (Luciano et al., 2019), production scheduling and control (Rojas, Rauch, 2019), execution of operational activities (Turner et al., 2019). The COVID-19 pandemic should further increase interest in these types of technologies, the application of which may increase the chances of maintaining continuous production operations.

Automation of production and application of technological solutions of Industry 4.0 is seen by many authors as a way to reduce the spread of pandemics. Authors (Kumar et al., 2020) predict that traditional solutions used in manufacturing products should be gradually replaced by digital technologies specific to Industry 4.0 such as AI, 3D printing, robots, cyber-physical systems, etc. During the COVID-19 pandemic, many companies have increased their interest in robots because the use, even partially, of robots and autonomous systems, results in reduced transmission of the virus compared to traditional human labor (Shen et al., 2021).

Digitization of manufacturing systems is an evolving process in manufacturing companies. However, the process is progressing relatively slowly. Business decisions in this regard have been made primarily from the perspective of process efficiency. Digitization requires allocating adequate financial resources, breaking down mental barriers, and dealing with the risks that occur during technology implementation. Digital transformation accelerated after the outbreak of the COVID-19 pandemic, and it is reasonable to assume that this will be a lasting phenomenon (Henderson, Graebner, 2020). Digital transformation also leads to the necessity of redefining ongoing business processes. Under normal circumstances, this process can proceed in a stabilized manner. During extreme conditions, enterprises must change business processes immediately (Swain, Garza, 2022).

In this context, it is essential to conclude that the crucial management task is to be aware of the organization's need to prepare for business continuity. The occurrence of the COVID-19 pandemic has largely verified the readiness of organizations to maintain business continuity. This verification yielded a negative result in a broad spectrum of cases (Röglinger et al., 2022; Theuerkauf, 2021). As indicated by (Łacka, Wojdyła, 2023), decisions to implement digitalization are mainly made based on efficiency criteria. Companies do not pay attention to the aspect of maintaining business continuity under pandemic conditions. However, a positive effect of the pandemic has been a leap in the awareness of companies of the need to prepare for business continuity and to have adequate resilience to crisis events (Santos et al., 2021).

The literature also highlights the significant role of Robotic Process Automation (RPA) technology. RPA allows organizations to maintain business continuity, improve the management of business processes as well as relieve the personnel workload. Such effects occurred in companies using RPA during the COVID-19 pandemic. Some research describes this (Siderska, 2021), but it only deals with applications of RPA technology in 110 Polish service companies. The technology applies to the building, deploying, and managing of programmed robots that emulate human actions in interactions with digital systems.

Recently, in Europe, there has also been a development of the concept of Industry 4.0, called Industry 5.0. Under this concept, it assumes that industry and purely economic aspects should also significantly affect areas of social life. According to the assumptions, the industry should be the basis for the functioning of societies in prosperity and the wellbeing of employed workers. Research and innovation can be the driving factor, making development more sustainable. Thus, the industry is to build value for all stakeholders involved in the industry's business processes. Noteworthy is the assumption that the design of industrial enterprises' operations should be resilient to external disturbances (Industry 5.0, 2021).

The above literature research conducted indicates a lack of analysis on the application a specific digital security measures in production companies. These prior empirical results allowed us to assume the following research hypotheses (H):

1. Automation and digitalization of manufacturing processes are significant measures in various production companies to maintain business continuity during the COVID-19 pandemic.
2. The production organization differentiates the measures used in companies during the COVID-19 pandemic.
3. There is a different level of implementation of measures depending on the occurrence of COVID-19 in enterprises.

Given the adopted research objective, the following research questions (RQ) were formulated:

1. Is the use of automation and digitization measures differentiated by the size of the enterprise?
2. Does the use of automation and digitization measures vary by the industry to which the company belongs?
3. Is the use of automation and digitization measures differentiated by the type of production used?
4. Is the use of automation and digitization measures differentiated by the form of production organization?
5. Does the replacement of hard copy documentation with digital documentation vary according to the size of the enterprise?
6. Does the replacement of hard copy documentation with digital documentation vary by the industry to which the enterprise belongs?

7. Does the automated collection of production data vary according to the size of the enterprise?
8. Does the use of automation and digitization measures vary according to the occurrence of COVID-19 in the enterprise?
9. Does the use of automation and digitization measures at different maturity levels vary depending on the occurrence of COVID-19 in the enterprise?
10. Does the use of automation and digitization measures at different maturity levels depend on the occurrence of COVID-19 in the enterprise?

3. Methods

The paper presents selected results of a survey conducted in a mixed-mode CAWI/CATI (Computer Assisted Web Interview/Computer Assisted Telephone Interview) on a representative sample of 600 manufacturing enterprises in Poland. The enterprises were selected by stratified random sampling, within the divisions of Section C (Industry) of the Polish Classification of Goods and Services. The survey covered enterprises operating in 21 industry sectors. The scope of the survey covered protection measures used in enterprises after the beginning of the pandemic, from a set predefined by the authors based on an analysis of literature, legal acts, research reports, and others, but also their own experience. Measures outside this set, declared individually by each company, were also included. The survey was conducted one year after the WHO announced the COVID-19 pandemic, between February 5 and March 5, 2021. The research method ensured obtaining data on applied security measures from enterprises manufacturing various products, using various production technologies, applying various forms of organization of the production process, and diversified conditions of workplaces. The surveyed sample included enterprises of four sizes:

1. Very small enterprises (microenterprises), with less than 10 employees (183 in the research sample).
2. Small enterprises, from 10 to 49 employees (there were 192 such enterprises in the research sample).
3. Medium-sized enterprises, from 50 to 249 employees (153 in the research sample).
4. Large enterprises, with 250 employees and more (there were 72 in the research sample).

The research presented in the paper focuses on real manufacturing processes carried out in manufacturing companies belonging to various industries. The survey included 42 protective measures classified into five groups:

1. Legal and regulatory measures.
2. Personal protective measures.
3. Protective measures for groups of workers.

4. Work organization measures.
5. Measures of production organization.

They included five solutions in the area of production organization that can protect against the development of pandemics: automated transportation, performing quality control in a remote form, digital work instructions, automated collection of production data, and replacing hard copy documentation with digital documentation.

The analysis was performed in the following cross-sections:

1. The use of a particular measure in a group of enterprises according to selected criteria concerning the characteristics of enterprises, such as enterprise size, industry, type, and form of production organization.
2. The scope of implementation of specific measure by the percentage share of workstations/operations, in which a particular measure was used for selected protections.
3. The association of the use of specific measures with the occurrence (or not) of COVID-19 infections in the enterprise.

Four key industries in Poland were selected to present the results. These were the manufacture of food products (59 entities), manufacture of products of wood, cork, straw and wicker (63 entities), the manufacture of metal products (126 entities), and the manufacture of furniture (60 entities). Enterprises belonging to these industries accounted for over 52% of entities in the research sample.

The study also analyzed the extent of implementation of particular solutions in enterprises, expressed as a percentage of positions or a percentage of operations where a specific solution was applied. Five levels of maturity of implementation of particular solutions were defined:

1. Maturity level 1 (ML 1); 0–20% of the workplaces have implemented the measure.
2. Maturity level 2 (ML 2); 21–40% of the workplaces have implemented the measure.
3. Maturity level 3 (ML 3); 41–60% of the workplaces have implemented the measure.
4. Maturity level 4 (ML 4); 61–80% of the workplaces have implemented the measure.
5. Maturity level 5 (ML 5); 81–100% of the workplaces have implemented the measure.

The systematic literature review analysis publications in scientific databases (Scopus, WoS, among others), research reports published by consulting companies, and legal acts issued by national and international organizations. The review focused on publications presenting measures applicable to enterprises, with a particular reference to manufacturing companies. The literature analysis provided was crucial to the measures selection and identified a research gap in the ongoing research in the form of the lack of recommendations of solutions possible for manufacturing enterprises in response to the COVID-19 occurrence.

TIBCO Software Inc.'s STATISTICA package, v. 13.3.721.0, and MS Excel were used for data analysis.

4. Results

The results of the study are discussed below. They cover the extent of the use of automation and digitization measures depending on four factors: the size of the enterprise, the industry it belongs to, the production type used, and the form of production organization (Fig. 1-4). Fig. 5-7 show the occurrence of COVID-19 infections at the company premises according to the use of the analysis measures and their maturity levels. The results are presented below in the arrangement of addressing a specific hypothesis and a specific research question within the hypothesis.

HIRQ1. The measure with the highest share among the surveyed entities (46%) is replacing hard copy documentation with digital documentation. The proportion of other activities was less than 23%. The distribution of measures implementation by enterprise size varies. Similar levels of implementation can be observed for two or three types of enterprise size – no one type is dominant for each measure. The highest adoption is in medium-sized enterprises, for most measures. Only in the case of replacing hard copy documentation with digital documentation, the highest share of implementation is found in small enterprises. In this case, the difference with respect to medium-sized enterprises is only 1%. For two solutions (automated collection of production data and automated transportation), the implementation volumes in small, medium-sized, and large enterprises are comparable (differences of 1-2%). In the case of replacing hard copy documentation with digital ones, the level of implementation is similar for micro, small, and medium-sized enterprises (difference 1-2%) (Fig. 1).

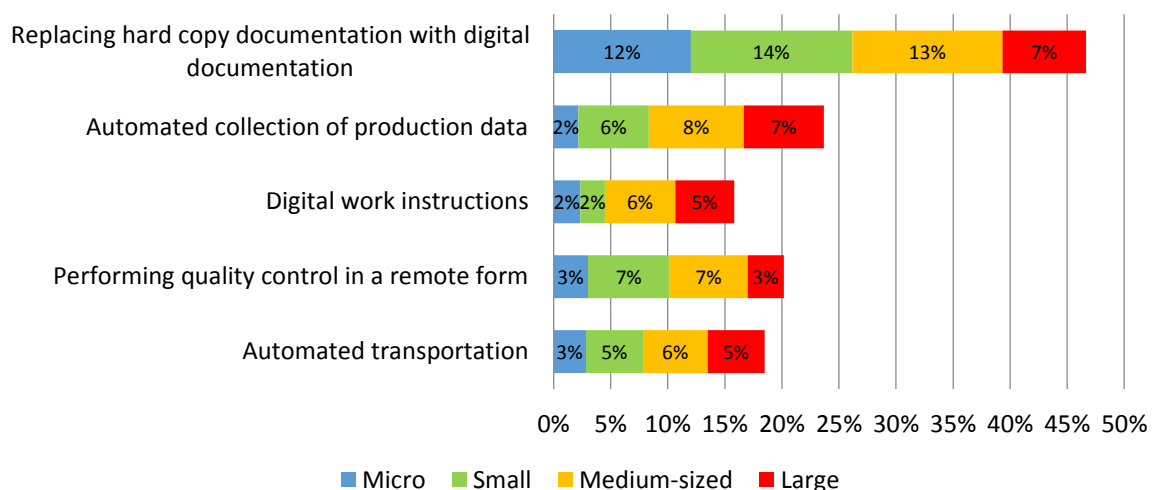


Figure 1. Use of automation and digitization measures by enterprise size.

Source: own elaboration.

HIRQ2. Within the industries surveyed, replacing hard copy documentation with digital documentation received a notably high level of implementation at 22%. The extent of implementation of other measures ranges from 7% to 13%. In the manufacture of metal

products, the maximum level of deployment was obtained, for all solutions surveyed (10%). In this case, the differences between the highest and the lowest level of deployment are 2-6%. Another remarkable industry is the manufacture of food products, for which the level of deployment ranges from 2 to 4%, for all surveyed entities (Fig. 2).

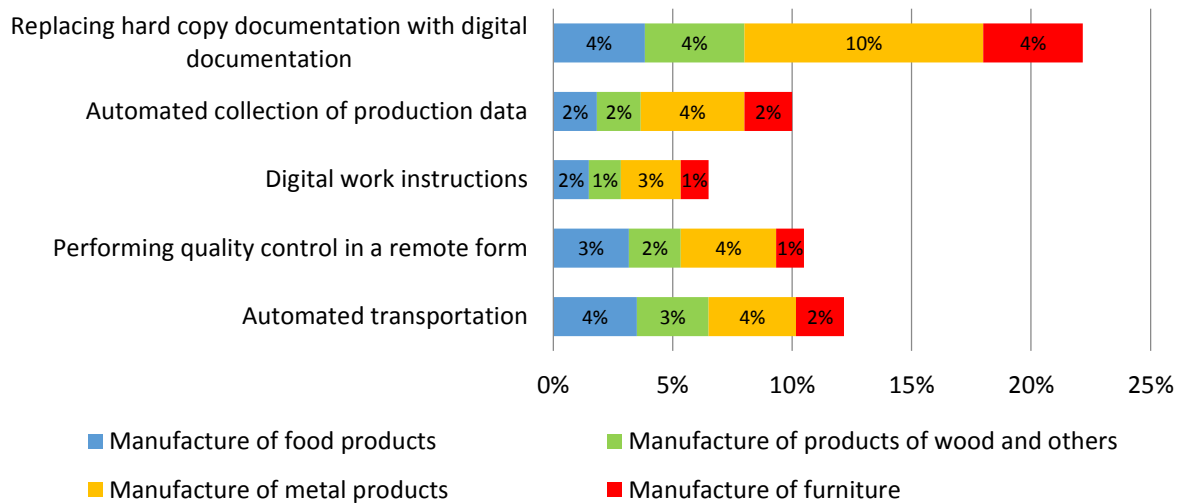


Figure 2. Use of automation and digitization measures by industry to which the company belongs.

Source: own elaboration.

H2RQ3. It is possible to notice a high share of the introduction of digital documentation (in place of hard copy documentation) at nearly 60% of entities differentiated by the production type. The extent of implementation of other solutions varies from 21% to 30% (Fig. 3). The four of the five analyzed solutions had the highest degree of adoption in batch production. The highest difference from mass production was 8 percent for replacing hard copy documentation with digital documentation. It also notes that this measure is likewise often used in job production (resulting in 22%).

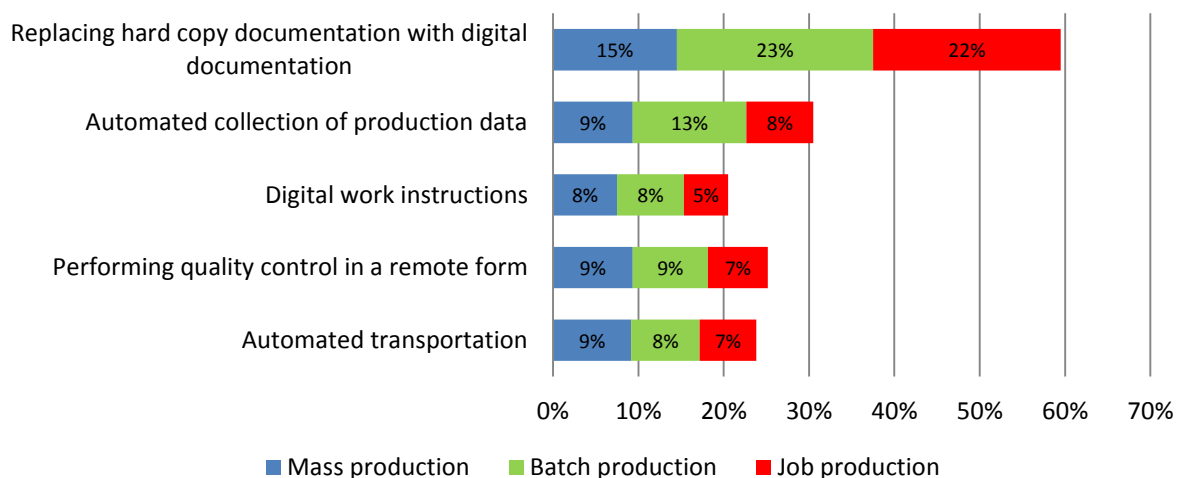


Figure 3. Use of automation and digitization measures by the production type used.

Source: own elaboration.

H2RQ4. In the scope of the forms of production, a high level of deployment was achieved by replacing hard copy documentation with digital documentation (54%). The range of implementation of other measures varies from 19% to 28%. In terms of all measures, no form is dominant. Replacing hard copy documentation with digital ones is more often used in production implemented in non-pipeline form – the difference to pipeline form is 8%. Other measures are mostly used in the pipeline form of production – the difference is between 0.4% and 4% (Fig. 4).

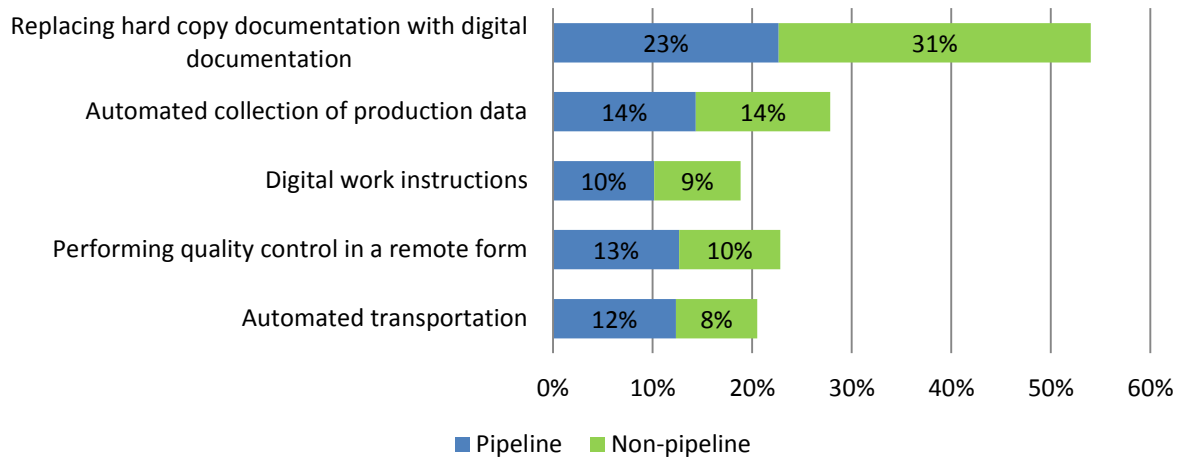


Figure 4. Use of automation and digitization measures by the form of production organization.

Source: own elaboration.

H1RQ5. As for the use of digital documentation at the company employment level, it is notable that the use of this solution in microenterprises is significantly high in the scope of 81-100% of workplaces. Due to the low costs of implementing the solution (connected with a small number of employees), it gets used more often throughout an organization – maturity level 5. In other enterprises, this solution receives to a greater extent, especially in the case of 41-60% of workplaces (Fig. 5). The figure next to the maturity level (ML) symbol shows the numbers of enterprises for that level.

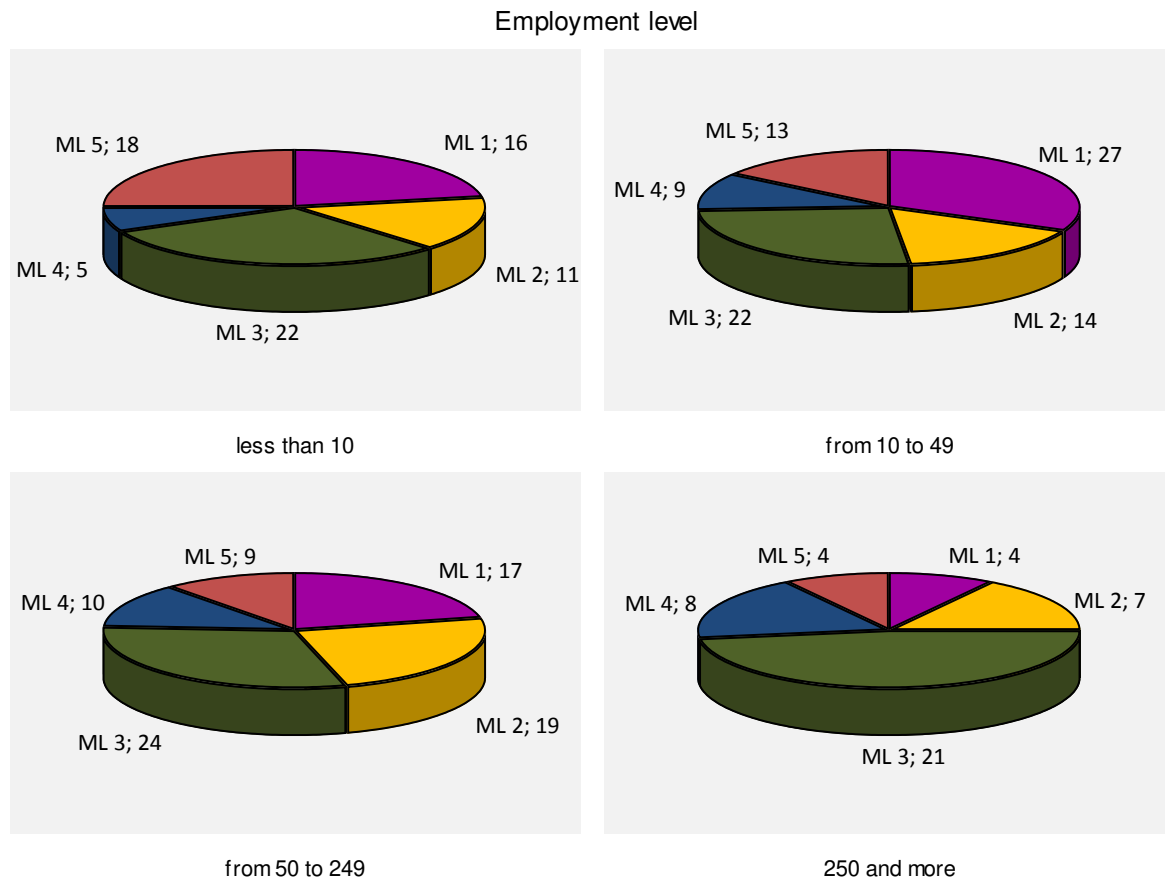


Figure 5. Replacing hard copy documentation with digital documentation by enterprise size.

Source: own elaboration.

H1RQ6. The analysis of the implementation of the solution according to the selected industries shows it is the highest for 41-60% (ML 3). The selected industries, due to their size, most often belong to medium/large enterprises, hence probably a lower implementation share. In the case of repetitive production, it is not worth investing in electronic documentation readers for a large number of workstations. A cheaper solution is to print documentation, which remains unchanged at a workstation for a long time. This applies, for example, to work instructions, product quality cards, design, and technological documentation (Fig. 6).

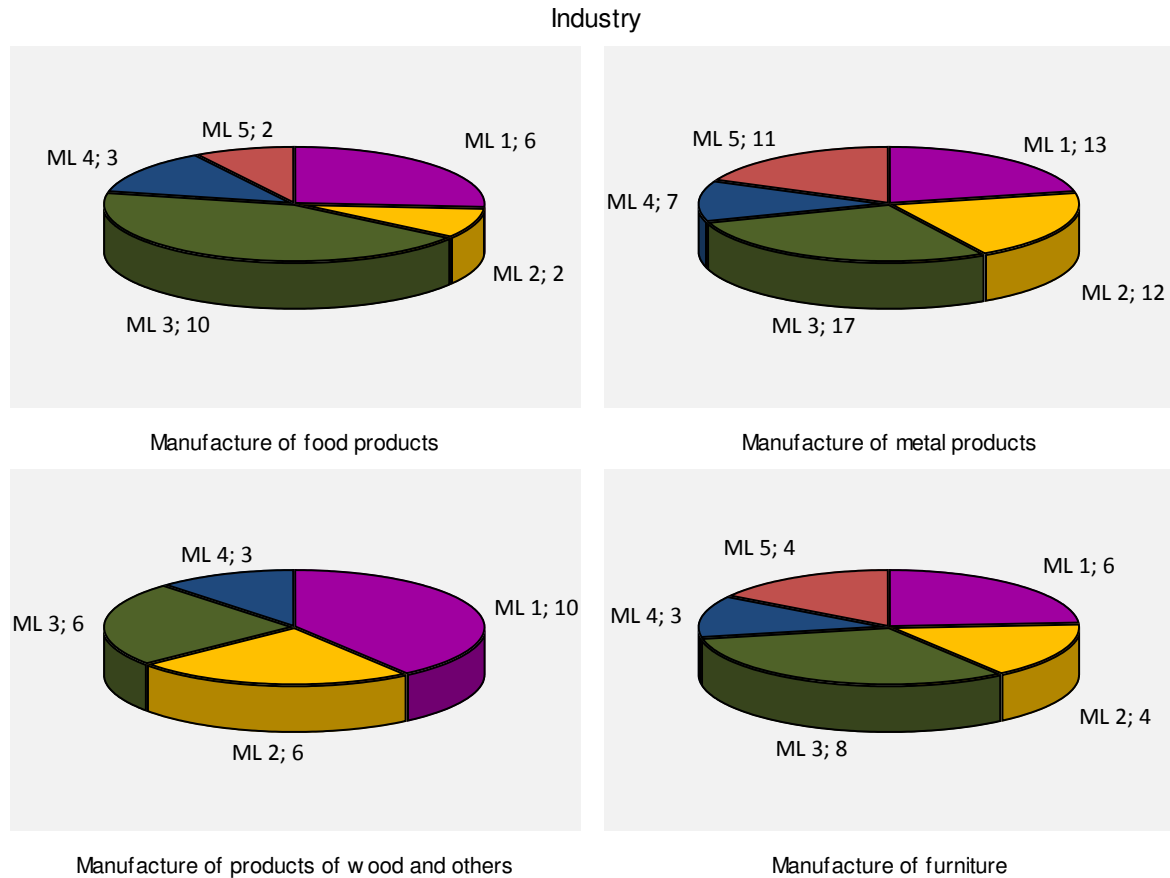


Figure 6. Replacing hard copy documentation with digital documentation by industry to which the company belongs.

Source: own elaboration.

H1RQ7. In terms of the use of an automated collection of production data in relation to the size of the enterprise, the solution was used at a low level. However, if implementation did take place, it was at a high level of maturity – ML 5 (Fig. 7). In this case, the investment in software and instrumentation is crucial, but once implemented, most of the organization's workplaces can be engaged.

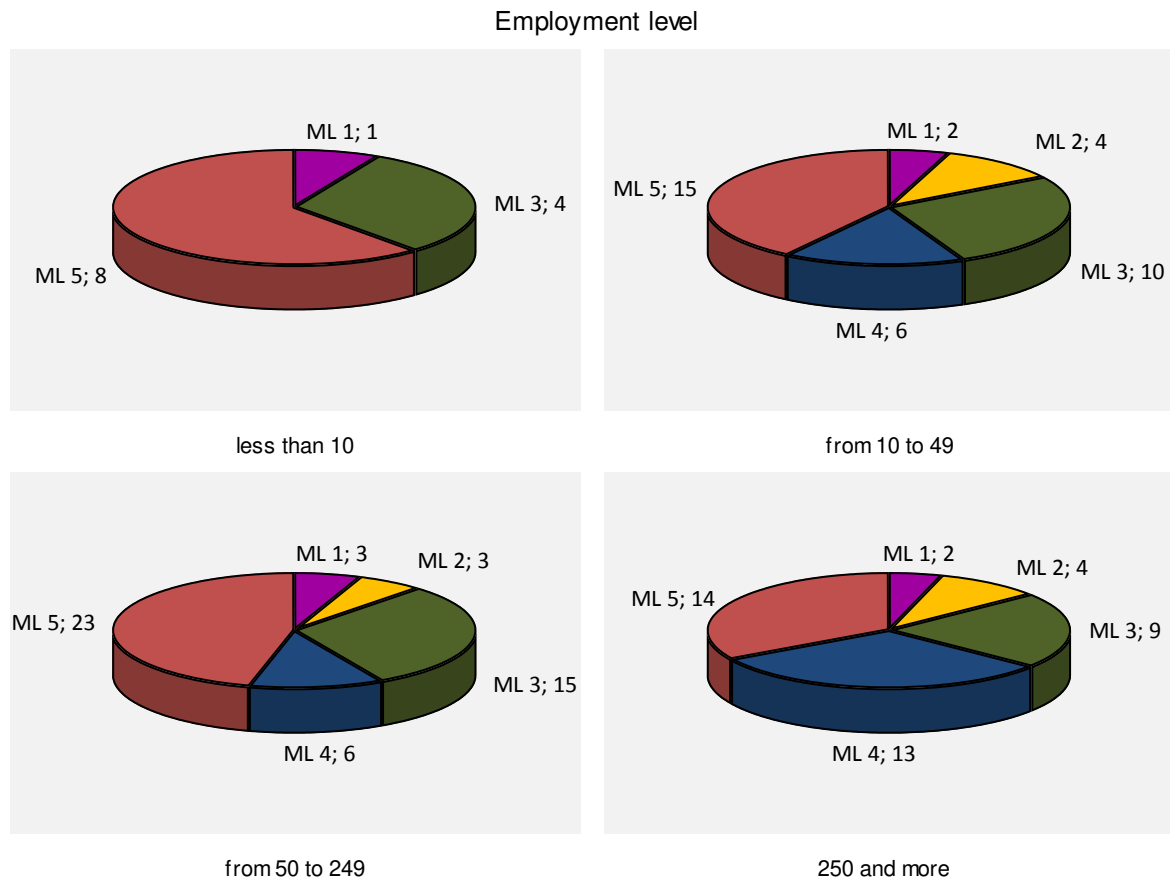


Figure 7. Automated collection of production data by enterprise size.

Source: own elaboration.

H3RQ8. For the occurrence of COVID-19 in the enterprise, the measure of replacing hard copy documentation with digital ones received the highest share. The level of completion of the other measures is similar to that in the study of dependence on enterprise size. The significant difference in the level of deployment of individual measures, as indicated, depends on the occurrence or non-occurrence of COVID-19. The highest difference occurs in two cases – the automated collection of production data and the replacement of hard copy documentation with digital ones. Accordingly, the difference is 11% and 10%. The differences range from 4 to 7% for the remaining measures (Fig. 8).

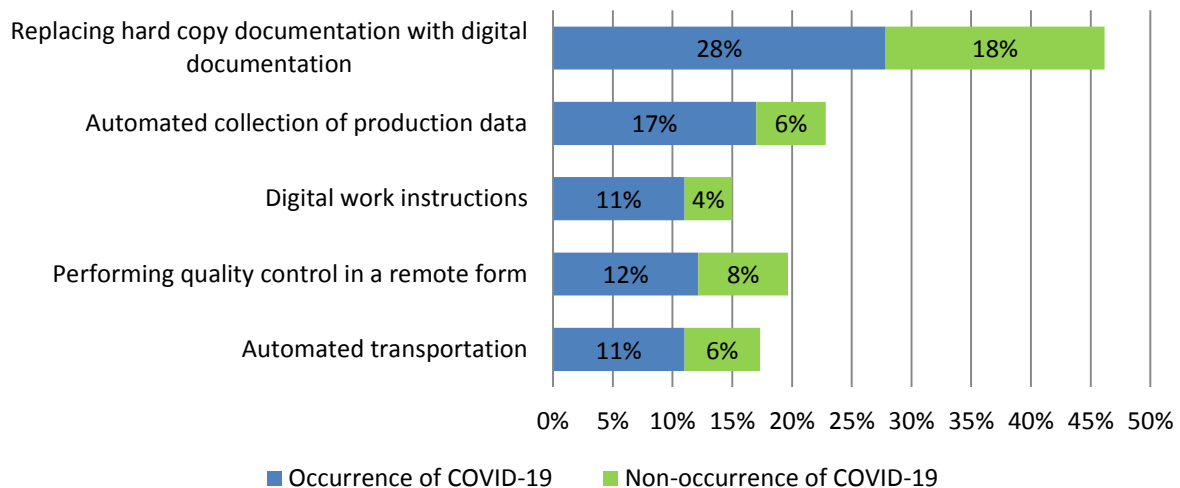


Figure 8. Use of automation and digitalization measures depending on the COVID-19 occurrence in the enterprise.

Source: own elaboration.

H3RQ9. An in-depth analysis of the use of digitalization/automation of production measures was conducted, for both groups of enterprises (with and without COVID-19 cases). This research was carried out only for entities that declared to have implemented the measure.

Most of the measures (four out of the five) were implemented at ML 3 and covered from 41 to 60% of workstations/operations. Deployment at ML 3 was declared by 24 to 35% of enterprises for all measures. For ML 4, the same level of deployment of individual activities can be observed. In such a case the implementation of measures at 61-80% of positions was declared by 13 to 19% of enterprises. Lower values were obtained for deployment on ML 2 and ML 5. The automated collection of production data on ML 5 was declared by as many as 44% of enterprises. This measure is important for preventing the development of pandemics, due to the restrictions on the movement of employees and unnecessary contact between them. The exchange of information and transfer of key data regarding the implementation of the production process can be done digitally, for example, using Industry 4.0 solutions.

It should be noted that a fairly high share of respondents' answers for the implementation of measures at ML 1 was obtained. These results (excluding the previously mentioned automated collection of production data) are between 17 and 26% (Fig. 9).

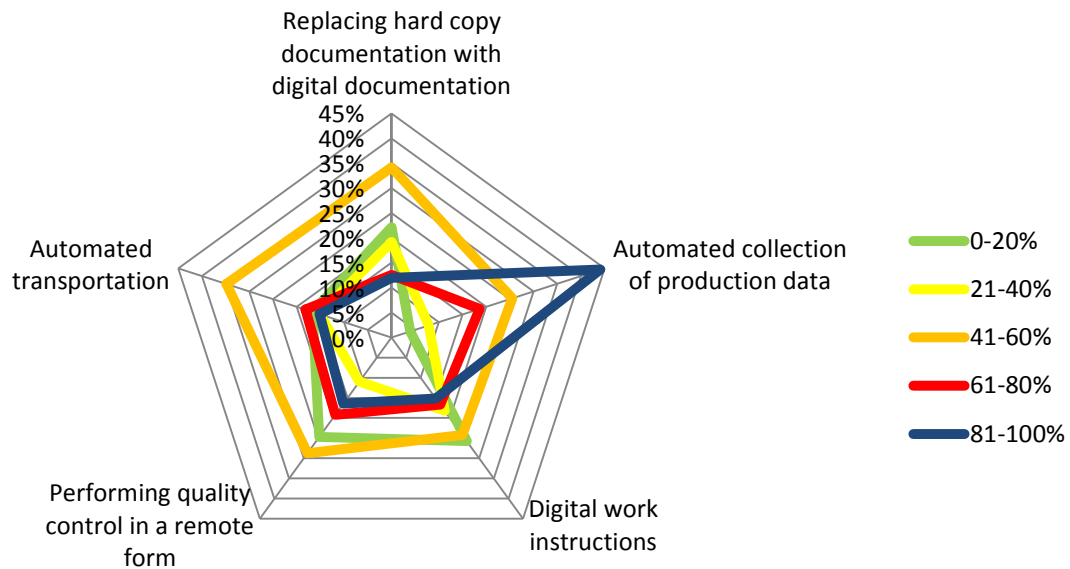


Figure 9. Use of automation and digitalization measures at different maturity levels when COVID-19 occurs in the enterprise.

Source: own elaboration.

H3RQ10. In the case of enterprises that avoided the occurrence of COVID-19, the implementation of measures at ML 5 received the highest share of responses for the three measures. These were: digital work instructions (42% of responses), automated collection of production data (37% of responses), and performing quality control in a remote form (31% of responses). Three measures were a high rate of importance at ML 3. These were: an automated collection of production data (34% of responses), automated transportation (32% of responses), and replacing hard copy documentation with digital ones (27% of responses). For the deployment of measures at ML 1, a relatively high share of responses was obtained. It was the same as in the case of enterprises where the COVID-19 was occurred. The results are at the level of 24-29%, excluding the automated collection of production data (9% of responses).

Remarkable is the high level of implementation of the automated collection of production data – implementation on at least 40% of workstations was declared by 82% of entities (Fig. 10).

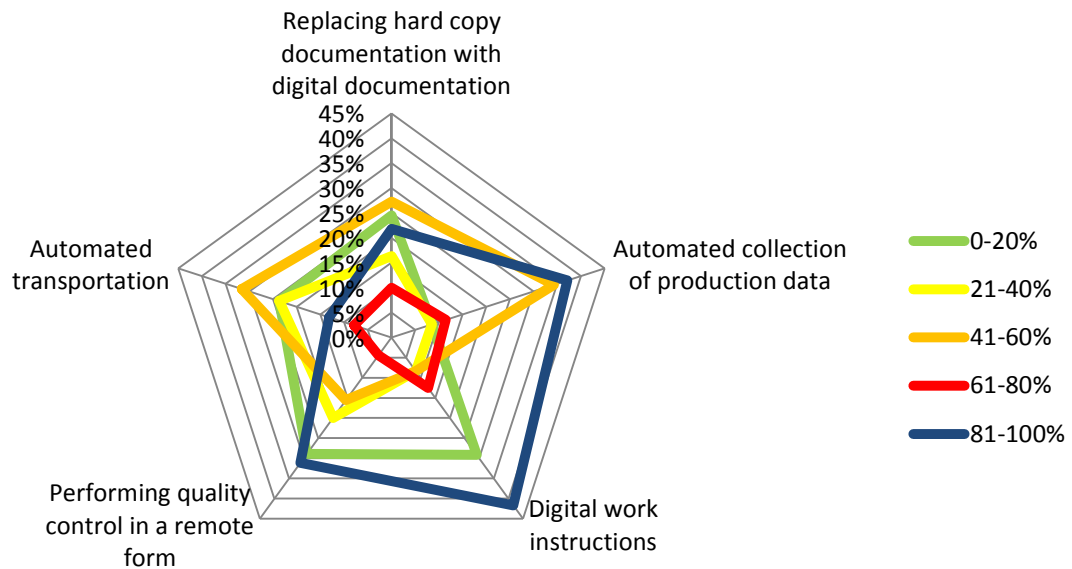


Figure 10. Use of automation and digitalization measures at different maturity levels when COVID-19 does not occur in the enterprise.

Source: own elaboration.

One can see a significantly higher share of deployment of the given measures at ML 5 in enterprises without COVID-19 cases. The highest difference occurs in replacing hard copy documentation with digital ones (27%). This may indirectly prove the effectiveness of automation and digitization measures, provided that they are common practices in the enterprise (applied at all positions).

5. Discussion

The results of the study indicate that production automation and the use of ICT and Industry 4.0 technology solutions can be a way to mitigate the spread of the pandemic.

On the basis of the research data, it seems that most of the identified digitalization and automation measures were implemented to the greatest extent in medium-sized enterprises, employing between 50 and 249 workers. Due to their scale of operations, these enterprises can afford to introduce various solutions with less financial outlay than, for example, large companies with more resources (machines, employees). In the case of the measure of replacing hard copy documentation with digital ones, it is possible to pay attention to quite a high share (12%) of very small enterprises. Additionally, this share is much higher than in large enterprises – the difference amounts to 5%. In the case of this solution, it is easier to introduce digital document circulation or equip employees with portable devices (such as laptops, tablets,

and graphic tablets) in smaller enterprises than in large ones due to the scale of implementation. The purchase of several devices for less than 10 employees is many times less outlay than for more than 250 people. In the PARP report was noted that the estimated investment cost of implementing COVID-19 protection measures during the first 6 months of the pandemic was about EUR 3,300 for medium-sized enterprises, while for very small enterprises it was about EUR 112 (PARP, 2020). Also, the level of sophistication of digital document workflow solutions is lower for very small enterprises, as they can often use free solutions offered in the market for communication between people.

In the scope of four key industries, in enterprises in the manufacture of metal products, the largest share of deployment was obtained for each measure. Due to the increase in production efficiency, enterprises in this industry implement many solutions leading to the automation of operations performed. The size of the processed products or the workplace accidents also leads to the deployment of these measures. In the conducted survey, enterprises in the manufacture of metal products were two times more than other enterprises (according to the distribution of industries in Poland). However, the results for individual solutions do not reflect this division. A significant difference can be seen only for the measure of replacing hard copy documentation with digital documentation – the distribution analogous to the market share of industries. Therefore, it is the manufacture of food products that indicates a high level of implementation of selected digitalization/automation solutions, for example, such as automated transportation or the performing quality control in a remote form. The manufacture of food products is characterized by a high number of manufactured products, which influences the necessity of introducing production automation solutions to the implemented processes. They increase process efficiency. Another aspect is the need to comply with the requirements of various standards and norms related to food production (e.g. HACCP, GMP). Automation of technology, transport, and storage operations reduces the possibility of contact between employees and food due to sanitary requirements while reducing the possibility of virus transmission.

Analyzing the indications of respondents in relation to the type of production realized in the enterprise, differences in the level of implementation of a given measure between successive solutions were noted. For example, the high share of replacing hard copy documentation with digital documentation (22%) is noteworthy. There is also a big difference in comparison to mass production. In job production, the digitalization of documentation can be observed due to the high variability of manufactured products and the necessity to prepare new construction and technological documentation for each new product. The opportunity of using computers to store it and mobile devices to access it is beneficial in terms of time and cost. In mass production, on the other hand, SOPs (standard operations procedures) are developed and fixed at the workstations for multiple uses and protected against damage. This document does not change during the realization of repetitive production processes, therefore once printed and secured (foiled) it can be used for a longer time.

In terms of the form of organization of production, the results obtained are not clear. For most of the solutions, the level of implementation of automation/digitalization solutions is higher in processes carried out in a pipeline form. The course of these processes is fixed and repeatable, therefore the introduction of automated transportation or performing quality control in a remote form is quite easy from the organizational point of view. It is known what devices and instrumentation should be used and on which workstations. The only deviation from the observed regularity is a higher share of replacing hard copy documentation with digital ones in a non-pipeline form. The use of this solution is indicated by 31% of enterprises that identified it as a dominant non-pipeline form of production. The reason for this, as in the case of job production, is the high variability of the operations performed and the lack of fixed assignment to a specific workstation or device. Therefore, the transfer of information in the remote form is more flexible and less costly.

There was a much higher level of implementation of all of the analyzed measures in enterprises where COVID-19 was identified. It is impossible to eliminate the spread of the virus. However, when the pandemic occurred, some organizations implemented measures based on government and industry recommendations or their knowledge and experience. These references were indicated by respondents. As the pandemic unfolded and lasted longer, more organizations implemented measures not only because of lockdown and existing obligations, but also because of the negative economic impact of temporarily excluding employees from work due to illness, imposed quarantine, or childcare leave. These factors were listed as significant sources of difficulties for enterprises in a report (PwC, 2020) on the study of Polish micro, small and medium-sized businesses in the face of the COVID-19 pandemic. Thus, the results obtained significantly indicate that the high share of examined measures in enterprises with COVID-19 cases is due not only to the imposed obligations but also to the registration of the negative results of COVID-19. Noteworthy is the fact that replacing hard copy documentation with digital ones proved to be particularly popular, due to the relative ease and possibility of rapid implementation of the measure. It is especially in specific production conditions or to the size of employment, as described in the earlier part of the paper.

Overall, the hypotheses set can be considered mostly verified. The research led to results that quantify the application level of identified security measures in manufacturing companies. The study was conducted in several cross-sections to obtain detailed answers to the formulated research questions. The obtained results and the interpretation of the research findings made it possible to verify the hypotheses presented. Hypothesis 1. was proved by the research conducted. Hypothesis 2. was proved in the area differentiated by the type of production in processes carried out in a pipeline form. Hypothesis 3. was proved in its entirety.

Conclusions

The development of the COVID-19 pandemic has influenced the implementation of selected measures in Polish enterprises due to the introduced government or industry recommendations, and primarily based on the findings of COVID-19 cases in the enterprise. The growing interest in digitally-enabled solutions observed in the research is consistent with the recommendations in (Kumar et al., 2020) and (Shen et al. 2021).

The research shows that of the five measures studied, replacing hard-copy documentation with digital ones was the most popular. The other measures were used to a lesser extent. It is also difficult to find dominant relationships regarding the deployment of these measures depending on the size of employment, industry, or production conditions.

The results show the scope/degree of application of solutions from the ICT and Industry 4.0/5.0 area in manufacturing enterprises, analyzed in different cross-sections (size, industry, occurrence of the COVID-19 case), concerning building the resilience of the manufacturing system to pandemic threats.

Practical lessons from the research demonstrate that digitization/automation measures should be used by managers to support the production processes execution. It is not only in the context of improving the efficiency of enterprises but also in terms of increasing their resilience to pandemic disruptions, in case similar events occur in the future. The implementation of solutions from the area of digitization of enterprises should be primarily aimed at improving the efficiency and security of the processes implemented. The research shows that these solutions can also increase the resistance of the production system to pandemic threats. The results obtained are interesting both in the area of management, digitalization, and automation (determining the benefits of the application of these solutions) and crisis management (identifying measures to minimize the effects of a pandemic).

The research was conducted in enterprises in Poland. The results testify to the low degree of implementation of automation and digitalization solutions in Polish enterprises. This confirms the very distant place of the Polish industry on the list of countries with the highest level of robotization in the industry (in 2020 – Poland has 42 robots, and leading Singapore 831 per 1000 employees; based on <https://corobotics.pl/robotyzacja-w-polsce/>).

Theoretical conclusions indicate the scope of application of selected solutions from the digitalization/automation area to the type of enterprise (size, industry, production conditions) and their possible impact on ensuring business continuity in pandemic conditions. The poor level of application of these solutions is confirmed by Poland's distant position on the list of countries implementing some automation technologies and tools.

In light of the results obtained, it seems desirable to periodically repeat the studies conducted. It would make it possible to compare how companies implement the lessons learned during the pandemic. It would also be possible to identify what other measures in the area in

question implement by companies. It would also be advisable to extend the research to companies characterized by a high degree of automation and digitalization of production. In terms of research methodology, when planning similar studies in the future, one can consider developing a quantitative-statistical approach, which was not assumed in the current study.

Acknowledgements

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IMPACT OF THE PANDEMIC CRISIS ON INTERNATIONAL ENTREPRENEURSHIP

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Purpose: The article aims to analysis the essence of multinational entrepreneurship, the main currents of research conducted in this field, and in the context of the crisis caused by the SARS-CoV-2 virus pandemic, which creates both economical barriers and opportunities for multinational companies, as well as to present the role of these enterprises in the economies' reconstruction.

Design/methodology/approach: The article reviews national and foreign professional, scientific publications concerning economical aspects on multinational entrepreneurship and conducted an analysis based on economic data on the situation of multinational companies, as well as the flow of FDI, including the OECD, International Group of Chambers of Commerce (IGCC) and Global Entrepreneurship Monitor databases (GEM).

Findings: The conducted literature and empirical studies allow us to conclude that the COVID-19 pandemic had a significant impact on multinational entrepreneurship, including changes in the activities of enterprises and attempts to adapt them to the changing and uncertain environment. The first response to the crisis for international companies is their use of available resources, followed by transformations of supply chains or changes in business models. Regarding multinational companies, the economic slowdown caused by the pandemic can be interpreted not only in terms of threats but also opportunities, as crises may also contribute to the creation of new opportunities for their development.

Research limitations/implications: The COVID-19 pandemic and numerous blockages in economies worldwide have created a unique situation that does not yet have a solid theoretical grounding in the economic literature on multinational entrepreneurship (context of the emergence of a crisis), which is a challenge for researchers. Research should also use innovative research methods to a greater extent, i.e., internationalization of complex systems, visualization, computer simulations, and experiments.

Practical implications: Regarding empirical research, it is worth noting that it is difficult to decide here to what extent the indicated changes are permanent. Hence there is a need for further research in this area. The existing assumptions concerning the business environment, the theory of internalization and patterns of multinational entrepreneurship, and the relations and connections between multinational entrepreneurship and international views of business and entrepreneurship also require re-analysis.

Social implications: The role of international enterprises in the reconstruction of national economies was pointed out.

Originality/value: The focus was on the cognitive aspects related to changes in the area of international entrepreneurship, relating to FDI flows and crisis trends caused by the COVID-19 pandemic, mainly due to the fact that in international business research this area of research often abounds in ambiguous conclusions.

Keywords: multinational entrepreneurship, internationalization of enterprises, foreign direct investment, COVID-19, economical aspects, crisis.

Category of the paper: research paper.

1. Introduction

The origins of the concept of *multinational entrepreneurship* date back to the late 1980s. However, the very idea of this entrepreneurship and its opportunities for the current and future development of enterprises became an independent trend and, at the same time, an emerging research direction only around the first decade of the 21st century (Daszkiewicz, 2014, pp. 70-81; Angelsberger et al., 2017, p. 20; Hofman-Kohlmeyer, 2018, p. 100). Moreover, during this period, attention was paid to the issue of the strategy of not only the expansion of large enterprises (transnational corporations, multinational companies) but also the behavior of small and medium-sized enterprises, which were perceived on the global market as unable to compete with them (Mtigwe, 2006, pp. 5-25). It has been noticed that due to increasing competition on domestic markets and rapid technological progress, more and more small and medium-sized enterprises undertake internationalization activities shortly after their establishment, despite little experience in operating on the domestic market. These entities are defined as: "born globalists", "global from the beginning", "early internationalized enterprises" or "born global" (Domańska, 2016, pp. 79-87; Daszkiewicz, 2015, pp. 70-81). It should be clearly emphasized that these trends contrast with the previously binding staged model — Uppsala, according to which enterprises first develop on the domestic market, gaining a stable position there, and only at the next stage of their life cycle, they expand later gradually entering foreign markets.

The COVID-19 pandemic and numerous blockages in economies worldwide have created a unique situation that does not yet have a solid theoretical grounding in the economic literature on entrepreneurship. Nevertheless, in the context of a crisis such as the COVID-19 pandemic and the entrepreneurship carried out during it, one can refer to the concept of crisis management (Williams, Vorley, 2015, pp. 28-49; Smallbone, et al., 2012, pp. 754-777). This line of research can be called *entrepreneurial crisis management* and is concerned with determining the company's response to a crisis. Much research in this trend involves the so-called *enterprise resilience* (Doern et al., 2019). However, research in this area (resilience in the context of

entrepreneurship and crises) is scarce. It focuses mainly on the pre-crisis period and skills or resources built by entrepreneurs to counteract or adapt to crisis events (Korber, McNaughton, 2018, pp. 1129 -1154).

This article aims to analysis the essence of multinational entrepreneurship, the main currents of research in this field, as well as in the context of the crisis caused by the COVID-19 virus pandemic, which creates both barriers and opportunities for multinational companies, as well as the role of these companies in the recovery of economies. On theoretical grounds, the concept of multinational entrepreneurship was referred to, and its most common forms and models were presented. On an empirical basis, reference is made to studies showing how coping with the economic slowdown of multinational companies and the role of *foreign direct investment* (FDI) flows in their reconstruction. A crucial issue in the context of the subject is how entrepreneurs operating in the international arena adjust their business models to respond to the crisis. The research problem is also essential to answer the question: What is the scope and impact of the pandemic on multinational entrepreneurship? Moreover, the article assumes that innovations stimulate and sustain companies' international business activities and during a crisis.

2. Multinational entrepreneurship and the network model – literature review

Entrepreneurship is one of the most critical drivers of economic growth, individual and regional wealth, and social development. Nowadays, the global goal of an entrepreneur after reaching a high level of maturity in the domestic market is to continue operating on an international scale.

The concept of multinational entrepreneurship, which is, in fact, an extension of the idea of entrepreneurship and the issues of international activity of entities contained therein, is not clear-cut. In the literature on the subject, this concept is often used intuitively and often unconsciously. Usually, it is equated with running a business on foreign markets, which seems to narrow down the problem (Morawczyński, 2008, pp. 165-176). According to P.P. McDougall and B.M. Oviatt, *Multinational entrepreneurship is a combination of innovative, proactive and risk-seeking behavior that crosses borders and aims to create value in organizations* (McDougall, Oviatt, 2000, p. 903). In turn, E. Duliniec cites a definition that defines multinational entrepreneurship as a process of creative discovery and use of opportunities outside the home market of the enterprise searching for a competitive advantage (Duliniec, 2013, p. 33).

Entrepreneurship in an international context is also associated with taking advantage of opportunities in the environment, and their international character is the distinguishing factor. It is also understood as an active attitude in the global environment, defined as *proactivity*. Therefore, the concept of entrepreneurship can be approached broadly, considering it a research area within the theory of entrepreneurship, covering at least two different research areas (Wach, 2020): in the scientific and visual aspect — as a creative process of noticing and using market opportunities on foreign markets; in the practical and empirical part — as international analyses and comparative research in the field of entrepreneurship.

A narrower approach, as one of the research approaches to the issues of internationalization of enterprises, indicates that in this case, four trends explaining the internationalization of enterprises can be distinguished (Zahra, 2005, p. 21):

- international new venture (INV),
- born global (BG) immediate internationalization models,
- accelerated internationalization models,
- general models of multinational entrepreneurship (ME).

Thus, multinational entrepreneurship can be considered a common area of two research domains, i.e., entrepreneurship and international business. On the one hand, this approach shows that theories and concepts of entrepreneurship provide its theoretical foundations, and on the other hand — by economic theories of internationalization of the enterprise (Kraśnicka, 2008, p. 13). This approach is illustrated in figure 1.

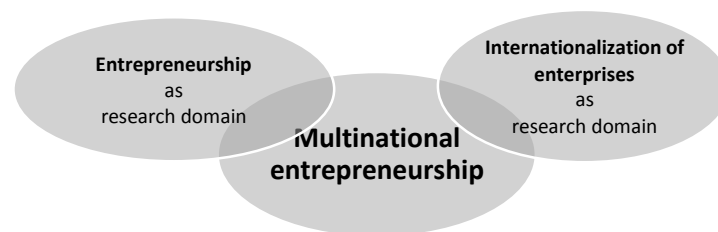


Figure 1. Multinational entrepreneurship as a common area of two research domains.

Source: own study based on (Kraśnicka, 2008, p. 13).

It can be noticed that multinational entrepreneurship as a research area is at the meeting point of two theories: entrepreneurship and internationalization of enterprises. However, some authors emphasize (Wach, Wehrmann, 2014, pp. 9-22) that entrepreneurship from the international perspective is on the border of not two but three disciplines: the theory of entrepreneurship and international business, and strategic management. It is worth emphasizing that international business is distinguished from multinational entrepreneurship, among others, by the approach of transaction costs and economic factors leading to internationalization. In turn, in terms of strategic international management, the concept of multinational entrepreneurship refers to the description of the so-called *Multinational Entrepreneurial orientation*. In the behavioral sense, it is used to describe the characteristics of enterprises that,

regardless of their age and size, seek opportunities to gain a competitive advantage by conducting innovative activities outside their home country (Al-Aali, Teece, 2014, pp. 95-116), and also refers to their business strategies applied in foreign operations (Allen, 2016, p. 93).

In the context of factors shaping multinational entrepreneurship, it can be described as creating innovative economic units or networks of organizations to achieve benefits or growth under conditions of risk and uncertainty. However, this definition indicates that among the essential factors of multinational entrepreneurship, network connections should be added — indicating the need to maintain and develop relations with network participants on foreign markets. It is worth noting that only this approach is in line with the modern concept of modeling the internationalization of enterprises. However, it is worth emphasizing that the changing patterns of international operations during crises disrupt these global business networks, widely regarded as essential for learning, access to resources, international expansion, opportunity recognition, and business innovation itself (Zahra, 2021). In times of economic slowdown, international companies may find it particularly unfavorable to weaken the positive impact of the factors mentioned above of multinational entrepreneurship and the synergy effect resulting from their combined impact on it.

Multinational entrepreneurship can also be considered in the context of internationalization modern models of a company. A modern approach to the internationalization of enterprises — the so-called network approach — is interactive and largely unpredictable. Internationalization of activities results from interaction and development of relationships through established contacts, joint activities, and mutual adaptation of resources (Gorynia, 2021a). Each enterprise creates its networks of connections, which in turn connect with the networks of other entities (Daszkiewicz, 2017, p. 23).

According to the network model, internationalization is defined as establishing, maintaining, and developing relationships with network participants in foreign markets. In this approach, internationalization is perceived as creating a network of economic ties outside one's own country by extending the range, penetrating markets, and integrating, as indicated by J. Johanson, L. Mattsson (1993, pp. 303-322).

Increasing the network's reach occurs by making foreign investments (mergers, acquisitions, building new branches), which results in the inclusion of new participants in this network, often located in countries where the enterprise has not yet operated. On the other hand, penetration should be understood as developing the company's market position or increasing the resources involved in the network if the company already has a specific function in it. Finally, integration can be understood as the alignment of different national networks with the global corporate network. Due to a hypothetically unlimited number of potential relationships, it can be assumed that the internationalization process is possible with the use of more than one configuration of network connections. Internationalization in network theory is considered a process in which the links between the companies forming the network are developed, maintained, or liquidated, depending on the company's strategy. This process emphasizes the

importance of gradual learning and market knowledge development due to interactions within networks. It is worth emphasizing that the company's position in the network can be considered in the company-company relationship or the company-network relationship.

Despite the short duration of the pandemic crisis, some researchers undertake empirical analyses. And so, already relating to the assessment of entrepreneurship of start-ups, the so-called research in the field of rapid response, in the field of crisis management in the enterprise at the micro-level, but also at the macro level — concerning political initiatives supporting entrepreneurship, was applied (Kuckertz et al., 2020, pp. 1-13). Some authors (Johnson, Onwuegbuzie, 2004, pp. 14-26) dealing with crisis and multinational entrepreneurship propose using mixed methods in this regard.

3. Methodology/Research methods

The article consists of a theoretical and empirical part. The theoretical background presents the concept and the most common forms of multinational entrepreneurship and networked model of internationalization. On the other hand, on the empirical basis, reference was made to the research showing how coping with the economic slowdown by multinational companies during a pandemic and the scale and dynamics of capital flows under Foreign Direct Investment (FDI) were indicated. The role of multinational companies in the process of economic reconstruction was also demonstrated. The article reviews national and foreign professional, scientific publications and conducted an analysis based on financial data on the situation of multinational companies and FDI flow, including the OECD, International Group of Chambers of Commerce (IGCC), and Global Entrepreneurship Monitor (GEM) databases. In particular, in the assessment of the impact of the economic crisis on Multinational Entrepreneurship, reference was made to surveys conducted among 189 companies, both Polish and foreign, associated in bilateral chambers (trade and economic) in Poland, belonging to the International Group of Chambers of Commerce (IGCC). The results of the most comprehensive entrepreneurship study in the world, conducted from April to June 2020 as part of a series of web seminars by the Global Entrepreneurship Monitor (GEM), were also used. Long-term global FDI flows were indicated, as well as their structure and dynamics during the pandemic.

4. Results

4.1. The effects of the pandemic on the activities of multinational companies

The unexpected and rapid spread of the coronavirus in Europe, faced by all countries and international companies operating within their borders in 2020 and 2021, and especially the accompanying lockdown announced independently and on different dates by individual countries, led to a slowdown in many economies and closure borders, and prevented the movement of goods within the existing supply chains. The lack of alternative scenarios for sourcing raw materials and parts for production and a business continuity plan in most companies has led to the collapse of many industries. Moreover, state restrictions — often different in the home country and the host country of foreign capital — resulted in increased uncertainty in the functioning of multinational companies. Hence, their social and economic effects, including financial ones, are currently difficult to estimate. Economists emphasize that the problem is that the turbulences resulting from the crisis affecting multinational entrepreneurship may result from disturbed structures and routines (Williams et al., 2017, pp. 733-769).

The COVID-19 crisis poses the greatest threat to the global economy since the financial crisis (OECD, 2020, Coronavirus: The World Economy at Risk, [https](https://www.oecd.org/coronavirus/)). As the UN report shows, it seriously disrupts economic activity and affects virtually all the Sustainable Development Goals (UNSG, 2020, [https](https://www.un.org/sustainabledevelopment/)). COVID-19 also presents enormous challenges. Research results indicate serious difficulties in business operations, including supply chain disruptions, problems with cash flow, and failure to meet delivery deadlines (OECD, 2020, Coronavirus (COVID-19: SME Policy Responses, [https](https://www.oecd.org/coronavirus/)), higher demand for imported goods and services, increased risk aversion in financial markets (OECD, 2020, Global...), as well as the decreased trust of entrepreneurs also significantly affecting their supply chains (OECD, 2020, Coronavirus...).

When considering the impact of COVID-19 on multinational companies, it must be emphasized that the changes that have occurred are multi-directional. In addition to the decline in global GDP, as well as the decline in the volume of foreign trade and its regionalization, they are associated with transforming global supply chains, disrupting existing businesses and networks, weakening the flow of capital, technology, and labor across international borders, and exacerbating the crisis of international institutions. As emphasized by S.A. Zahra, each of these changes can paralyze the business activity of international ventures. Still, their collective effect can be even more devastating because these changes are closely correlated with each other. Enterprises in many industries have encountered significant difficulties in functioning. Threats have become visible relating to the following markets: real estate, vocational training, professional sports, business, and recreational travel, consulting, restaurants and bars, culture and other entertainment, educational services, advertising agencies, casinos and gambling,

hairdressing salons, and much more. However, it should be considered that despite these difficulties, the post-COVID-19 world is likely to offer new opportunities for these endeavors. Many industries have also seen growth since COVID-19. It includes enterprise technology services, home entertainment, artificial intelligence, robotics, telemedicine, medical equipment suppliers, e-commerce retailers, e-learning providers, pick-up and delivery courier services, cybersecurity, and sanitation manufacturing. It is worth emphasizing that many of these industries are international (Zahra, 2021).

Global Entrepreneurship Monitor 2021/22 data shows that in most countries entrepreneurial activity has not yet returned to pre-pandemic levels. COVID-19 has hit entrepreneurship significantly, with fewer people starting businesses and many more failing. However, there are entrepreneurs who took advantage of the emerging opportunities (6 trends...., 2022).

In assessing the impact of the economic crisis on multinational entrepreneurship, it is also worth referring to surveys conducted among companies associated in bilateral chambers (trade and commerce) in Poland, belonging to the International Group of Chambers of Commerce (IGCC), cooperating with sections from many countries including from the USA, Austria, Great Britain, Belgium, France, Ireland, the Netherlands, Spain, Israel, Canada, Germany, Poland, Portugal, Romania, Switzerland, Italy, and the Scandinavian countries. They were conducted both among Polish and foreign enterprises and concerned about the impact of the pandemic on doing business in Poland (IGCC, 2020). One hundred eighty-nine enterprises operating in Poland took part in it, half of which employed up to 50 people, 32% were medium-sized enterprises (with 51-500 employees), and 19% of companies employed more than 500 people. In turn, their structure, broken down by countries of origin of foreign capital and industries, is presented in Figure 2.

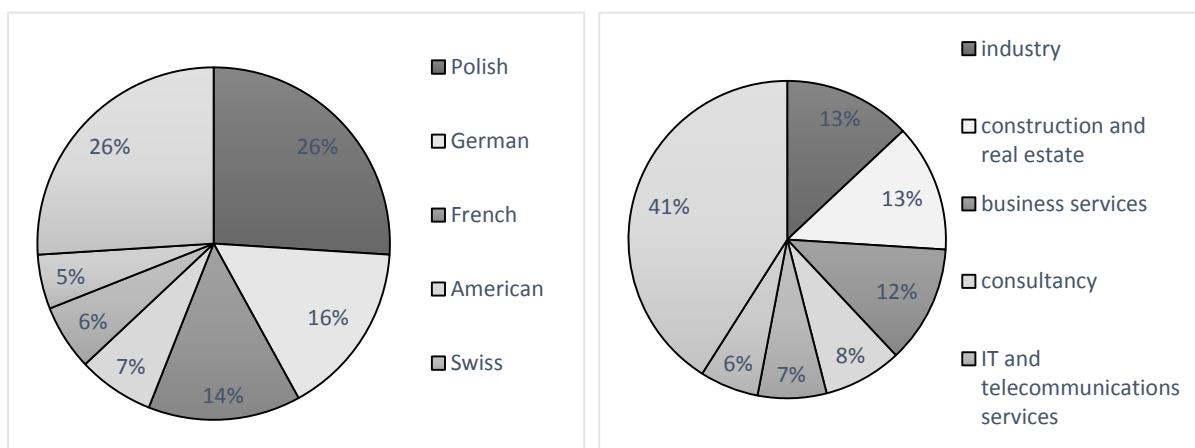


Figure 2. The structure of enterprises surveyed by IGCC broken down into countries of origin of foreign capital and industries.

Source: own study based on (IGCC, 2020).

The studies mentioned above were conducted twice — in March 2020, when the first restrictions in the economies were introduced, and again in June 2020. It made it possible to verify the fears of that time and identify the most significant problems faced by entrepreneurs. Research conducted in June 2020 shows that 80% of enterprises expected a decline in financial results at the end of the year, and nearly 90% recorded a decrease in sales. A quarter of the surveyed enterprises indicated a decrease in sales of 25%.

The biggest problem faced by entrepreneurs in mid-2020 was the cancellation of orders by customers (51% of responses), which was the concern of most enterprises in the March survey. In turn, delays in payments from customers or order fulfillment affected fewer enterprises than indicated by the first survey results (27% and 29% of responses in June, compared to 56% and 41% in March). Only the decrease in production occurred on a slightly larger scale than forecasted (28% of responses in June and 21% in March). Movement restrictions and closed borders were a significant obstacle to doing business, especially among companies operating in many markets, as indicated by 38% of respondents. A better situation than assumed was in logistics and transport of goods, as approx. 50% of enterprises did not report the impact of COVID-19 in this area. However, in every third company, there were problems with the delivery of products from sub-suppliers from Poland and abroad. Only every tenth enterprise experienced issues with transport in the country or emerging shortages in inventory. The consequence of the reduced sales was also taking many actions to reduce the operating costs of enterprises (IGCC, 2020).

Moreover, the research shows that companies most often protected themselves against bankruptcy by cutting costs, mainly not related to their core business, and treated the reduction of jobs as a last resort. As it turned out, 52% of companies have already reduced expenses not related to the company's core activity in such areas as marketing, advertising, or training, and nearly 40% declared to maintain these restrictions in the following months. In almost 2/3 cases, the reductions amounted to over 50% of the existing costs. The following steps taken by enterprises include: stopping recruitment (45% of responses), raises (37%), and bonuses (28%). In 29% of enterprises, a salary reduction was introduced at 5%-20% of the previous salary. However, only 17% of the surveyed enterprises reported this type of action in June 2020. In turn, the reduction of jobs — at the level of 2% -10% of the workforce — was performed by approx. 15% of enterprises. The epidemic also affected the ongoing or planned investments, both in terms of the expansion of enterprises, the establishment of new branches or production plants, and the purchase of new equipment and employee development. Entrepreneurs also indicated that only those already well-advanced investments have a chance to be completed, as most of the planned investments have been withheld by them. Changes are also taking place in the very organization of enterprises. Over 80% of the surveyed enterprises indicated the introduction of greater flexibility in the ways of working. A significant change is also the faster digitization of external (32%) and internal (38%) services, as well as the development of online sales channels (26% of responses) (www.inwestycjezagraniczne.com).

In turn, the most comprehensive study of entrepreneurship in the world: Global Entrepreneurship Monitor (GEM), led by scientists from the United Kingdom, the Netherlands, Spain, Italy, Chile, Mexico, USA, Canada, Japan, and Thailand, as part of a series of webinars from April to June 2020, indicated the effects of COVID-19 on companies operating in many countries around the world (Ionescu-Somers, 2020). GEM researchers also considered the impact of various previous crises on entrepreneurship, including Multinational Entrepreneurship. The key conclusions drawn from these observations indicate that recessions and crises are "painful" and create new opportunities for entrepreneurs. One of the key trends in the development of multinational companies in the long term is a greater emphasis on issues related to sustainable development, which may shift the balance between global and local supply chains favoring the latter. It should be emphasized that such a scenario is supported by the "Green Deal" Strategy initiated by the European Union at the end of 2019, which indicates the development of companies based on opportunities with high added value for society (OECD, 2021). One of the critical features of an entrepreneur is the willingness (and ability) to find ways to overcome barriers (Wach et al., 2022). A survey conducted among 4000 Spanish entrepreneurs in April 2020 on the impact of COVID-19 on entrepreneurship shows a positive conclusion, as the surveyed entrepreneurs in Spain are actively discovering new market opportunities. The study highlighted teleworking opportunities as it found that companies that followed up also had more optimistic outlooks for introducing new products and services (58%) and finding new customers and markets (57%). In turn, also in Thailand, despite the pandemic, entrepreneurs discovered the opportunities for developing entrepreneurship resulting from the situation, in particular regarding the sale of goods and services abroad. They demonstrated flexibility, resilience, and adaptability (Ionescu-Somers, 2020). It is worth noting that to understand the state of entrepreneurship during a pandemic, GEM researchers highlighted the critical essential characteristics of entrepreneurs: their adaptability and finding opportunities.

It is also worth pointing to the development trends of multinational companies in the long term (Brdulak, 2021). The coronavirus (COVID-19) pandemic has caused severe disruptions to the economy and the lives of companies and has a vast impact on their operations, many of them struggling with financial difficulties. The COVID-19 crisis has exposed serious weaknesses in business operations and supply chains related to working conditions and disaster preparedness. Nevertheless, national governments have taken extraordinary steps to contain the epidemic, such as a general closure, a large-scale reduction in economic activity, and the provision of relief and recovery packages to support companies and workers challenged (OECD, 2021).

The pandemic reality has significantly changed the perception of the supply chain by international companies (Gorynia, 2021b). In the context of halting the economy, it is noticeable that the decision-making processes in such enterprises are shortened. In particular, the supply chains are broken, and consequently: shortening the planning cycle, increasing the importance of inventories and increasing their stocks, limiting the "just in time" model, considering

alternative suppliers (in the case of lack of raw materials on the market), as well as shortening the process from ordering to delivery to the warehouse or to the recipient or consumer (shortening the *lead time supply chain*). These changes may also persist in the post-COVID situation (Pycla, 2021).

An important area for multinational companies to adapt to the current situation is to make changes in their business practices. Many companies have been forced to help contain and mitigate the economic blow to their employees and supply chains. However, these activities may carry significant risks due to the unforeseen effects of the Covid-19 virus.

Research conducted among entrepreneurs by the largest strategic consulting company in Poland — McKinsey (2020, 2021), an integral part of McKinsey & Company (a global strategic and operational consulting company), shows that multinationals perceive some changes caused by COVID-19 not as transitional, but as permanent. Among the factors that had the most substantial impact on multinational companies, one should mention in particular those that led to a change in their business model, such as security in ensuring supply chains (including the increase in the importance of stocks stored in warehouses), diversification of suppliers, producers, sales channels and used means of transport — as elements of risk management, as well as focusing on suppliers/producers closer to the market (by shortening supply chains — using nearshoring and insourcing), digital transformation and its accompanying elements (migration of assets to the cloud, the use of advanced technologies for operational activities, online work, the growing importance of cooperation and security related to the management of large data sets regarding the analysis of consumer expectations). It should be emphasized that although entrepreneurs expected these changes in the next decade, the pandemic situation led to their significant acceleration.

In the development of multinational companies, the emphasis is primarily on the dynamic development of technology, including the increasing level of digitization and the ever-growing role of social media (Williams et al., 2020), management of large data sets using algorithms, and artificial intelligence. The competencies of human capital will be different from before because such enterprises will require a holistic view of processes, as well as the ability to work in mixed teams (not only consisting of people but also robots), good communication skills, and efficient use of various tools of the new technology. The role of digital platforms ensuring the security of transactions within which purchases and sales will be made will also increase.

4.2. Global changes in foreign direct investment during a pandemic and their role in the recovery process

It is worth noting that the pandemic occurred when global FDI flows were at the lowest level in 15 years. However, it is worrying that these flows have generally fallen steadily over the past five years. The increase in the dynamics of FDI flows starting from 2020 is optimistic (figure 3, 4). In order to better illustrate the analyzed phenomenon, a trend line in global FDI inflows and outflows has been added to the charts.

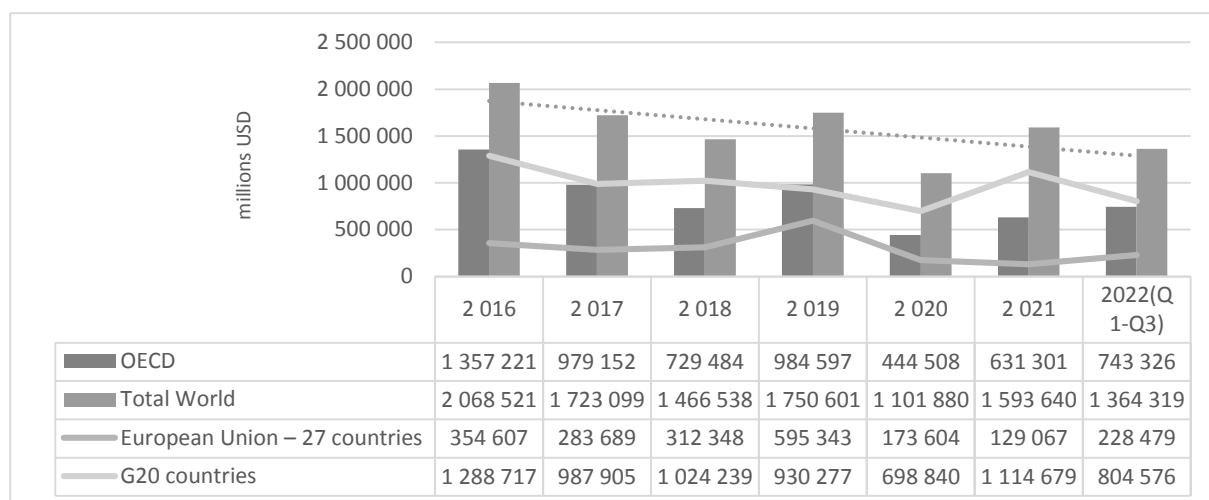


Figure 3. FDI inward flows (in USD millions).

Source: own study based on OECD International Direct Investment Statistics database.

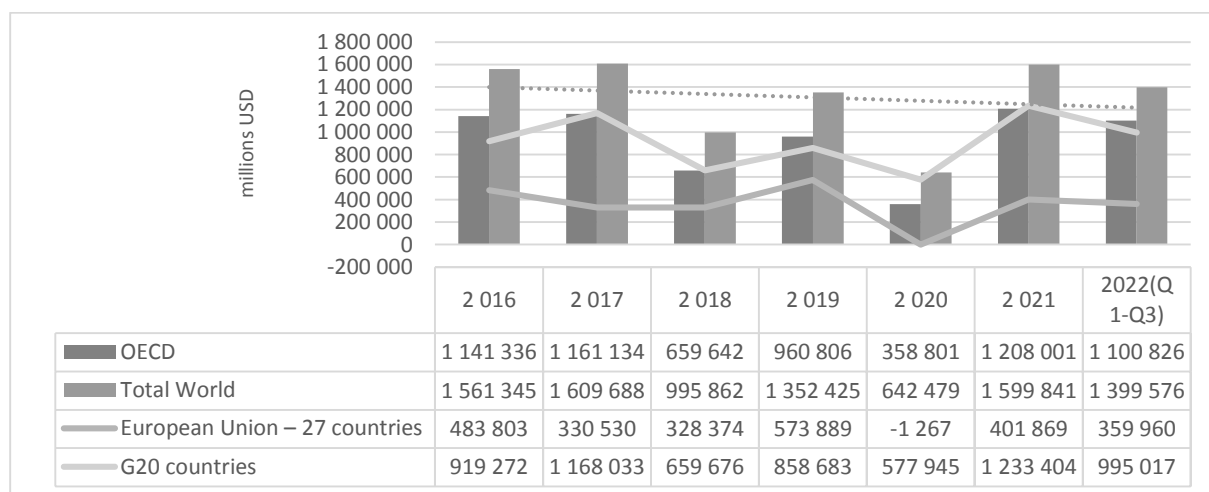


Figure 4. FDI outward flows (in USD millions).

Source: own study based on OECD International Direct Investment Statistics database.

According to the United Nations Conference on Trade and Development (UNCTAD), global inflows of foreign direct investment in 2020 decreased by 42% compared to the same period in 2019. Such a low level was observed recently in the 1990s and is more than 30% lower than the decline that followed the global financial crisis of 2008-2009. According to UNCTAD data, global FDI flows rebounded in 2021, rising by 88% to USD 1,815 billion and 37% above pre-pandemic levels. However, the prospects remains uncertain given the current geopolitical context. The global environment for international business and cross-border investment also changed dramatically in 2022 as a result of the food, fuel and financial crises caused by the war in Ukraine - seen in many countries around the world. Likewise, the recent recurrence of COVID-19 in China, along with the re-locking of areas that play an important role in global value chains, could further constrain new investments from scratch in GVC-intensive industries. In addition, the expected interest rate hikes in economies that are experiencing significant inflation increases could slow down M&A markets and the increase in

international project financing. The resulting uncertainty of investors, translating into their negative sentiment on the financial markets, as well as the upcoming recession, put a significant pressure on the decline in global FDI in 2022. Data for the first quarter of 2022 show that the number of greenfield projects alone decreased by 21%, and international project financing transactions by 4% (UNCTAD, World Investment Report 2022).

Unfortunately, according to the authors of the UNCTAD report, the forecasts for the next year, especially in the industrial sector, are not optimistic. Investment increases are expected in the technology and healthcare sectors. In turn, in the medium term (the second half of 2020 and 2021), it was indicated that the FDI flow would depend on the success of individual governments' actions in the field of economic and health policy. According to UNCTAD, global FDI flows increased to USD 972 billion in the first half of 2022, the vast majority of this increase took place in the first quarter, while global FDI flows fell by 22% in the second quarter of 2022 (compared to the previous quarter). Given the geopolitical situation and the war in Ukraine, rising energy prices, rising inflation and interest rates in many countries, this decline is not surprising. The United States was the world's largest FDI destination, followed by China and Brazil (UNCTAD, 2022, Global Investment Trends Monitor).

According to the OECD, in Q3 2022, global FDI flows fell by 7% compared to Q2. Analyzing these data through the prism of the first quarter of this year, an upward trend is noticeable. Global FDI flows in the first nine months of 2022 remain 16% higher than the levels recorded in the first nine months of 2021. Still the largest recipient of FDI inflows in the world. The main (in Q3 2022) are the United States (USD 86 billion), as well as Ireland (\$37 billion) and the UK (\$36 billion). The largest sources of FDI outflow in the world were the United States (USD 66 billion), Japan (USD 40 billion) and China (USD 90 billion). In turn, analyzing the inflow of FDI to OECD countries, an upward trend is clearly visible, resulting mainly from negative levels of inflows in some European countries (they increased by 56% in Q3 2022 compared to Q2). Overall, in the first nine months of 2022, the OECD FDI inflow was 57% higher than in the same period of 2021. FDI flows into non-OECD G20 economies decreased by 43% in Q3 2022 compared to Q2, largely driven by decreases in China where FDI inflows dropped to their lowest quarterly levels since 2005. In the first nine months of 2022, non-OECD G20 economies saw a decrease in FDI inflows of 34% compared to the same period in 2021. According to OECD data, FDI outflows from non-OECD G20 countries decreased by 24% in Q3 2022 compared to Q2, mainly due to outflows from Brazil caused by FDI outflows. In total, in the first nine months of 2022, FDI outflows from outside OECD G20 countries were 17% lower than in the first nine months of the previous year. FDI inflows nearly doubled in Q1 2022 compared to Q4 2021, thanks in part to record inflows in Australia and strong growth in some European countries (Foreign Direct Investment Statistics...).

Once we compare the pre-pandemic results to 2020, and then beyond, we will be able to see which economies improved their entrepreneurial activity, and if those economies were ones in which entrepreneurs saw opportunities.

It is worth pointing out that multinational companies can play an essential role in supporting economies during and after the crisis and subsequent economic recovery through financial and non-financial support for their subsidiaries and links with local enterprises. They can also play an important role in the recovery of FDI. As evidenced by previous crises, foreign subsidiaries, including SMEs, can show greater resilience thanks to their links with parent companies, and above all, due to the availability of their financial resources. However, the contribution of international enterprises to the reconstruction of FDI goes beyond the financial support of foreign subsidiaries (OECD, OECD Policy Responses..., 2020). Multinational companies can also stimulate the innovation of economies, as they are larger, more efficient than domestic ones, and more active in the field of R&D.

5. Discussion

There is no doubt that the pandemic is a threat to the innovation of multinational companies. However, being innovative is a prerequisite for being resilient, as innovative companies constantly anticipate and adapt to a wide range of crises (Linnenluecke, 2017). As it turns out, the first response to the crisis for multinational companies is their use of available resources. However, their development and innovation potential are then threatened. The spread of COVID-19 threatens to reduce the innovation potential accumulated in recent years, relating to the generation of economic, social, and environmental value soon (Rutkowski, 2020). As it turns out, the economic climate is currently unfavorable to innovation, although multinational companies are fully committed to responding to the crisis, also in this area.

However, it should be emphasized that a pandemic may lead multinational companies to choose different action scenarios (OECD, OECD Policy Responses..., 2020). One of them points to the possibility of geographically shifting their foreign activities. To protect against disruptions in the supply chain, multinational companies can shorten global value chains. The alternative scenario assumes that companies may also seek geographic diversification to reduce the risk of exposure to site-specific shocks and lower the cost level. These changes may have significant consequences not only for the current situation of economies (Global Expectations..., 2020). Multinational companies have an enormous impact on macroeconomic aggregates shaping the national income, including trade, R&D, and employment, and the development prospects of these economies.

While many other crises in the past have struck at a specific point, and often only at a regional level or have developed over an extended time, the COVID-19 pandemic has spread around the world with global effects. Infection control measures taken by governments have caused the crisis to suddenly stop or slow down the economic activity of many companies. Of great importance in the COVID-19 crisis is the concept of crisis management, which aims

to foster the resilience of multinational companies. To understand the state of entrepreneurship during a pandemic, one can refer to two concepts relating to the critical essential characteristics of entrepreneurs: the ability to adapt to them and finding opportunities (Ionescu-Somers, 2020).

In this article, the main focus was on how the economic crisis caused by infection control measures and the blockage of a large part of economic activity affects multinationals. The drastic action by governments in various countries to limit the spread of the SARS-CoV-2 coronavirus is an exogenous shock to all enterprises, including multinationals. However, only enterprises with a high level of entrepreneurship before the crisis are well-prepared to deal with such exogenous shocks (Bishop, 2019, pp. 496-515). A pandemic for multinational companies can be defined as a period of variability, uncertainty, complexity, and ambiguity, i.e., under the metaphorical sign of the "black swan" (Winston, 2020). In leadership theory, this refers to the acronym VUCA (from the four characteristics: Volatility, Uncertainty, Complexity, and Ambiguity). It is worth emphasizing that these features, on the one hand, seem to be a threat. On the other hand, they may become an opportunity if the company reacts to them appropriately, i.e., takes specific actions at the strategic level. Hence, the COVID-19 pandemic is an event of great importance and severe consequences for multinational companies, as it suddenly changed the situation in their environment. However, as indicated, this event can be interpreted not only in terms of threats but also opportunities. Crises may foster new opportunities, including innovation (Brem et al., 2020, pp. 360-369). The most crucial issue in times of crisis is to be proactive and forward-looking. Any actions taken without defining resources, assessing the company's ability to implement individual strategies, focusing on key development factors, and flexibly updating the strategic concept are burdened with an error that can carry severe threats to the company's operations. Both wrong decisions and lack of flexibility in action will result in ineffectiveness and inability to adapt to the new situation.

6. Conclusions

The literature research and the presented data partially answer the research questions posed in the introduction. The article presents considerations regarding multinational entrepreneurship based on current trends. Unfortunately, the pandemic situation has already significantly changed the structure of the world economy, and its final shape is difficult to predict. Continuous turning points and the lack of a sufficient amount of data result in the inability to present precise scenarios of business solutions — the presented analyses are intended only to show general trends or mechanisms of solutions taken by enterprises in the pandemic era. Entirely alternative solutions will likely emerge. The competitive struggle of multinational companies in the search for margins along the entire chain may result in creating either giant entities with very complex structures or a withdrawal from finance as the only valid

measure of success. There are also suggestions for them to take long-term actions to solve fundamental problems, such as: promoting health, equality, and environmental protection. It is pointed out that such enterprises must secure future innovation by meeting the goals of sustainable development and digital transformation. Whether multinational companies will benefit from their entrepreneurial potential depends on whether they are innovative in achieving these goals.

An important role of multinational companies is also their participation in solving the problems of post-Soviet economies. Multinational companies can provide expertise, transfer skills, provide resources and develop new business models to meet these expectations. Besides, these companies can merge with other local and foreign companies to steer the changes in the desired direction of recovery. As a result, this changes the role of multinational entrepreneurs into institutional builders and reformers — becoming institutional entrepreneurs. These changes in the institutional context can trigger major changes in the objectives of multinational enterprises, decision-making principles, and strategic behavior. In the case of multinational enterprises in the post-COVID-19 era and the globalization trend, there may also be a de-globalization scenario, according to which enterprises may also limit their international operations and focus on neighboring countries only selected regions of the world.

However, the effects of the COVID-19 pandemic also for multinational entrepreneurship are and will undoubtedly be very extensive, and hence it isn't easy to present them in detail in one article. It is even more challenging to predict its long-term consequences for the global economy, particularly in terms of the flow of foreign direct investment (FDI) and the activities of transnational corporations (TNCs), substantial from the point of view of multinational entrepreneurship. Therefore, the article focuses on the key trends during the pandemic, which was considered essential for multinational entrepreneurship. Hence, this article, showing the picture of the situation of multinational enterprises in the pandemic era, is only a contribution to the research at the interface between multinational entrepreneurship and the crisis. The authors realize that it does not fully cover all issues related to multinational entrepreneurship in the current situation and after it.

The issues of multinational entrepreneurship in the context of the economic crisis, due to the prevailing pandemic, attract the attention of an increasing number of scientists. It should be undoubtedly emphasized that there is a need for further, in-depth research in this area. The existing assumptions regarding the business environment, the theory of internalization, and patterns of multinational entrepreneurship also require re-analysis (Zahra, 2021). To answer the growing complexity of questions, one should consider the use of innovative research methods, such as the internationalization of complex systems (Chandra, Wilkinson, 2017), visualization (Schotter, Buchel, Vashchilko, 2018), or computer simulations and experiments (Heukelom, 2014), used in a new stream of economics — behavioral economics.

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THE MARKET OF EDUCATIONAL SERVICES FOR SENIORS ON THE EXAMPLE OF THE OFFER OF UNIVERSITIES OF THE THIRD AGE

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Purpose: Problems related to the aging of the population have not only social but also economic consequences. It is therefore important to draw the attention of governments and social organizations to undertaking initiatives aimed at activating elderly people and, if possible, keeping them on the labor market.

The idea of U3A is rich, widespread and firmly rooted in the educational system of many countries. Universities of the Third Age (UTW), established in the world since 1973, and in Poland since 1975, play a special role in solving social problems related to counteracting social exclusion and activation of the elderly.

Methodology: A trend model for the increase in the number of seniors was determined. In order to assess the phenomenon of the development of universities of the third age, dynamic indicators were used and the average rate of change of the phenomenon was determined.

Findings: The aim of the article was to present the development of UTAs in Poland in dynamic and spatial terms. The conducted analysis shows that U3A enjoy great interest in Poland. The offer of universities was regionally diversified both in terms of the number of operating universities, organizational and legal form and the number of people interested in classes offered by the U3A.

Keywords: Universities of the Third Age, activation of seniors.

Category of the paper: Research paper.

1. Introduction

Today's world is struggling with many problems, including issues such as growing social inequalities, rising unemployment, an aging society, social exclusion, climate change or growing environmental pollution and its impact on the health of society. Therefore, in recent years, activities aimed at activating the elderly have been included not only in the subject of scientific research, but also in the initiatives and programs of the European Union. The aim of

the article is to present the activities of Universities of the Third Age and to present their special role in solving social problems related to counteracting social exclusion of the elderly.

Universities of the third age can be broadly defined as “socio-cultural centers where older people gain new knowledge on various topics or test (update) existing knowledge” (Formosa, 2012).

The problem of aging populations is one of the most important challenges facing European countries, as it has not only social but also economic consequences. It is therefore reasonable to draw the attention of European societies to a change in the direction of activity of the elderly towards their activation and, if possible, keeping them on the labor market.

One of the forms of activation of the elderly, which is part of the idea of social innovation, are Universities of the Third Age, which give the opportunity to develop one's own interests, broaden knowledge, but also improve the physical condition of students.

2. Demographic processes taking place in Poland

Changes in the demographic structure of the population related to the increase in the share of elderly people that have been taking place for years are a challenge for the economy and society.

Mering believes that already in 2030, more than half of the inhabitants of Western Europe will be over 50 years old, and their life expectancy will be close to 90 years (2011).

The concept of old age cannot be included in the framework of rigid statistics, but it is conventionally assumed that old age comes after the age of 60. Elderly people do not constitute a homogeneous group, because they are distinguished by their health, level of mental and physical fitness, life, social and economic situation. Undoubtedly, the increase in the population of the elderly caused that issues related to the aging process and old age itself as a phase of life became the subject of research in many fields of science, including demography, economics, social policy and sociology (Pulturzycki, 1991).

The decreasing scope of social roles made available to the retired population causes the younger part of society to fear old age and retirement. This process works in contemporary reality according to the principle of feedback: reluctance to retirees, as a passive part of society, results in alienating them from the spheres of active participation in social and professional life, which is a growing problem, also economic. In addition, the end of professional work results in withdrawal from social contacts and causes a sense of isolation from the rest of society. Although a large part of the population of today's seniors enjoys good health, is active, fit and ready for intergenerational activities, the social image of the elderly is largely based on the stereotype that describes seniors as a group of infirm, ailing, passive, reluctant or even unnecessary and useless people (Kamiński, 1986, p. 37).

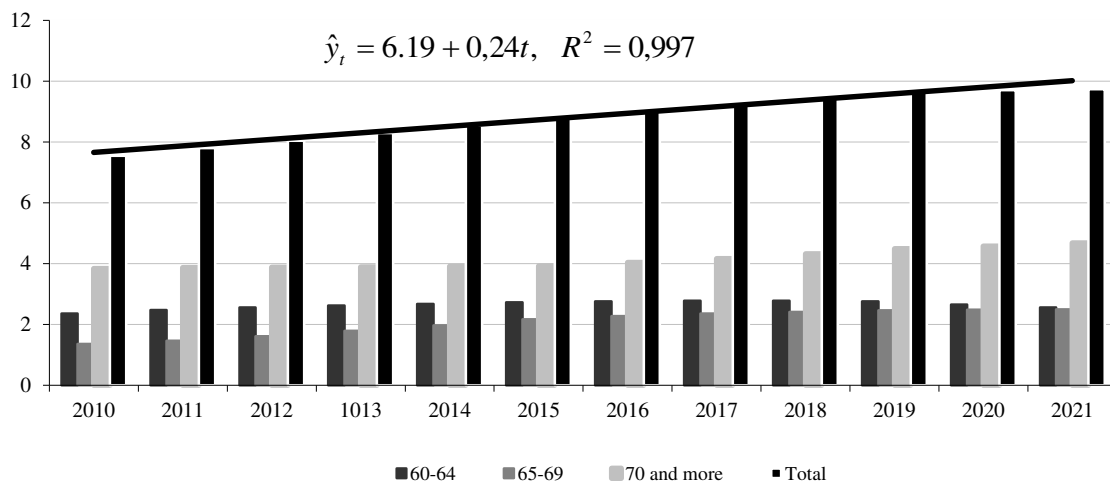


Figure 1. Number of senior citizens in Poland in 2010-2021 by age group [million] with a matched trend line.

Source: own calculation base on: <https://stat.gov.pl>, 20.02.2023.

At the end of 2021, the population of Poland amounted to 38,433.0 thousand people and was 96.9 thousand lower than in 2010. In 2021, the median age for the entire population of Poland was 40.2 years, while in 2010 it was lower by almost 5 years. The number of Polish residents aged over 60 is also growing (Senior economy..., 2022) (figure 1). From year to year, the number of middle-aged people increased by 2.34%. In the last 10 years, the most important number of people aged 65-69 was 1,1 million persons. At that time, the number of people over 60 at risk by 2,2 million persons.

The broadly understood progress of civilization brought the development of medicine and pharmacology, resulting in the improvement of the health conditions of modern seniors and the extension of the average life expectancy of people. Therefore, the number of elderly people is growing - in the 70-74 age group, in 2021, compared to 2010, an increase of 10.66% was recorded. In the case of the oldest people, an increase of 2% was recorded compared to 2010 (Gospodarka senioralna..., 2022). This group will require special care in the future, as in their case the deterioration of general health is observed, communication problems appear, which are associated with the reduction of social ties and the loss of previously performed functions in professional and family life (Drożdż, 2013, p. 25).

Compared to 2010, in 2021 the number of people aged 65 and more increased by 61.89% (figure 2). In many cases, this group includes people who want to stay active. They are looking for an offer on the market that will enable them to develop their own interests or give them the opportunity to meet other seniors.

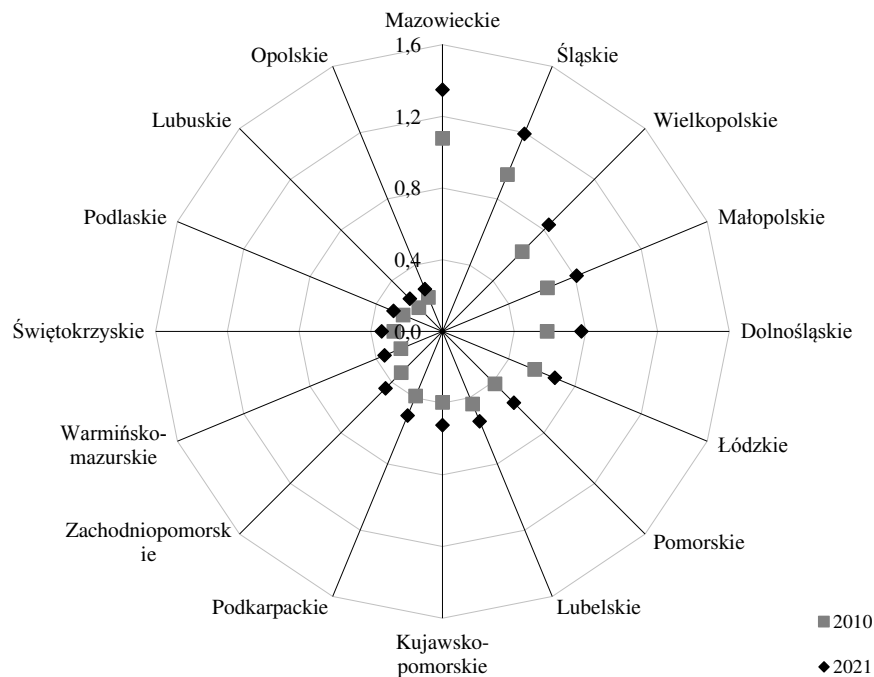


Figure 2. Number of people aged 60 and more [million] in Polish voivodeships in 2010 and 2021 [million].

Source: own calculation base on: <https://stat.gov.pl>, 20.02.2023.

Technological progress and demographic processes, among which the extending life span of people plays an important role, as well as the desire to maintain psychophysical activity as long as possible after retirement, have resulted in an increase in the number of educational programs addressed to the elderly.

In the global information society, a citizen is expected to know the necessary ICT tools and to have the ability to communicate electronically with other people or various institutions. These skills are taught in a professional manner at Universities of the Third Age (UTW), which enable older people to meet such needs as: self-education, staying and working in a group, acceptance, expanding knowledge and skills, filling free time, mental and physical stimulation, learning new technologies and methods of communication, and also create opportunities to pursue interests (Półturzycki, 1991). When preparing education programs for seniors, every andragogue is aware that they tend to focus more on practical thinking than on theoretical considerations. Hence, the offer of U3A includes many practical courses in the field of computer use or learning foreign languages (Borczyk, Załon, 2014).

The problem of an aging society and the related dynamic development of the environment of senior organizations in Poland and Europe made the subject of education and activation of the elderly very important and noticed by state authorities, EU institutions and many international organizations. Both in the documents of the Council of Europe and in many reports prepared by other European institutions, it is emphasized that along with the development of

a knowledge-based society, the importance of lifelong learning increases. The principle of knowledge for all, lifelong learning is also an important foundation of the Lisbon Strategy.

With reference to the above documents, many various initiatives have been undertaken in Poland, the aim of which is, among others, development of lifelong learning and social activation of the elderly, counteracting their social exclusion and age discrimination (Pędziwiatr, 2015). Many of these activities constitute an innovative approach to the problem and contribute to the increase of social well-being.

Issues related to the elderly are mainly addressed in reports and programs aimed at preventing the exclusion of seniors. It has also become the subject of interest of the scientific community. Psychological aspects of the aging process were presented in their works by e.g. Szatur-Jaworska, Błędowski, Dzięgielewska (2006), Szarota (2010) and Stuart Hamilton (2006). Skrzypczak (2010), in turn, studied the importance of older people in the development of the local community, and Semków (2008), together with Kaczmarczyk and Trafiałek (2007) and Połuszna (2012), in their works drew attention to the importance of activating older people.

In Poland, studies on life satisfaction of the elderly were conducted by Braun-Gałkowska (2006) and Dzięgielewska (2006). Halicka (2004), examining this problem, emphasized that it depends on many factors. Among them, she attributed the greatest importance to health, family and economic situation and activity, she also added that social contacts are also important.

Trafiałek (2007) noticed that a new lifestyle in retirement appeared throughout the civilized world, with particular emphasis on sport, social life, and expanding interests.

3. Origin and specificity of operation of Universities of the Third Age

Universities of the Third Age, created in the world since 1973, serve to improve the quality of life of the elderly and to expand their knowledge of modern technologies. The first of them was founded in France by Pierre Vellas, a professor of social sciences at the University of Toulouse. In the second half of the 20th century, similar universities were also established in other countries, e.g. Spain, Belgium, Brazil, Canada and Italy (Ziębińska, 2007, p. 48).

The definition of what the University of the Third Age is is very broad. What mainly connects these institutions is precisely the name and goals as well as a specific group of listeners. Most universities of the third age include among the main tasks in particular: taking care of preserving and increasing the intellectual, mental and physical fitness of the elderly, social activation of the elderly, conducting lectures in various fields of science (in particular medicine, biology, sociology, law, economics, history and art), promoting physical culture under the guidance of professional instructors, organizing interest groups in various fields and scopes run by the participants themselves or individual specialists. The U3A may also carry out information and programming activities through the mass media, as well as scientific and research activities and organize training activities.

In the classic division, the following types of Universities of the Third Age are distinguished:

- French - U3A closely related to the university, where great emphasis is placed on educational activities.
- British - based on the self-organization of the elderly, operating mainly in the form of an association, most often not associated with a university, rather of a recreational nature.
- Canadian - combining the activities of the association and the university, i.e. science and recreation.
- South American - created thanks to the bottom-up initiative of older people who work with difficult youth, socially engaged (it can be compared to social rehabilitation activities).
- Chinese - undertaking creative and artistic activities, promoting the arts, from arranging bouquets to handicrafts (Wnuk, 2012).

In Poland, the idea of creating a U3A appeared as early as 1975, when the first institution of this type was established in Warsaw. In the 1980s and 1990s, the U3A movement developed rather slowly. The largest number of U3As was established in 2007, when more U3As were established in one year than in the first 25 years of the movement's development (figure 3).

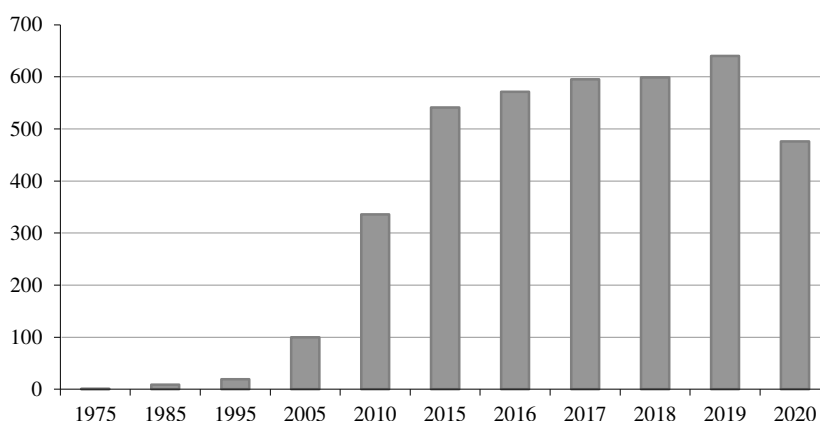


Figure 3. Number of Third Age Universities according to the year in which they started operating in Poland between 1975 and 2020.

Źródło: Uniwersytety Trzeciego Wieku w roku akademickim 2017/2018, 2019, 2021, GUS.

The coronavirus pandemic reorganized the activities of universities of the third age, and thus significantly affected the functioning of U3A students. The number of operating universities in 2020 decreased compared to 2019 (fig. 3). Nascimento de Maio (2020) in the study of the first wave of the epidemic listed the following negative effects of closing universities of the third age for their students: social isolation, reduced quality of life, emotional problems (stress, uncertainty, depression), boredom, lack of motivation, family and marital problems, deteriorating health and physical well-being (level of strength, general mobility,

functionality), resulting from the forced abandonment of participation in gymnastic, sports and rehabilitation classes carried out so far at the U3A; loss of appetite, change in eating habits, loss of muscle mass. Similar negative effects of the pandemic on the functioning of seniors are also indicated by Grech (2020), Cheung, Fong, Bressington (2020) Duan, Zhu (2020) and Vostanis, Bell (2020). Currently, UTAs in Poland operate in two forms: traditional - French and new - British. The French form assumes that a U3A student can be a person with higher education, and lectures are conducted by representatives of the staff of the university at which the U3A operates. However, according to the British form, any senior can become a student, and education is not supported by a university (universities are run by non-governmental institutions) (Zgliczyński, 2012).

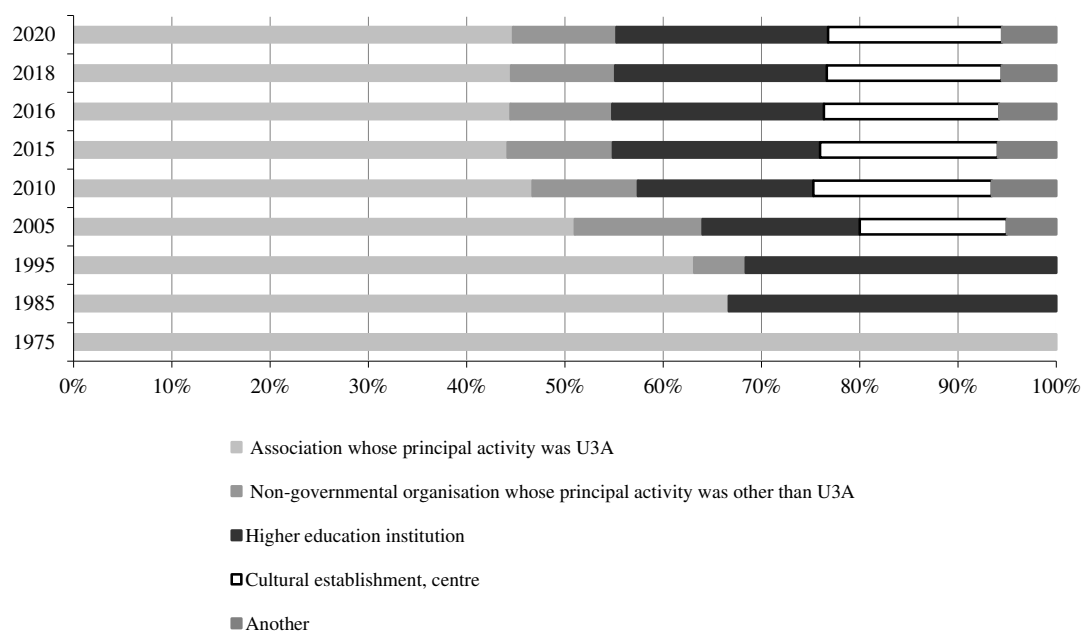


Figure 4. Structure of the Third Age Universities in Poland according to the year of their establishment and organizational and legal form from 1975 to 2020.

Źródło: Obliczenia własne na podstawie: <https://stat.gov.pl>, 20.02.2023.

In Poland, there are three organizational types of UTAs. Most U3As operate as associations whose main form of activity was the U3A. The institutions established by the associations base their work on the activity of volunteers. Such a structure is most numerous in Poland. A large group is characterized by links with higher education institutions. The third type is activity at community centres, libraries and social assistance centres.

Table 2.

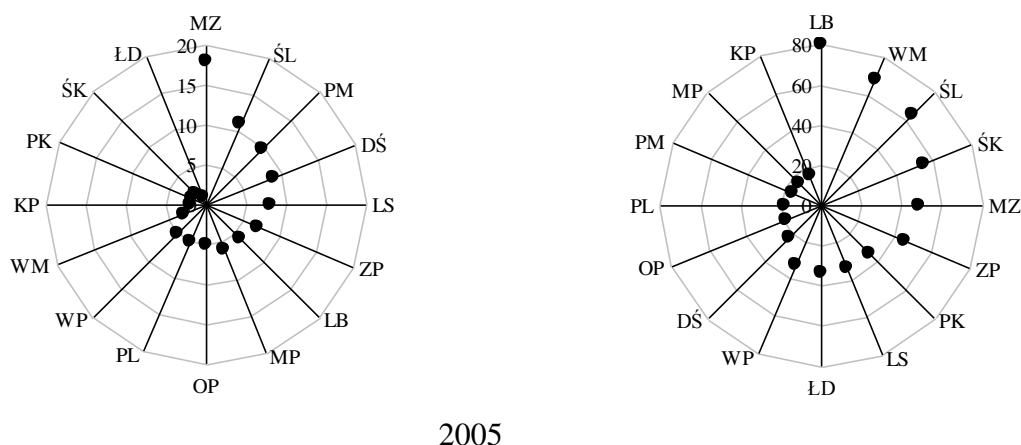
Structure of Third Age Universities according to the organizational and legal form in Polish voivodships in 2020

| Specification | (a)/ Associations | (b) non-governmental organisations | Higher education institutions | Cultural establishment, centres | Other |
|---------------------|-------------------|------------------------------------|-------------------------------|---------------------------------|-------|
| Dolnośląskie | 0,31 | 0,06 | 0,27 | 0,25 | 0,10 |
| Kujawsko-pomorskie | 0,14 | 0,11 | 0,63 | 0,09 | 0,03 |
| Lubelskie | 0,44 | 0,31 | 0,13 | 0,13 | 0,00 |
| Lubuskie | 0,50 | 0,14 | 0,00 | 0,36 | 0,00 |
| Łódzkie | 0,39 | 0,03 | 0,12 | 0,30 | 0,15 |
| Małopolskie | 0,38 | 0,18 | 0,20 | 0,24 | 0,00 |
| Mazowieckie | 0,39 | 0,13 | 0,05 | 0,38 | 0,06 |
| Opolskie | 0,75 | 0,06 | 0,06 | 0,06 | 0,06 |
| Podkarpackie | 0,58 | 0,11 | 0,21 | 0,05 | 0,05 |
| Podlaskie | 0,61 | 0,22 | 0,06 | 0,11 | 0,00 |
| Pomorskie | 0,41 | 0,09 | 0,19 | 0,13 | 0,19 |
| Śląskie | 0,32 | 0,04 | 0,44 | 0,13 | 0,06 |
| Świętokrzyskie | 0,63 | 0,19 | 0,06 | 0,13 | 0,00 |
| Warmińsko-mazurskie | 0,68 | 0,12 | 0,15 | 0,03 | 0,03 |
| Wielkopolskie | 0,73 | 0,02 | 0,13 | 0,07 | 0,05 |
| Zachodniopomorskie | 0,70 | 0,15 | 0,06 | 0,09 | 0,00 |

a: principal activity was U3A, b: principal activity was other than U3A.

Source: own study on: <https://stat.gov.pl>, 20.02.2023.

When analyzing the organizational and legal form of U3A activities in individual voivodships, one should emphasize the great interest in running U3As by associations. In the Opolskie, Wielkopolskie and Zachodniopomorskie voivodships, it is the most frequently chosen form of functioning of the U3A, over 70% of the operating organizations operate as an association. Against this background, the Kuyavian-Pomeranian Voivodship stands out, where most of the institutions, as much as 63%, operate at a university.



DŚ: dolnośląskie; KP: kujawsko-pomorskie; LB: lubelskie; LS: lubuskie; ŁD: łódzkie; MP: małopolskie; MZ: mazowieckie; OP: opolskie; PK: podkarpackie; PL: podlaskie; PM: pomorskie; ŚL: śląskie; ŚK: świętokrzyskie; WM: warmińsko-mazurskie; WP: wielkopolskie; ZP: zachodnio-pomorskie.

Figure 5. Number of Third Age Universities that started their activities in 2005 and 2020 in Polish provinces.

Source: own study on: <https://stat.gov.pl>, 20.02.2023.

Comparing the development of these institutions over time, in 2020 many more institutions started their activities compared to 2005. Most institutions in 2020 started their activities in Lubelskie, Warmińsko-Mazurskie and Śląskie Voivodships, while this still new idea in 2005 enjoyed great popularity. interest in the Mazowieckie, Śląskie and Pomorskie voivodeships (fig. 3).

Not in all of Poland in the analyzed period did the U3A movement develop so dynamically. So far, most universities have been established in the Mazowieckie, Śląskie, Dolnośląskie and Wielkopolskie voivodeships. However, if we take into account the number of inhabitants over 50, which in the voivodship falls on one U3A, it turns out that the idea of the U3A was also very well received in the Kujawsko-Pomorskie, Lubuskie, Warmińsko-Mazurskie and Opolskie voivodeships.

The Świętokrzyskie, Podlaskie and Podkarpackie voivodeships are definitely the worst. Seniors there find it most difficult to take advantage of the university's offer. This is a direct result of the fact that in these voivodships there are much fewer analyzed facilities than in other units (6, 13 and 15, respectively). Świętokrzyskie is one of the voivodeships with the fewest registered NGOs. This may partly explain the small number of UTAs in these areas, as Universities of the Third Age most often operate as non-governmental organizations. Most often they are independent associations, very rarely foundations. Every fifth U3A is subordinated to a local government institution. Usually it is a community center, but it also happens that the U3A operates as part of a library or other unit appointed by the commune/city office. Contrary to their name, U3As are the least likely to operate at universities.

Regardless of the legal form, a clear majority of U3As are associated with a university. If the U3A does not operate within the framework of the university, it signs a cooperation and patronage agreement with the university.

Table 3.

Structure of the Third Age Universities according to the message of the main activity in Polish voivodeships and in Poland in 2020

| Specification | Education of the elderly | Integration of the elderly | Activation of the elderly | Self-help | Regionality |
|---------------------|--------------------------|----------------------------|---------------------------|-----------|-------------|
| Dolnośląskie | 0,46 | 0,50 | 0,04 | 0,00 | 0,00 |
| Kujawsko-pomorskie | 0,67 | 0,19 | 0,13 | 0,00 | 0,02 |
| Lubelskie | 0,38 | 0,56 | 0,00 | 0,06 | 0,00 |
| Lubuskie | 0,27 | 0,55 | 0,14 | 0,00 | 0,05 |
| Łódzkie | 0,42 | 0,36 | 0,18 | 0,03 | 0,00 |
| Małopolskie | 0,60 | 0,31 | 0,09 | 0,00 | 0,00 |
| Mazowieckie | 0,59 | 0,21 | 0,18 | 0,01 | 0,01 |
| Opolskie | 0,50 | 0,44 | 0,06 | 0,00 | 0,00 |
| Podkarpackie | 0,68 | 0,32 | 0,00 | 0,00 | 0,00 |
| Podlaskie | 0,11 | 0,56 | 0,17 | 0,11 | 0,06 |
| Pomorskie | 0,50 | 0,31 | 0,16 | 0,00 | 0,03 |
| Śląskie | 0,62 | 0,28 | 0,09 | 0,00 | 0,01 |
| Świętokrzyskie | 0,50 | 0,31 | 0,13 | 0,06 | 0,00 |
| Warmińsko-mazurskie | 0,41 | 0,53 | 0,06 | 0,00 | 0,00 |
| Wielkopolskie | 0,47 | 0,38 | 0,13 | 0,02 | 0,00 |
| Zachodniopomorskie | 0,36 | 0,48 | 0,15 | 0,00 | 0,00 |
| Poland | 0,51 | 0,35 | 0,11 | 0,01 | 0,01 |

Source: own study on: <https://stat.gov.pl>, 20.02.2023.

Most institutions cite the education of older people as the main objective of their activities. This type of activity is most often indicated in the Podkarpackie, Kujawsko-Pomorskie, Śląskie and Małopolskie voivodeships. Universities associating seniors in the Lubelskie, Lubuskie and Warmińsko-Mazurskie voivodeships set the integration of the elderly as their main objective.

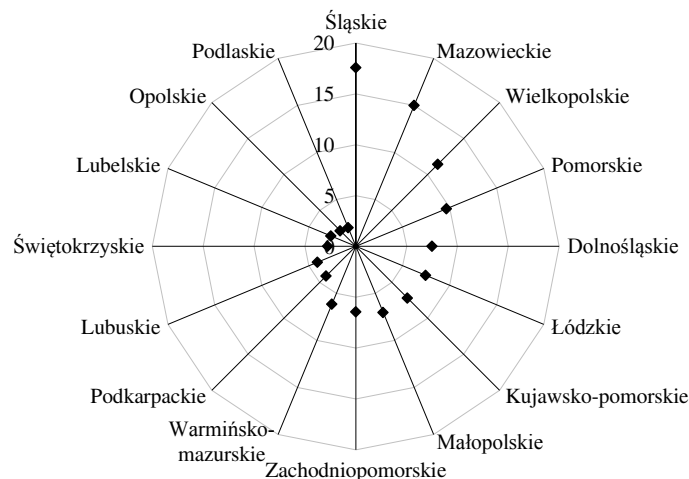


Figure 6. Number of students of Third Age Universities [thousands] in Polish provinces in 2020.

Source: own study on: <https://stat.gov.pl>, 20.02.2023.

The idea of Universities of the Third Age enjoys the greatest popularity in the Śląskie and Mazowieckie voivodeships, here over 15,000 participate in various types of hares. students and Wielkopolskie, where over 10,000 students are registered.

Table 4.

Structure of students of Third Age Universities in Polish voivodeships and in Poland in 2020 by age and gender

| Specification | Age | | | Gender | |
|---------------------|-------------|-------------|-------------|-------------|-------------|
| | up to 60 | 61-75 | 76 and more | w | m |
| Dolnośląskie | 0,16 | 0,70 | 0,14 | 0,87 | 0,13 |
| Kujawsko-pomorskie | 0,13 | 0,71 | 0,09 | 0,85 | 0,15 |
| Lubelskie | 0,03 | 0,73 | 0,16 | 0,85 | 0,15 |
| Lubuskie | 0,07 | 0,77 | 0,16 | 0,85 | 0,15 |
| Łódzkie | 0,10 | 0,73 | 0,16 | 0,85 | 0,15 |
| Małopolskie | 0,09 | 0,75 | 0,15 | 0,84 | 0,16 |
| Mazowieckie | 0,07 | 0,68 | 0,21 | 0,87 | 0,13 |
| Opolskie | 0,07 | 0,70 | 0,19 | 0,87 | 0,13 |
| Podkarpackie | 0,16 | 0,71 | 0,13 | 0,83 | 0,17 |
| Podlaskie | 0,05 | 0,80 | 0,15 | 0,85 | 0,15 |
| Pomorskie | 0,07 | 0,72 | 0,20 | 0,82 | 0,18 |
| Śląskie | 0,15 | 0,71 | 0,12 | 0,80 | 0,20 |
| Świętokrzyskie | 0,14 | 0,58 | 0,13 | 0,87 | 0,13 |
| Warmińsko-mazurskie | 0,11 | 0,63 | 0,25 | 0,87 | 0,13 |
| Wielkopolskie | 0,18 | 0,66 | 0,13 | 0,84 | 0,16 |
| Zachodniopomorskie | 0,09 | 0,73 | 0,17 | 0,84 | 0,16 |
| Poland | 0,11 | 0,70 | 0,16 | 0,84 | 0,16 |

w: woman; m: man.

Source: own study on: <https://stat.gov.pl>, 20.02.2023.

In most voivodeships, over 85% of students are women. Most of the students are aged 61 to 75. The percentage of this age group is over 70% of all participants. Persons up to 60 years of age constitute the largest percentage among students in the Wielkopolskie voivodships, ie 18%, Dolnośląskie Podkarpackie 16% and Śląskie 15%.

Table 5.

Structure of students of the Third Age Universities in Polish voivodships and in Poland in 2020 according to education and labour market attitude

| Specification | Education | | | | Labour market status | | | |
|---------------------|-----------|------------------|-----------|----------|----------------------|------------|----------|------------|
| | primary | basic vocational | secondary | tertiary | retirees | pensioners | employed | unemployed |
| Dolnośląskie | 0,04 | 0,12 | 0,51 | 0,33 | 0,94 | 0,04 | 0,02 | 0,00 |
| Kujawsko-pomorskie | 0,06 | 0,16 | 0,55 | 0,23 | 0,85 | 0,11 | 0,03 | 0,02 |
| Lubelskie | 0,03 | 0,04 | 0,51 | 0,42 | 0,95 | 0,05 | 0,00 | 0,00 |
| Lubuskie | 0,02 | 0,10 | 0,51 | 0,37 | 0,80 | 0,19 | 0,01 | 0,00 |
| Łódzkie | 0,03 | 0,07 | 0,50 | 0,41 | 0,88 | 0,07 | 0,04 | 0,01 |
| Małopolskie | 0,03 | 0,09 | 0,47 | 0,41 | 0,86 | 0,06 | 0,06 | 0,01 |
| Mazowieckie | 0,02 | 0,08 | 0,47 | 0,43 | 0,92 | 0,04 | 0,04 | 0,00 |
| Opolskie | 0,02 | 0,08 | 0,65 | 0,25 | 0,90 | 0,08 | 0,02 | 0,00 |
| Podkarpackie | 0,01 | 0,06 | 0,50 | 0,43 | 0,86 | 0,05 | 0,09 | 0,00 |
| Podlaskie | 0,02 | 0,11 | 0,41 | 0,47 | 0,95 | 0,02 | 0,02 | 0,00 |
| Pomorskie | 0,04 | 0,08 | 0,47 | 0,41 | 0,90 | 0,06 | 0,04 | 0,00 |
| Śląskie | 0,02 | 0,09 | 0,54 | 0,35 | 0,87 | 0,08 | 0,05 | 0,01 |
| Świętokrzyskie | 0,02 | 0,06 | 0,57 | 0,35 | 0,95 | 0,04 | 0,01 | 0,00 |
| Warmińsko-mazurskie | 0,02 | 0,09 | 0,51 | 0,38 | 0,81 | 0,17 | 0,02 | 0,00 |
| Wielkopolskie | 0,03 | 0,11 | 0,50 | 0,36 | 0,80 | 0,08 | 0,10 | 0,01 |
| Zachodniopomorskie | 0,03 | 0,09 | 0,53 | 0,35 | 0,91 | 0,05 | 0,03 | 0,00 |
| Poland | 0,03 | 0,09 | 0,50 | 0,38 | 0,88 | 0,07 | 0,04 | 0,01 |

Source: own study on: <https://stat.gov.pl>, 20.02.2023.

Among the listeners, over 88% are retirees and people with secondary education who in their free time broaden their knowledge and acquire new skills. Quite a large group are also people with higher education, especially in the Podlaskie Voivodship, where almost 47% are people who have completed higher education. Over 40% of students with higher education also study in the Mazowieckie, Podkarpackie, Lubelskie, Kujawsko-Pomorskie, Łódzkie, Małopolskie, Łódzkie and Pomorskie voivodeships.

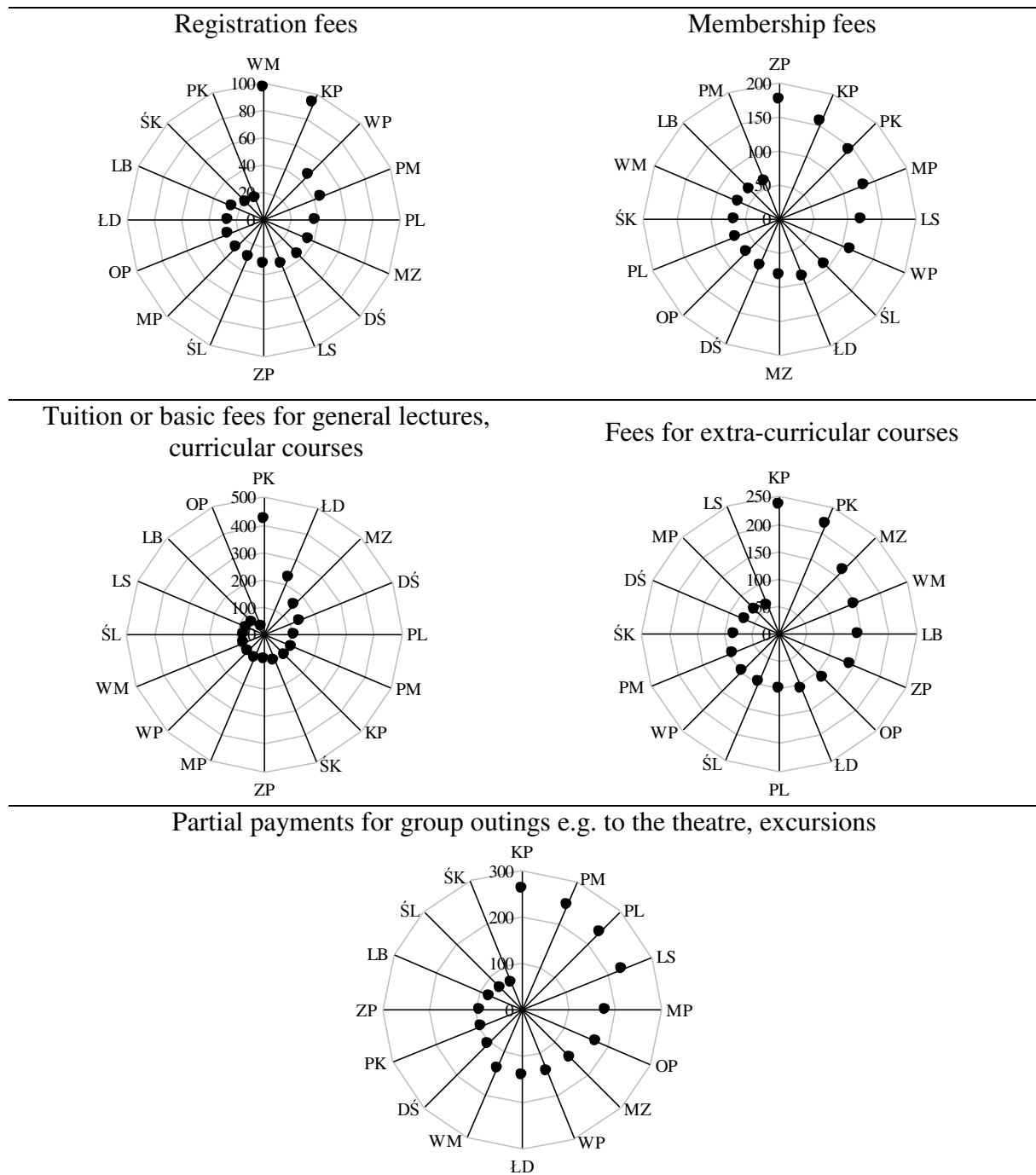
All universities have regular classes. Classes are understood as meetings of groups, sections, workshops, courses, clubs and interest circles - so all types of classes that take place regularly (e.g. weekly) or cyclically (e.g. 10 meetings on a given topic) are intended for relatively small group of participants and require active participation. The largest number of regular classes per number of U3As is organized in the Podkarpackie, Warmińsko-Mazurskie and Wielkopolskie voivodships.

Lectures are a typical university form of knowledge transfer. Lectures are understood here as didactic meetings attended by the majority of U3A students at the same time. During lectures, students usually do not perform practical tasks or exercises. In this sense, lectures can also include some lectures, seminars, seminars, etc. Almost all U3As offer lectures understood in this way, but by far the largest number of hours of lectures is offered in the Pomeranian Voivodeship, whose offer is more than twice as high as that of the Małopolskie Voivodeship, which is ranked second.

Almost all U3As, apart from lectures and regular classes, organize various types of activities parties, cultural events and social gatherings. The purpose of such meetings is most often to give seniors the opportunity to participate in social and cultural life. Most events of this type are offered in the Mazowieckie Voivodeship. This value is significantly higher than the second in the order of the Dolnośląskie voivodeship.

A particularly important issue, especially for retirees and pensioners, are matters related to the need to pay fees. The highest entry fees are charged in the Warmińsko-Mazurskie and Kujawsko-Pomorskie voivodeships, the fee is about PLN 100, while the lowest in the eastern provinces of Lubelskie, Podkarpackie and Świętokrzyskie, where fees for classes range from PLN 20. In the case of associations, members are required to pay a membership fee. The highest rates apply in the Zachodniopomorskie, Kujawsko-Pomorskie and Podkarpackie provinces, where they exceed PLN 150. The highest fees for program classes are charged in the Podkarpackie Voivodeship, where they exceed PLN 400. Much lower fees are charged in the Łódzkie Mazowieckie and Dolnośląskie voivodeships. Universities often offer courses in small groups, in addition to program classes organized for the whole year. These are mainly computer and language courses as well as sports activities. The cost of such classes is the highest in the Kujawsko-Pomorskie and Podkarpackie Voivodeships, where it may exceed PLN 200. The lowest costs for additional activities are in the Lubuskie, Małopolskie and Dolnośląskie voivodeships.

Joint trips to the theater or sightseeing tours are very popular among listeners. Gathering a certain number of people, depending on the attraction, gives you the opportunity to negotiate a lower price, which is very beneficial for U3A students.



DŚ: dolnośląskie; KP: kujawsko-pomorskie; LB: lubelskie; LS: lubuskie; ŁD: łódzkie; MP: małopolskie; MZ: mazowieckie; OP: opolskie; PK: podkarpackie; PL: podlaskie; PM: pomorskie; ŚL: śląskie; ŚK: świętokrzyskie; WM: warmińsko-mazurskie; WP: wielkopolskie; ZP: zachodnio-pomorskie.

Figure 6. Average amount of fees charged by Third Age Universities in Polish voivodeships in 2021 by destination [per student in PLN].

4. Conclusions

The topic of activation of seniors plays an important role in many countries and has both social and economic consequences. Activation of seniors is easier thanks to financial support obtained from various social programs, both national and offered by e.g. the European Union.

A special type of activities that favor the activation of the elderly are the Universities of the Third Age, which have been created in the world since 1973 in order to improve the quality of life of the elderly.

The idea of Universities of the Third Age is most popular in the Śląskie and Mazowieckie voivodeships, where over 15,000 students participate in various types of hares, and the Wielkopolskie voivodeship, where over 10,000 students are registered.

All universities conduct regular classes such as lectures, workshops, courses, the main purpose of which is to activate older people and develop their interests. The largest number of regular classes per number of U3As is organized in the Podkarpackie, Warmińsko-Mazurskie and Wielkopolskie voivodeships.

Almost all U3As, apart from lectures and regular classes, organize various types of activities parties, cultural events and social gatherings. The purpose of such meetings is most often to give seniors the opportunity to participate in social and cultural life. Most events of this type are offered in the Mazowieckie voivodeship.

The need to pay the registration fee should be assessed unfavourably, which prevents many seniors from participating in the classes. The highest fees are charged in the Warmińsko-Mazurskie and Kujawsko-Pomorskie voivodeships and certainly constitute a significant expense for many people. The willingness to participate in various types of language or computer courses or sports activities is also associated with incurring additional costs, which is an additional burden on the seniors' budget. The activities undertaken by the U3A are undoubtedly a good example of social innovation, the task of which is to activate the elderly, but in the future they should be co-financed to a large extent so that the price does not limit access to the U3A's offer.

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ARTIFICIAL INTELLIGENCE (AI) IN CRM – POSSIBILITY OF EFFECTIVE INTEGRATION, OPPORTUNITIES AND THREATS

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Purpose: The purpose of this article is to discuss the aptitude and readiness of companies to carry out effective integration of Customer Relationship Management (CRM) systems with Artificial Intelligence.

Design/methodology/approach: The article attempts to answer the following research questions: RQ1: Are companies ready to use AI in their CRM systems? RQ2: What are the most common AI tools used in CRM systems? RQ3: What are the most common opportunities and threats of using AI in CRM systems? In view of the above, an analysis of national and international literature sources and an analysis of recent research from the IT industry on trends in the use of AI, particularly in customer service, as well as an original pilot study using an online questionnaire were adopted as the research method. The pilot research was conducted among 104 companies via the Internet.

Findings: The evaluation of the data collected showed that companies are aware of the calls made on them by the evolution of modern technologies using artificial intelligence and how important it is, in view of the above, to integrate the CRM system with AI and, where possible, to use its facilities to improve customer service and business in general.

Research limitations/implications: The conducted study was of a pilot nature, in the future it is planned to conduct a wider research in order to verify a greater number of variables affecting the integration of AI with CRM. Artificial Intelligence is a constantly evolving topic, limiting the verification of only a few variables affecting the integration of AI with CRM may quickly become obsolete.

Practical implications: The integration of AI capabilities with CRM is recognised as one of the key factors for improving the speed and efficiency of customer service. The pilot survey indicated what the general sentiment and readiness of companies to use the potential of AI is, how the application of AI can help organisations gain the adaptive organisational capabilities needed to increase overall business efficiency and CRM effectiveness, paying attention to the key goals and opportunities, paying attention to the key goals and opportunities that have been described in detail, as well as the risks associated with the integration of artificial intelligence with CRM.

Social implications: In view of the widespread fear of replacing some work positions with Artificial Intelligence, the conducted research indicates that some of them may be a bit exaggerated and some justified, especially when it comes to repetitive analytical tasks in the CRM system.

Originality/value: The article deals with the current topic of using Artificial Intelligence solutions in business.

Keywords: CRM, Artificial Intelligence, enterprises, customer, management

1. Introduction

Artificial Intelligence (AI) was first defined in 1956 as the science and engineering of creating intelligent machines. Over the subsequent decades of the 20th century, AI has gradually evolved into intelligent machines and algorithms that can reason, learn from each other and mimic human intelligence (McCarthy, 2007). The Journal of the UK Institute of Business Ethics defines AI as, “A term generally used to describe the simulation of elements of human intelligence processes by machines and computer systems. AI is characterised by three main features: (1) Learning - the ability to acquire relevant information and rules to use it; (2) Reasoning the ability to apply acquired rules and use them to reach approximate or finite conclusions (3) Iteration - the ability to change a process based on new information acquired” (Business Ethics and Artificial Intelligence, 2018). Since the topic of AI has become so popular and important, it is no wonder why policymakers around the world are considering regulating the most important use of AI (Schuett, 2019). Also, the European Commission (COM, 2018, COM, 2018 final, COM 2019) and the European Parliament (Resolution on Civil Law Rules on Robotics, 2017; Resolution on Autonomous Weapon Systems, 2018; Report on a comprehensive European industrial policy on artificial intelligence and robotics, 2019) explain what AI is, describing it as the ability of machines to exhibit human skills such as reasoning, learning, planning and creativity. AI enables technical systems to perceive their environment, deal with what they perceive and solve problems, working towards a specific goal. The computer receives the data (already prepared or collected with its sensors, such as a camera), processes it and reacts (Enhölm et al., 2022). AI systems can adapt their behaviour to some extent by analysing the consequences of previous actions and acting autonomously (<https://www.europarl.europa.eu/...>, 2020). Researchers have broadened the definition of AI (which can perform cognitive tasks, particularly learning and problem-solving) to include exciting technological innovations such as machine learning and neural networks (Wang, 2019; Zawacki-Richter et al., 2019). Nowadays, the use of AI has become widespread in various industries, mainly for commercial purposes. AI is applied in business, science, art and education to improve the user’s experience or enhance productivity. AI applications also exist in numerous areas of our daily lives (e.g. smart home devices, smartphones, Google, Siri) (Ng et al., 2021). There are also non-commercial projects using AI technologies for socially beneficial outcomes, the number of which has increased significantly worldwide in recent years (this is so-called AI for social good or AI4SG) (Cowls et al., 2021). As can be seen from the

above, AI is used on many different levels. Many companies and consumers/customers have already become accustomed to the ever-increasing challenges posed by AI. However, there are still individuals or companies that are quite sceptical about technological inventions and innovations. Nevertheless, judging by the opportunities AI offers companies, speeding up and streamlining their operations in various areas, eventually even the sceptics will have to be convinced by the new AI-driven reality. Given this and to fill the research gap, the article will attempt to discuss the issue of integrating AI with one of the most important areas of any company, namely customer service, and more specifically with, the CRM system. The current AI tool used in CRM and the opportunities and potentials associated with this will be identified. Therefore, the research questions posed are as follows: RQ1: Are companies ready to use AI in their CRM systems?; RQ2: What are the most common AI tools used in CRM systems?; RQ3: What are the most common opportunities and risks of using AI in CRM systems?

2. An overview of the literature

2.1. Artificial intelligence in business

The results of the latest McKinsey Global AI Survey indicate that AI adoption continues to grow and the benefits are significant. As the use of AI in business becomes more widespread, the tools and best practices to make the most of AI have also become more sophisticated (The state of AI in 2021). This means that AI in business is no longer treated in terms of unrealistic possibilities, it has become commonplace for companies and a consequence of adapting to a changing environment using technological innovations and virtual solutions (Perifanis, Kitsios, 2023). In addition to market giants such as Apple, Oracle and Microsoft, more and more companies are seeing this technology as an opportunity for their business, both in manufacturing and services. The latest results of a survey commissioned by IBM show that the percentage of businesses that have adopted AI now stands at 35%, an increase of 4% from the previous 2021 survey. Surprisingly, it is not companies from America or Europe that see the greatest potential in AI, but, as the latest IBM study shows - China and India have the highest levels of AI saturation, at 58% and 57%, respectively, while statistics from, for example, the United States show an AI saturation of 25%, and the UK 26% (<https://www.erp-view.pl/...>, 2022). However, according to various sources (<https://www.money.pl/...>, 2023; <https://forsal.pl/lifestyle/...>, 2023), this is about to change, as Microsoft has earmarked as much as \$10 billion to invest in the artificial intelligence platform (i.e. chatbot - ChatGPT) developed by OpenAI, apparently seeing the potential of this technology and therefore wanting to base its future business on it. Google has relatively recently unveiled its response to the advent of ChatGPT, namely Bard, whose features are just as impressive as ChatGPT's, so the revalue for the user will be fierce.

Of course, one of the most frequently cited barriers to using AI in business is the high cost of this investment. Meanwhile, also from a global survey conducted by IBM, it is concluded that by no means are financial issues of companies behind the limited implementation of artificial intelligence, but, as respondents in the global survey indicated, limited AI skills, knowledge or experience was listed first (34% of indications), while only for 29% is the price too high and for 25% the lack of tools or platforms for model development is a barrier. A similar proportion (24%) also indicate that the problem is that it is too complex or difficult to integrate or scale (24%) and that the high complexity of the data is an obstacle (24%) (<https://www.erp-view.pl/...>, 2022). A study conducted by PwC in 2023 shows precisely the issue of spending on AI. The results of this study show that global spending on AI will reach \$500 billion in 2023, while by 2030, it is estimated that the potential contribution of AI to the global economy will be \$15.7 trillion (<https://www.erp-view.pl/rynek-it...>, 2022). According to the researchers, AI will operate in critical areas and solve key problems for businesses, this is the opinion of the vast majority - as many as 95% - of the managers surveyed who took part in the AI Engineering Survey. Interestingly, the same people declare that it is a challenge for them to scale AI-based applications, with 76% of respondents saying they have problems with this (The state of AI in 2021, <https://www.mckinsey.com/...>, 2021), a far higher indication than the IBM survey cited earlier demonstrates. By contrast, according to Eurostat (Use of artificial intelligence in enterprises, 2021), in 2021, only 8% of companies in the EU with at least 10 employees will be using AI-supported technologies, including chatbots. Moreover, according to Eurostat research, the large enterprises used AI more than small and medium enterprises. In 2021, 6 % of small enterprises, 13 % of medium enterprises and 28 % of large enterprises used AI. This difference might be explained, for example, by the complexity of implementing AI technologies in an enterprise, economies of scale (i.e. enterprises with larger economies of scale can benefit more from AI) or costs (i.e. investment in AI may be more affordable for large enterprises).

Business activities undertaken with the use of AI are forced by the increasing competition of global giants. Technological changes create both new labor markets and create structured databases, which allows us to redefine the needs or expectations of consumers, even those that have not yet been discovered. It is noteworthy that when preparing forecasts for technology, we do not pay attention to the social and legal, and often also market, consequences of its implementation, which will be discussed later in this paper. It is difficult to predict the direction of technological development. It is certain that marketing technologies supported by tools based on machine learning will not only change economic activity, but will also affect social, political and economic reality. Business sees its future in technologies such as IoT, machine-to-machine communication, augmented reality (AR), 5G technology and advanced predictive technology, all of which are underpinned by artificial intelligence (Kitsios, Kamariotou, 2021; Loureiro et al., 2021). Companies have found a powerful ally in AI that improves the efficiency of their core business and supports operational business processes. In this way, artificial intelligence serves as a tool to support e-commerce (Karimova, 2016); financial operations and information

analysis processes for commercial operations (Cavalcante et al., 2016; Ince, Aktan, 2009; Maknickiene, Maknickas, 2013); fraud detection processes in financial operations (West, Bhattacharya, 2016); or textual analysis of financial information (Shravan Kumar, Ravi, 2016; Xing et al., 2018). In addition, AI plays an important role in marketing-related processes (Chopra, 2019; Lee et al., 2020; Li et al., 2017; Wirth, 2018); customer management (Ledro et al., 2022); product launch, after-sales service and inventory management (Sheta et al., 2015) and in the implementation of Industry 4.0 processes (Ramakrishna et al., 2020).

3. Research

3.1. Research methods

The research was conducted among 104 companies from September 2022 to March 2023 using the CAWI method and it was a pilot study. The respondents were requested to complete the online survey questionnaire. The purpose of this studies is to discuss the aptitude and readiness of companies to carry out effective integration of Customer Relationship Management (CRM) systems with artificial intelligence. The article attempts to answer the following research questions: RQ1: Are companies ready to use AI in their CRM systems? RQ2: What are the most common AI tools used in CRM systems? RQ3: To analyze the above issues, both secondary studies presented in the national and abroad literature sources and reports and the author's pilot study using an online questionnaire are used. What are the most common opportunities and threats of using AI in CRM systems? The characteristics of the respondents are presented in Table 1.

Table 1.

Research sample characteristics

| Enterprise size | | | | | |
|---|-----------------------|--------------------|-----------------------|-------------------------|------------|
| | Micro | Small | Medium | Large | One-person |
| Sample size | 13 (13%) | 43 (41%) | 37 (36%) | 9 (9%) | 2 (2%) |
| Type of business conducted | | | | | |
| | Industrial activities | Service activities | Commercial activities | Construction activities | Other |
| Sample size | 16 (15%) | 58 (56%) | 21 (20%) | 6 (6%) | 3 (3%) |
| Operation period of the current business | | | | | |
| | Less than a year | 1-5 years | 6-10 years | Over 10 years | |
| Sample size | 3 (3%) | 6 (6%) | 39 (38%) | 56 (54%) | |
| Enterprise coverage | | | | | |
| | Local | Regional | National | International | |
| Sample size | 10 (10%) | 12 (12%) | 59 (57%) | 23 (22%) | |

Source: author own work.

Most of the surveyed companies are small (41%) and medium-sized (36%), they mostly provide service activities (56%), for the 54% companies operation period of the current business is over 10 years, and the market coverage for 57% companies is national (Table 1). Selected questions were used in the paper to give the answers for three main RQ.

3.2. Results of the research - Artificial intelligence in CRM systems

RQ1: Are companies ready to use AI in their CRM systems?

Particularly in customer relationship management (CRM) AI has found space to utilise its potential, e.g. giants such as Salesforce, Oracle and Microsoft are equipping their CRM solutions with AI-based modules. Integration of AI with CRM started around 2017. As recently as 2015, the global CRM market was forecast to be worth \$37bn in two years. Those predictions were confirmed, and the total market is now expected to be worth more than \$82 billion by the end of 2025. Such dynamic growth will be due, among other things, to modern technologies that will completely remodel the way in which customer relationships are managed. According to own research conducted on 104 companies (of various sizes), there is a lot of interest in using AI solutions in the CRM system (Table 2).

Table 2.

Are companies ready to use AI in their CRM systems?

| Enterprise size | General implementation of AI in CRM system | | |
|-----------------|--|----------|-------|
| | Yes (%) | No (%) | Total |
| Micro | 3 (23%) | 10 (77%) | 13 |
| Small | 16 (37%) | 27 (63%) | 43 |
| Medium | 28 (76%) | 9 (24%) | 37 |
| Large | 6 (67%) | 3 (33%) | 9 |
| One-person | - | 2 (100%) | 2 |
| Total | 53 | 51 | 104 |

Source: author own work.

More than half of the surveyed enterprises (51%) use AI solutions in their CRM systems. As could be predicted, it is especially the group of medium and large companies that uses the solutions offered by AI in CRM systems. Other results are not as impressive as it was indicated earlier in the article, probably this situation depends mainly on the lack of knowledge and skills on the possibility of using AI in customer service. However, this is a development area and sooner or later smaller companies will find a way to use this modern technology.

According to IDC analysis (Ismail, 2017), between 2017 and 2021, AI-supported CRM systems will contribute \$1.1 trillion to the value of the business of companies using CRM. Therefore, organisations should develop and replenish their resources so that they can use the funds raised to invest in AI. If implemented properly, then AI can drive creativity in organisations and, when integrated with CRM (Bag et al., 2021; Balakrishnan, Dwivedi, 2021), also support rapid, intuitive decisions based on real-time data and data-driven predictions (Dwivedi, Wang, 2022; Grover et al., 2020). The implementation of AI into CRM is seen as having a positive impact on organisational performance when complemented by the

organisation's improved ability to accept the technology and the strength of employees' cognitive acceptance of the new system, thanks to the expertise acquired (Massi et al., 2020). The scale of application of AI in CRM is very broad; assuming that this is not yet the end of its possibilities, it is highly likely that in the future human labour, in the area of customer service, will be partially or completely replaced by AI (Rzepecka, 2019).

Meanwhile, still human and artificial intelligence work together on a complementary basis (Kurzweil, 2000; Frey & Osborne, 2013). Thus, in the case of CRM - AI is used to analyse data of a different nature about customers in order to assess their buying habits, likes and dislikes, etc., which generated knowledge is still used by humans to make strategic marketing, sales decisions, etc. A CRM system integrated with AI is essential to increase customer loyalty, increase revenue and increase an organisation's competitive advantage (Chatterjee et al., 2019). That is, the main applications of AI in CRM systems include predicting customer behaviour, suggesting the next best action or product recommendations for a given customer segment. In the next few years, it is very likely that AI will be used in marketing and sales in such a way that marketers will plan the goals and results of campaigns in CRM systems, and the AI itself will select customer segments and choose activities to carry out the campaign from the catalogue of activities of a given company (based on historical data) to achieve the set results (<https://mitsmr.pl/b/co-dalej-z-crm...>, 2019). Using AI in CRM systems processes can bring many benefits to an organisation, such as improved process efficiency, better customer service and increased sales. In 2017, it was predicted that in the context of CRM, AI would have a major impact on (Gantz et al., 2017): (1) accelerating sales cycles, (2) improving lead generation and qualification levels, (3) increasing revenue resulting from optimised marketing activities, (4) optimising service/product pricing, (5) accelerating resolution of issues reported by customers, (6) supporting the construction of branding campaigns, (7) call centre savings while increasing resolution rates, (8) savings in employee recruitment, (9) optimising logistics processes, (10) fraud prevention and detection.

Thus, AI-based CRM systems provide centralised processes that help effectively manage relationships with thousands of customers. Integrating AI with CRM to analyse available data from internal and external sources effectively improves organisational performance. Also, with AI solutions such as (1) machine learning, (2) predictive analytics, (3) automation, or (4) sentiment analysis, for example - the CRM system increases its potential by: (1) intensive monitoring of patterns and trends over time, instead of rigid and coded instructions, (2) faster data-driven decision-making, sales forecasting and efficient allocation of resources at all levels, (3) automation of even complex work, (4) the ability to capture, analyse and visualise how customers perceive products and services (Josiassen et al., 2014; Kochański, 2016).

RQ2: What are the most common AI tools used in CRM systems?

There are countless opportunities to effectively improve and strengthen the CRM system integrated with AI (Saxena, 2017; Nguyen, Waring, 2013; Verma, Verma, 2013). Most commonly, AI is used in CRM for the following **purposes**: (1) communication (Rogowska,

2010; Neves, Barros, 2003; Deryugina, 2010), (2) automatic capture of customer data from various sources (Jarek et al., 2018; Kozłowska, Rodzik, 2018; Shang et al., 2017), (3) expanding the customer database (Kietzmann et al., 2018), (4) customer sentiment surveys (Warszycki, 2019). Own research has shown which of the AI technologies is most often used in the surveyed enterprises, adequate to the size of the company (Table 3).

Table 3.

AI tools used in CRM systems

| Enterprise size | AI in CRM system | | | | | |
|-----------------|--|------------------------------------|-----------|---|--|--|
| | General implementation of AI in CRM system | Communication (virtual assistant): | | Automated data capture from a variety of sources (Activity Capture) | Extending the customer database (e.g. Predictive Lead Scoring) | Exploring customer sentiment (e.g. Opportunity Insights) |
| | Yes (%) | Chatbot | Voicebot | | | |
| Micro | 3 (23%) | 1 | - | 1 | 1 | 2 |
| Small | 16 (37%) | 5 | 4 | 16 | 8 | 15 |
| Medium | 28 (76%) | 21 | 17 | 26 | 22 | 25 |
| Large | 6 (67%) | 6 | 6 | 6 | 6 | 5 |
| Total | 53 (51%) | 33 | 27 | 49 | 37 | 47 |

Source: author own work.

The results of the research do not differ significantly from the averages presented in various sources. Medium and larger enterprises use most of the AI tools included in the study in their CRM systems, such as chatbots, voicebots, Activity Capture, or Predictive Lead Scoring and Opportunity Insights.

By analysing the subsequent above purposes, it is possible to match them with the specific solutions offered by AI a supporting CRM. Adequate to the purpose (1), communication between company and customer is increasingly provided by the *virtual assistant*, which customers have grown accustomed to and has become a cost-effective solution for companies. This remote helper can automate the receipt and management of multiple messages and recovery actions. Virtual assistants take the use of data to the next level by such things as “learning” it according to specific patterns. The virtual assistant will take care of managing notifications about when to catch up with customers and what the best form of communication should be for the person (chatbot, voicebot).

For example, a voicebot intelligent assistant calls a customer who has abandoned a shopping cart, collects feedback and offers a discount or alternative based on the previous choice. And most importantly, it personalises and automates communication. As a result, the intelligent voice assistant is able to convert abandoned shopping carts at a much higher level of efficiency than other tools. Solutions such as Siri and Amazon Alexa have accustomed consumers to using conversational but intelligent voice assistants. Therefore, companies, seeing the benefits of using such solutions for both sides of the purchasing process, are increasingly using AI-powered voicebots for purchasing conversations, i.e. conversational commerce (Schmidt et al., 2018; Bolton et al., 2021; Tulshan, Dhage, 2019). But in fact, the reach and capabilities of the virtual

assistant are extensive, e.g. Siri, Google Assistant, Microsoft Cortana and Amazon Alexa, are generally available on state-of-the-art mobile phones or in homes (e.g. Amazon Echo and Google Home) and cars (e.g. the Google Assistant connection with Hyundai). Virtual assistants can communicate with the various IoT devices on which the supported operating system runs. And yes, Siri only works with Apple devices - iPhone, iPad, iPod Touch, Home Pod, Mac, Apple Watch and Apple TV. Microsoft Cortana works with Windows 10, Android, Xbox One, Skype, iOS, Cyanogen and Windows Mixed Reality devices. Alexa works with Amazon's Resound, Fire and Dash families of things, as well as various interesting Android and iOS devices (Tulshan, Dhage, 2019).

Regarding the purpose (2), that is, *automated data capture*, it is artificial intelligence integrated into CRM that provides the ability to now collect customer information from a variety of sources, such as, but not limited to, WhatsApp, social networks (e.g. Twitter) or IoT devices with as little or no human intervention as possible. This saves time for customer service staff by discarding the copying of physical information entered into the system. They can use this opportunity if only to strengthen their contacts with customers.

In addition, the Activity Capture function also works well here - it analyses all e-mails and calendar events, automatically assigning them to the relevant records (such as customers, sales opportunities, etc.). It eliminates the need for traders to waste time on manual data cross-referencing, which is subject to considerable risk of error and, moreover, intrusive in everyday work. Furthermore, by anticipating customer behaviour, organisations can take customised action to subtly personalise communications and create genuine enthusiasm for each potential customer. In this way, they can reinforce a positive corporate image and stimulate an increase in the number of potential customers (Ngai et al., 2008; Smith, Rupp, 2002; Kansbod, 2022; Monod et al., 2022). For example, Microsoft is launching a new sales-oriented component of its Viva platform. Viva Sales is a CRM companion application that is expected to integrate with Teams, Outlook and Office, including Word, Excel and PowerPoint. It also works with Microsoft Dynamics 365 Sales CRM and third-party CRM systems. Viva Sales is based on automatically capturing customer data and integrating it with calls and chats in Teams and e-mails in Outlook. According to the developers, the component turns the Microsoft 365 platform into an intelligent sales assistant. Viva Sales uses a set of predictive AI technologies, "Context IQ" to generate contextual reminders and recommendations (Sulikowski, 2022).

As for the purpose (3) - i.e. *extending the customer database* - SI also found its application. Depending on the type of customer, their willingness to share information with the company varies; some do it willingly, others rather infrequently and they only care about completing the transaction and not about completing the data in their purchasing profile. Here, the AI acts as a dedicated expert who not only analyses and collects data from the available pool but additionally encourages customers to provide new data. They will make the customer profile in the CRM system more complete, which will translate into the more effective building of relationships and contacts between the company and the consumer. Furthermore,

AI interference in, for example, customer loyalty programmes, allows the AI, after a customer has made a purchase, to associate which products have been purchased and assign them to a personalised user profile. With access to such information, we can have a real impact on subsequent consumer choices. The Predictive Lead Scoring tool used here automatically analyses everything about individual customers (i.e. their metadata, related events, sales topics) and assigns them an appropriate score - i.e. a value that determines the customer's sales potential, as well as its value to the company. Predictive scoring segregates the customers collected in the CRM system, informing which ones are worth focusing on.

Analysing the role of AI towards the (4) purpose i.e. *exploring customer sentiment*, it can be noticed that AI can also be used to explore customer sentiment and then to establish techniques that increase customer engagement. Intelligent machine algorithms can select audiences according to purchase history, gender, online behaviour, location and other such characteristics or behaviours. Using the results gathered previously, the CRM software will be more accurate, creating tailored messages that will have an impact on the customer to a greater or lesser extent. It is also worth mentioning the call centre, which is still being used to build a relationship with the customer and check their mood, here too AI has its uses. As the capabilities of call centre supervisors are quite limited, it is assumed that they can only analyse about 1-5% of the calls made, which does not allow for the identification of the entirety of problems, with AI it is possible to verify 100% of customer calls and better assess the level of customer satisfaction with the service (<https://www.forbes.pl/...>, 2022). Again, another tool, Opportunity Insights, analyses current communications exchanged with contractors (e.g. e-mails from potential customers) based on historical data collected in the CRM system, informing users of the increase or decrease in sales opportunities and suggesting what steps they should take to close the topic successfully.

In addition, AI uses information to understand projects, guide ideal approaches, predict outcomes and computerise customer engagement processes. The use of AI in CRM systems will make organisations smarter and enable them to conduct marketing and sales activities with any customer, regardless of the scale of the business. The data collected in a CRM system is worthless if it is not used. However, a lack of time and adequate human resources can result in customer information not being used. In order to use the data effectively, it is necessary that the information is properly sorted and organised. Only then will a better understanding of the customer by the company be possible. The use of AI in CRM systems will make the communication carried out by organisations much more effective and efficient in terms of resources used (<https://initius.pl/news/...>, 2019).

RQ3: What are the most common opportunities and risks of using AI in CRM systems?

For a better understanding of the use of artificial intelligence in CRM systems, the surveyed enterprises were asked about the opportunities and threats they face in connection with the implementation of modern solutions to the customer service system (Table 4). In this question

were used three most frequently discussed and analyzed opportunities and threats in literature and Internet sources. They were discussed in detail in the Table 4.

Referring to the obtained research results and analysis of literature sources, it is obvious that AI creates a number of opportunities and possibilities for customer service. It is also worth noting that, in most organisations, CRM systems need to meet the challenges of the future in order to fully exploit the potential offered by the volumes of data available worldwide, cloud computing and data from the so-called Consumer IoT (Stein et al., 2013).

Table 4.
Opportunities and threats of AI in CRM systems

| Answers | Main opportunities and threats of AI in CRM systems | | | | | |
|--------------|--|--|---|---|--|--|
| | opportunities | | | threats | | |
| | Better understanding of customer needs and its retention | Improving and speeding up customer service | Trend to use a combination of cloud and on-premise platforms for AI | Lack of support for large volumes and speed of loading and unloading data | An access to machine intelligence and ability to build neural networks | AI abuse (e.g. deepfakes, security of use) and lack of legal regulations |
| Yes | 49 (92%) | 44 (83%) | 36 (68%) | 35 (66%) | 20 (38%) | 41 (77%) |
| No | 0 | 2 (4%) | 6 (11%) | 10 (19%) | 19 (36%) | 5 (9%) |
| I don't know | 4 (8%) | 7 (13%) | 11 (21%) | 7 (13%) | 14 (26%) | 7 (13%) |

Source: author own work.

According to experts, the reality is that CRM development will be driven more towards Data Management Platforms (DMPs) in the near future than the development of existing systems, as no CRM system in its current form can handle the volume and velocity of data loading and unloading that will be needed for effective marketing (Libai et al., 2020). From the form in which the data is stored to the lack of an application programming interface (API) to add data from third-party sources (data fabrics) in real-time, this obviously means that current systems cannot cope with analysing this data to segment customers correctly. Equally important when it comes to adapting a CRM system to new conditions, is to pay attention to the popularity of the cloud and the petabytes of data collected by internet users, so there is access to machine intelligence and the possibility of building neural networks as a service (AI-a-a-a-S) in CRM systems, which make the use of AI in sales start to make sense. Therefore, implementing a CRM system integrated with AI is essential for all organisations working in B2B settings to analyse vast amounts of data and obtain useful business information for decision-making (Chatterjee et al. 2019). Nonetheless, it is comforting and forward-looking to note that, according to a study by Saleforce.com, most companies (whether high performers or not) tend to use a mix of cloud and on-premise platforms for AI, similar to general IT workloads. However, high-performance companies use cloud infrastructure much more often than their competitors: 64% of their AI workloads take place in the public or hybrid cloud, compared to 44% at other companies. This group of companies also access a wider range of AI capabilities and techniques in the public cloud, for example, as they claim to use the cloud twice as much

as the rest for natural language speech understanding and facial recognition (The state of AI in 2021).

It is also worth considering another issue related to some AI solutions like ML (Machine Learning), in order not to be suspected by e.g. a customer of AI abuse. One of the more popular abuses of AI are so-called deepfakes, which involve using AI to create or manipulate audio and visual content to make it authentic. The deepfake method is ideal for use in disinformation campaigns, as it is difficult to distinguish at first glance from real content. Also of interest, although also partly controversial for reasons of security of use (there have been cases of ChatGPT generating malware e-mail), is the previously mentioned ChatGPT in customer service (Yu et al., 2021). However, it has many advantages, improving and speeding up customer service, an AI-based chatbot can interact with customers in a natural and conversational way. It enables companies to provide 24/7 customer service, responding quickly to customer queries and providing accurate and timely answers. The chatbot is designed to learn from customer interactions, so that over time it is able to provide more accurate and personalised responses. ChatGPT is also able to understand customers' moods and intentions, so it can provide more effective responses to customer queries. Importantly, ChatGPT allows companies to easily integrate with CRM systems and payment processing platforms. This allows companies to automate and streamline their customer service processes, making it easier to respond quickly and accurately to customer enquiries. It also offers a number of other features, such as a customisable chatbot interface, integration with third-party services and customer service call tracking (Shafeeg et al., 2023). The most frequently cited reasons for using ChatGPT in CRM are (Rizvi, 2017; Latinovic, Chatterjee, 2022; Wamba-Taguimdje et al., 2020): (1) automated on-demand support (24/7 customer service), (2) cost-effective solution (even for small businesses, fast customer service without the need for additional staff), (3) easy to use (easy to set up and use, user-friendly interface that makes it easy for customers to access support), (4) scalable solution (allowing companies to adapt customer service operations to meet changing needs), (5) configurable solution (allows companies to tailor customer service agents and processes to their specific needs to be efficient and effective).

Any ethical issues related to the use of AI in business are also quite an important issue, which also applies to customer service itself (Dignum, 2018). It is not without reason that the European Commission published on 8 April 2019 a document called Ethics Guidelines for Trustworthy AI¹⁸ developed by the European Commission's Independent High-Level Expert Group on Artificial Intelligence (AI-HLEG). The guidelines developed aim to promote Trustworthy AI defined by three components fulfilled throughout the entire AI system lifecycle. These components are (1) compliance with the law and all applicable rules and regulations; (2) ethicality, i.e. adherence to ethical principles and values; (3) robustness, both technically and socially, given that even with good intentions, AI systems can cause unintended harm. Efforts should be made for these three components to occur simultaneously, and when this does not occur, efforts should be made to harmonise them. In view of the above, the argumentation

of the OECD experts from the “Science, Technology and Industry” research group that it is necessary to regularly produce measurement and empirical data on the development of the AI is undoubtedly correct, as it is currently of vital importance for economic and political decisions (Baruffaldi et al., 2020).

One of the biggest concerns about customer service automation relates to job losses. Automation, computerisation and artificial intelligence are strongly influencing the labour market, thereby shaping new qualifications and skills. Unofficially, it is said that soon approx. 30% of current consultants will no longer perform their current duties and, according to the World Economic Forum, up to 85 million jobs worldwide will be replaced by machines by 2025, but 97 million new jobs will be created (Battina, 2018; Goyal, Aneja, 2020; Shaw et al., 2019). However, this does not mean, for example, that consultants are saying goodbye to their jobs in the industry for good. Based on past experience, it can be concluded that humans and their creativity, associated with out-of-the-box thinking, will not be able to be replaced by machines or even advanced programmes. Already, the demand for data analysts and people who can pick out trends from data is very high. Furthermore, both humans and AI have relative strengths, with humans leading the way in intuition, empathy, broad judgement and complex reasoning. Therefore, in order for companies to reap the benefits of artificial intelligence, the focus should be on promoting full or partial delegation of decisions that enhance managers’ capabilities.

4. Discussion and conclusions

The importance of artificial intelligence is becoming apparent as the contours of digital transformation become clearer. Companies have realised the value of the data at their disposal. Now they need the tools to make better use of them. And the shift towards self-service and the associated reduction in costs, especially for repetitive processes, as well as the attention to the so-called customer experience, is decisive for the competitiveness of companies, which makes them constantly reach for AI-based solutions. Simple activities can be expected to be replaced by technology and become automated. There is no doubt that AI has incredible potential for business in various areas of its operations. Still, where some see opportunities, others see a threat, and so scientists are trying to avoid at all costs a future in which we will not be able to recognise texts created by artificial intelligence from those that are human-made. However, the results of their study suggest that this not-so-optimistic future has already arrived, and the distinction mentioned may not be possible (Enholm et al., 2022; Dwivedi et al., 2021).

Despite the many challenges - business is already appreciating the potential of intelligent algorithms, seeing that their application allows them to build a competitive advantage. For companies to adapt to digital transformation, including the integration of AI into the

customer service process, a precise rethink is required in the first place, e.g. which AI solutions/tools are necessary in the existing CRM modules. This is important in terms of planning the costs of implementation and follow-up, thereby training employees. The fact that the intended changes in the company are being properly promoted cannot be overlooked here, and this is followed by an appropriate attitude and conviction on the part of employees to these forward-looking solutions.

In practice, the more management is convinced of the usefulness of the new CRM system integrated with AI, the better the attitude of employees will be to use it and take it for granted to achieve success in the area of customer service. Therefore, the top management of the organization should make interested employees aware of the usefulness and effectiveness of this new system, it can, for example, publish success stories of the new system and its solutions that are already successfully used in other organizations. The management of organizations implementing a CRM system integrated with AI should make holistic attempts to shape the attitude of employees towards the intentions of adopting the new system.

Conducting a systematic review of national and international literature, as well as own pilot studies, indicated that companies are aware that digitalisation has become a necessity and that AI will replace human labour in many areas. Of course, a more advanced level of implementation of AI solutions is shown by the larger surveyed enterprises. But it still leaves much to be desired. In view of this, the integration of AI capabilities with CRM is recognised as one of the key factors for improving the speed and efficiency of customer service. The survey provided answers to the research questions posed (RQ1, RQ2, RQ3), thereby indicating what the general sentiment and readiness of companies to use the potential of AI is, how the application of AI can help organisations gain the adaptive organisational capabilities needed to increase overall business efficiency and CRM effectiveness, with four key purposes and details the opportunities and risks that the integration of AI with CRM presents.

AI is a constantly evolving topic, it provides some companies with fear and for others it is another development opportunity, which is why they approach it with enthusiasm. One way or another, this is the future of economics, economy, and sociology, each of these areas will sooner or later have to face the solutions offered by artificial intelligence. Therefore, this article is a prelude to continuing further research in this area.

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LEGAL AND PSYCHOLOGICAL ASPECTS OF HUMAN RESOURCES MANAGEMENT IN HOSPITALS

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Purpose: The aim of the article is to present the issue of managing a hospital establishment in the light of two aspects: formal-legal and psychological.

Design/methodology/approach: In the first part, the authors focus on defining the issue of mandatory conditions and citing the provisions of law regulating the activities of hospitals in the field of medical staff management. The content of the publication discusses the required qualifications which health professionals are subject to and must be taken into account by the hospital management when employing staff. The issue (formally unregulated) was also raised: motivational systems for medical staff in hospitals which is not mandatory from the point of view of the person managing the hospital, however, according to the authors, is an important factor in effective management of human resources.

In the second part of the paper, the topic of effective hospital management is considered from a psychological perspective. Based on Abraham Maslow's hierarchy of needs, it shows how supporting good relations between medical staff affects the prevalent atmosphere in hospitals. The authors consider the impact of endured stress of medical staff on the level of patient care, detailing the impact of eustress and distress.

Findings: The issue of occupational burnout among medical staff employed in hospital and some recommendations are indicated for the unit managing the facility which are to counteract this phenomenon. The publication also focuses on the correlation between empathy felt by medical staff, their attitude towards the patient and the degree of provided care which directly affects the process of treatment and convalescence.

Originality/value: There are presented some actions to raise the level of empathy and communication skills of staff and can be implemented by the hospital management unit. It was based on a meta-analysis of the results of various studies and existing sources.

Keywords: Law, psychology, hospital, management, medical staff.

Category of the paper: Conceptual paper.

1. Introduction

The functioning of hospitals is an important social problem affecting every beneficiary of health care. The manner and efficiency of this functioning largely depends on how it is managed. This topic should become the subject of social discussion so that ready-to-implement solutions applicable in Poland are developed, streamlining and regulating actions that can be taken by the hospital management unit. The following article is an attempt to respond to this need from the point of view of three aspects: **formal and legal** and psychological.

2. Formal conditions

The legal definition of a hospital was formulated in the Act on Medical Activity of 15 April 2011 (Journal of Laws of 2022, item 633, as amended) where a hospital was defined as a medical facility in which a medical entity performs medical activities such hospital services (Article 2(1)(9) that are performed 24 hours a day consisting of diagnosis, treatment, care and rehabilitation and cannot be provided as part of other stationary and 24-hour health services or ambulatory health services; hospital services also include services provided with the intention of terminating their provision within a period not exceeding 24 hours (Article 2(1)(11)).

According to the data of the Central Statistical Office (GUS, 2019) at the end of 2019, there were 890 inpatient general hospitals in Poland with 166.8 thousand beds. Out of this number, nearly 70% of hospitals are public hospitals whose operations are financed on the basis of contracted services from the state budget through the National Health Fund. In terms of the number of inhabitants, there were 2.3 hospitals per 100,000 inhabitants and 43.5 beds per 10,000 inhabitants which means that there were on average 230 inhabitants per bed. 7,464.4 thousand patients were hospitalized.

There were 126.07 thousand doctors working directly with patients, 210.92 thousand nurses and 27.63 thousand midwives. These data clearly show that the medical staff is a large group of employees, whose management should positively translate into both their professional satisfaction- but also- above all, the quality of medical services provided by them (GUS, 2019).

The number and qualifications of the medical staff necessary to provide medical services in hospitals is strictly defined by law - The Regulation of the Minister of Health on Guaranteed Services In The Field Of Hospital Treatment of 22 November 2013 (Journal of Laws of 2021, item 290 i. e.)

In Annex 3 to this regulation, the Minister of Health defined The Detailed Conditions For The Implementation Of Guaranteed Services In The Field Of Hospital Treatment, specifying, among other things, the requirements for medical staff for each profile or type of hospital organizational unit (E.g: Allergology, Dermatology, Clinical Oncology etc.).

Another legal act regulating the employment of medical personnel in hospitals is The Regulation of the Minister of Health On The Method Of Setting Minimum Standards For The Employment Of Nurses And Midwives In Healthcare Entities That Are Not Entrepreneurs of 28 December 2012 (Journal of Laws, item 1545).

There are two basic forms of employing medical personnel, i.e. an employment relationship established pursuant to Art. 22 § 1 of The Act of June 26, 1974 - Labour Code (Journal of Laws of 2022, item 1510 i.e.) and on the basis of a contract for the provision of health services concluded pursuant to art. 27 of the Act on Medical Activity. It should be emphasized that the simultaneous employment of medical personnel in hospitals financed from public funds on the basis of an employment relationship and a contract for the provision of health services is unacceptable and constitutes a violation of Art. 132 sec. 3 of the Act On Health Care Services Financed From Public Funds of 27 August 2004 (Journal of Laws of 2022, item 2561 i.e.) which clearly states that "you cannot conclude a contract for the provision of health services with a doctor, nurse, midwife, other person performing the medical profession or a psychologist, if they provide health care services with a healthcare provider who has concluded a contract for the provision of healthcare services with the National Health Fund".

While considering the legal aspect of managing medical staff in hospitals, one cannot ignore the aspect of working time regulations applicable to this group of employees. The working time of doctors in the adopted settlement period may not exceed 7 hours 35 minutes a day and an average of 37 hours 55 minutes a week in an average five-day working week.

The rule for employees employed in a medical entity is the settlement period, which may not exceed 3 months (Article 93(4) of the Act on Medical Activity). According to Art. 97 sec. 1 and 2 of this Act, an employee of a medical entity has the right to, at least, 11 hours of uninterrupted rest each day, and each week the employee has the right to minimum 35 hours of uninterrupted rest, including at least 11 hours of uninterrupted daily rest. The rest time specified in the above-mentioned provisions applies only to employees working under an employment contract in one hospital, as the current legal status does not allow the employer to check the possible additional employment of a medical worker. It should also be emphasized that the provision of Art. 97 of the Act On Medical Activity does not apply to doctors providing medical services on the basis of civil law contracts.

The management of medical personnel as an important issue for the implementation of state policy was the subject of a study conducted on the basis of the provisions of The Act on the Supreme Audit Office of 23 December 1994 (Journal of Laws of 2022, item 623) under the subject of Hospital Staff Resources in the period from 1 January 2019 to 10 June 2022 by the Supreme Audit Office, known as NIK, which identified five areas as the scope of the audit: employment of hospital staff; organization of work of medical staff; compliance with working and rest time standards; professional development of medical staff and the remuneration system (NIK, 2022).

The NIK audit showed that the hospital defined 12 risks related to the management of the hospital human resources, including, among others, increased medical work costs; staff fluctuation, absenteeism of medical staff or even post-traumatic stress caused by long-term work in a hazardous area. This fact confirms that hospitals as entities employing medical staff are aware of the importance of the issue of employee management.

2.1. Legally unrelated aspects of medical staff management

Employee management is commonly referred to as Human Resource Management. The authorship of this phrase since 1954 is attributed to Peter Drucker, who in his repeatedly reprinted book *The Practice of Management* (Drucker, 2018), emphasized the importance of a man (employee) in the company's operations, and hospitals can be included in this category for the purposes of these considerations. P. Drucker formulated the idea that the most valuable resource at the employer's disposal is a man who is creative by nature. Consequently, the author formulated a thesis on employee motivation, which is one of the most important elements that can make an employee involved in the optimal implementation of the goals of the organization in which s/he is employed. At the same time, he emphasized the fact that the organization of work must result in something more than getting the employee to perform the expected duties. Referring to this assumption, it can be said that in the case of hospitals, the organization of work, i.e., Human Resource Management of medical staff, should result in the development of employees, increase their involvement and identification with the direction of activities and goals of the entity employing them. In the case of hospitals, these goals can be comprehended as providing medical services at the best possible level in accordance with the applicable standards, both substantive (medical knowledge) and ethical, and a high degree of respect for patients' rights.

The method that allows to achieve high involvement of employees in the activities assigned to them seems to be the creation of an incentive system that would result in the release of employees' optimal potential and commitment. Lack of such involvement and failure to use fully one's own skills and experience will only result in the performance of obligatory duties in exchange for receiving remuneration within a specified period. Such a model will certainly not have a positive impact on the achievement by the employer (hospital) of a satisfactory objective in terms of quality. It can be assumed that when creating an incentive system, the employer should introduce solutions resulting in the creation of a friendly working environment in which the staff will be aware of the importance of the goals pursued and believe that the personal contribution of each employee in this area is important. Thanks to this, employees get a chance to develop their creativity without focusing only on the routine performance of their duties. It should also be assumed that a positive role in the incentive system will be played by solutions that will allow each staff member to emphasize their strengths and work at an appropriate pace on strengthening the weaker ones.

At the same time, when managing human resources in a hospital, it should be remembered that it is a working environment characterized by certain conditions that are unique to it.

These conditions were clearly identified in her work by Małgorzata Sidor-Rządowska (Sidor-Rządowska, 2019), who defined them as: “a constant burden of responsibility for the life and health of other people; dealing with extreme situations (suffering, death); decision-making dilemmas related to the process of making a diagnosis and the choice of therapeutic procedure (in the case of doctors); inability to predict a large part of tasks combined with 24/7 readiness to perform them; a low degree of tolerance for ambiguity and error; accumulation of tasks that require both a high degree of independence and an extremely high ability to work together; difficulties in measuring the effects of implemented activities; double (clinical and administrative) subordination of a large part of employees”.

3. Introduction to the psychological approach

The issues of human resource management in health care should also be looked at from a psychological perspective. It can be analysed in two ways. Firstly, attention should be paid to the protection of the mental well-being of medical personnel, for which the management unit is responsible in the workplace. Then, as a consequence, analyse the impact of the mental state of employees of a given hospital facility on their readiness to take care of the mental well-being of patients under their care. In particular, the impact of staff trusts in the management unit and each other, as well as the impact of stress and burnout levels and ways to prevent them will be analysed.

3.1. Relations between staff

The person who decides on the management of the facility should try to create a friendly working environment in order to ensure the well-being of the staff. This can be viewed from the perspective of providing tangible and intangible resources. As material, we can understand, firstly, the environment, which is the place where professional duties are performed, secondly, amenities, and thirdly, ensuring safety while fulfilling them. On the other hand, intangible resources are factors directly related to the organization of work. These include, among others: working time, overloading it, enabling a balance between private and professional life. Intangible factors that are important for the atmosphere in the work environment also include all aspects related to interpersonal relations between staff, such as willingness to cooperate, the atmosphere between them and preventing mobbing and discrimination (Kolasińska, 2020). From a psychological point of view, interpersonal relationships in the workplace are one of the key determinants of well-being in it.

According to Maslow's theory, fulfilling the needs of belonging and recognition, which are at the middle levels of the pyramid, is the way to satisfy the ultimate human need, i.e., self-fulfilment. In turn, the achievement of this need prevents or slows down the professional burnout syndrome, which will be discussed later in this article. From the perspective of the effective management of a group of cooperating individuals, ensuring good relations between them is also crucial for their psychological well-being and a positive atmosphere in the workplace. As a social being, people need to be connected to other people and to have their performance reflected in them (Jankowska, 2011).

A supportive working environment also provides a sense of security and reduces the stress of being responsible for the health and lives of patients.

3.2. Stress in a transactional perspective

A certain level of stress when performing a responsible job is advisable. So-called eustress, i.e., positive stress, is motivating to act, sustains aspirations and allows you to focus on your duties. Remaining in a state of eustress, we tend to adopt coping strategies focused on solving the problem, which increases work efficiency. However, one must not forget that working with a patient is a stressor itself. If we add other stressors, such as an unfavourable work environment to the already existing stress, the optimal level of stress may be exceeded. Then the individual will enter its maladaptive level, distress, which is conducive to making mistakes and reacting focused on emotions (Ogińska-Bulik, 2009), which in the specificity of work in health care can have particularly dangerous consequences.

3.3. Professional burnout and empathy in health care

In the effective management of a hospital facility, the unit overseeing the work of the staff should have as one of its overriding goals from a psychological point of view the prevention of professional burnout among the medical staff.

Indeed, professional burnout promotes a decrease in energy levels in an employee, especially one who interacts with patients in their daily work which contains a strong emotional gradient. Dealing with the suffering and personal problems of patients can be severely mentally exhausting. Professional burnout must be prevented for the sake of both the well-being of healthcare professionals and the resulting psychological state of patients. Indeed, symptoms of professional burnout include: impatience, increased irritability, cynicism, isolation and lack of expression of feelings, displaying superiority and infallibility (Wilczek-Rużyczka, 2014). It is not difficult to deduce the impact on the patient of dealing with staff displaying the above behaviours. The atmosphere of hostility and distance is not conducive to the healing process. Professional burnout syndrome kills expressions of empathy towards the patient.

In medicine, until recently, empathy was defined as the appropriate recognition of a patient's condition without empathising with the patient. Meanwhile, the patient cannot be approached purely empirically while at the same time cutting oneself off to protect one's own emotions. Empathy must be based on genuine emotions and self-reflection. An overly conservative

approach is not recommended, as this demotivates appropriate action, but at a level that does not add to the stress. Genuine, emotionally felt empathy is quite important for the appropriate recognition of pain by medical staff in the patient under their care. Observing someone else's pain not only triggers a response from the same centres in the observer's brain that are responsible for the patient's pain, but in all likelihood also involves the same biochemical substances that are involved in the patient's own pain (Janczukowicz, 2014). By feeling empathy in this way, the doctor can be counted on to approach the patient in a more individualistic way and to put more effort into the patient's healing process. This is why it is so important from the perspective of the hospital management unit to prevent professional burnout in their subordinates.

Preventive measures against this that are within the employer's reach include, for example, giving employees tasks that are not below or above their professional competence. Another good practice would be to evaluate their performance objectively, with constructive feedback for the future. It is also a good idea to provide opportunities for learning and development, through training, courses and additional qualifications. It may also be helpful to organise training or workshops on stress management and improving interpersonal skills. It is also important to provide recovery breaks where possible. Most crucial in counteracting burnout, however, is adequate job remuneration and ensuring that at least once a year an employee takes a leave of no less than two weeks (Gembalska-Kwiecień, 2015). Applying these measures can allow health care staff to take care of their own mental health and physical well-being and to realise their full potential for work and remain nimble. This will be a resource for both them and the patients in their care.

In addition to measures to counteract professional burnout, a measure for the benefit of the patient on the part of the facility manager would be to provide medical staff with so-called empathy training. One proposal for such training, which is in line with the possibilities of hospitals in Poland, is the Bonvicini & Associates training. It emphasises communication skills and empathic expression. It uses methods designed to allow people to experience the clinical situation and take on the role of the patient. During the development of the training, participants took part in three 60-hour workshop series, during which they were taught to use appropriate communication techniques based on the '4ES' programme: "engage, empathise, educate, enlist". As a result of the classes, not only are the methods used to administer, but also to activate. After each of the three series of workshops, doctors participated in a coaching session, during which recordings of the patient's last visit were discussed. The results of these activities showed a positive impact on the level of empathy of the trained staff during the interaction with the patient. The overall rate of improvement was, in terms of global empathy, 37% improvement over the baseline measurement. At the same time, the control group showed no effect (Sikora, Biegańska, Baran, 2016). The fact that it not only increases the level of empathy towards patients, but also emphasises contact, can be considered a significant resource of this method. As mentioned earlier, good contact between medical staff and patients promotes a feeling of safety during treatment.

It is worth including in the training of employees teaching them how to communicate effectively. Such communication should be clear, credible and reliable. Maintaining these principles can often eliminate the dangers that arise from misunderstandings about medical advice. It is worth sensitising medical staff to the fact that patients do not have the expertise, nor do they understand such language. Therefore, it is important for doctors to adapt the language of the message to the recipient. It is also important to remember to distinguish between effective communication with the patient and with authorised family members.

In communication with the patient, it is always necessary to take into account both the aspect of transmitting medical information and its reception by the patient, and the second, understanding the message sent by the patient (Kuriata-Kościelniak, 2020).

4. Summary

In the process of optimal human resource management of medical staff, it is necessary not only to take into account the mandatory requirements of the law in this respect, but also to introduce rules that will be an effective motivation for employees to achieve the goals of the entity employing them.

The unit managing the hospital is responsible for taking care of the mental well-being of its staff. The psycho-physical state of the staff determines their attentiveness towards the patient and the level of care towards the patient, and to some extent the efficiency of the recovery and treatment. In order to achieve it, the manager should care about a friendly atmosphere in the workplace, including tangible and intangible resources. It is important that s/he counteracts professional burnout in themselves and their subordinates and provides ways to balance stress levels. Training and workshops on good contact, empathy and communication are also important.

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ENVIRONMENTAL SUSTAINABILITY AND ENERGY MANAGEMENT DURING THE WAR CRISIS

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Purpose: The new reality of the ongoing war in Europe, in addition to the enormity of the unimaginable human tragedy, has generated serious problems of various categories, especially in the field of energy security management. Thus, there is a hypothesis that in the current situation, the implementation of the idea of sustainable development in terms of energy development and maintenance of measures for achieving climate goals, may be significantly hampered and slowed down. Based on the analysis, it was determined that there are legitimate concerns about the existence of obstacles to the process of achieving sustainable development in the context of interest.

Design/methodology/approach: Research related to this issue consisted of a literature analysis of available texts. This article is purely theoretical in nature and is based on a literature analysis. For the purpose of it, three groups of keywords were developed to reflect their diverse characteristics, in order to identify the state of the current literature covering the knowledge of energy management in the energy crisis associated with the outbreak of war in Ukraine.

Findings: The issues raised in this article are merely an exemplification of the problems concerning further energy development and the implementation of the concept of environmental sustainability caused by the invasion of Ukraine by the Russian Federation. From a sketchy analysis of the available information, it can be deduced that, on the one hand, the effect of this aggression on the realisation of the concept of sustainable development may be an acceleration of, for example, decarbonisation, but, on the other hand, it is a very complex problem, as it may trigger a crisis whose scale and effects we are not yet able to determine.

Originality/value: The article deals with new problems emerging in the space of energy management and the implementation of environmental sustainability in the context of armed conflict in Europe. The considerations presented may open up new fields and directions of research exploration for researchers.

Keywords: energy, management, crisis, sustainable development, war, climate.

Category of the paper: Conceptual paper/ Literature review.

1. Introduction

The globalization of all areas of the economy, such as technology, production, finance, trade, institutions of various kinds, and energy, has brought the world economy into a web of various interdependencies, creating a kind of system. Embedded in the operation of this system is the realization of the idea of sustainable development, which aims to pass our planet on to the next generation in such a condition that they can live to enjoy health and a high standard of living. Related to its implementation is the protection of the environment, which depends, among other things, on optimal global energy management. The events surrounding the Russian Federation's aggression against Ukraine show how fragile the foundations of global interdependence are and how easily the entire world economy is shaken. The Russian Federation's aggression against Ukraine on February 24, 2022 deeply shook not only all of Europe, but also the entire world. It has caused great tragedy and suffering for millions of Ukrainian citizens, as well as people around the world. The brutality of the aggressor causes a sense of helplessness, in all those who have sensitivity to the suffering of others. In addition to the usual human reflexes of empathy, it brings consequences in the form of various concerns about the continued existence in the world and problems arising on various levels. Russia's bellicose actions in Ukraine have shaken the security of the energy market and caused a jolt to secure global energy development. Energy is an important factor in sustainable development efforts. And sustainable energy development is the process of sustainably, safely and efficiently providing energy for CSR (Graczyk, 2017). Energy security and attempts to become independent of raw materials imported from Russia have therefore become a priority issue in Europe (FE, 2022). The development of civilization increasingly based on consumerism requires more and more raw materials for the production of goods. On the one hand, it leads to human dependence on a comfortable and prosperous life, on the other hand, it causes a deterioration in the quality of this life, health and the environment. It threatens not only present but also future generations (Kielczewski, 2010; Marszałek-Kotzur, 2021). In turn, the development of technology in military terms has resulted in the temptation of unbridled aggression and a catastrophic vision of the world for future generations. The multidimensional personal, nuclear, energy, food and ecological catastrophe mentioned by A. Kuzior is slowly being realized, the consequences of which for our planet may be lamentable. The so-called normative turn, which proclaims the axiological and ethical neutrality of technology, has led to its valuation and revealed the need to develop the issue of human responsibility (Kuzior, 2006; Marszałek-Kotzur, 2019; Jonas, 1996). In order to ensure the quality of human life, various measures are taken within the framework of the concept of sustainable development. Responsibility, and especially the institutional responsibility of states, is a key element for these activities. It is referred to, among other things, the Rio Declaration, one of the most important final documents of the 1992 Earth Summit. The emergence of this document proves that man

has realized the scale of the dangers of leading to an environmental crisis and is making an effort to prevent it (Piątek, 2005). Thus, the fundamentals of the global economy demanded the development of a new paradigm that respects the principles of global sustainability (Bocian, 2011). The necessity to meet the needs of the currently living generation while taking care of the needs of future generations was taken as the starting point in discussions of the idea of sustainable development. An important feature of sustainable development is the sustainability of intergenerational prosperity. The introduction of the concept of sustainable development aims to ensure a compromise between economic, social and environmental goals (Herrmann et al., 2020). The concept of sustainable development is based primarily on policies of economic interventionism. The practical application of sustainability in organizations is humanistic management, which can be defined as guided by the perception of humans as the center in their natural and social environment (Kuzior et al., 2022).

2. Methods

This article is purely theoretical in nature and is based on a literature analysis. For the purpose of it, three groups of keywords were developed to reflect their diverse characteristics, in order to identify the state of the current literature covering the knowledge of energy management in the energy crisis associated with the outbreak of war in Ukraine. According to these groups, several phrases were formulated for a query in the Scopus Database. The results of documents in keywords, titles and abstracts were taken into account. The first group concerns activities related to the implementation of the idea of sustainable development and climate change (sustainable development, climate change). The phrase "sustainable development" received 388,667 document results, and the phrase "climate change" received 469,422 document results. The second group is related to energy management and energy crisis (management of energy, energy crisis). For the query "management of energy" there were 284,038 and for the query "energy crisis" there were 21,438 document results. The third group represents the question of the war in Ukraine and further development of energy in its context (war in Ukraine, energy, energy development). For the phrase "war in Ukraine" 2189 document results were obtained, for the word "energy" 4428 document results, and for the phrase "renewable energy" 6 document results. The literature review was aimed at identifying research on the topic and implementing a scientific process, eliminating the researcher's bias. The literature on the topic addressed in the article is quite extensive on the issue of implementation of sustainable development, climate change and energy management. The literature on energy development in the situation of war in Ukraine is not numerous. Taking into account the above-mentioned research gap along with the intention to identify it, an analysis of this issue was made. The verified hypothesis is as follows: there are legitimate

concerns about the existence of serious constraints in the process of achieving the objectives of sustainable development. The research questions posed are contextual and descriptive in nature. The article uses some of the studies describing the concept of sustainable development (Stiglitz, 2002; Kuzior, Ober, Karwot, 2021; Kuzior, 2010; Kuzior, Kwilinski, Hroznyi, 2021) and decarbonization activities (Kuzior, Postrzednik-Lotko, Postrzednik, 2022). Also used were a small number of available materials on the current state of energy in Ukraine (Kuzior, Lobanowa, Kalashnikowa, 2021), the European Union's activities in this area, as well as media published statements of experts in conducted discussions on the further development of the energy crisis related to Russia's aggression against Ukraine (Wang et al., 2022; Pereira et al., 2022; Rozenas, Vlasenko, 2022; Europe..., 2022; Kagerl et al., 2022; Esfandabadi, 2022; Fishedick, 2022). The literature study, i.e. the analysis and critique of the literature of selected publications, made it possible to determine what and how was analyzed in the topic of sustainable development itself and issues related to further energy development in the context of the war, and allowed to outline the direction of further research. The focus was on the issues of defining what sustainable development is in its essence, what climate goals have been set in connection with its implementation, and what actions the European Union has taken in terms of moving away from fossil fuels and energy independence from supplies from the Russian Federation. Some sample suggestions for energy management solutions were also cited. According to the study, the global network of various interconnections, including energy, generates serious problems and a lot of difficulties are posed by sustainable energy management. There is also a lack of sufficient reflection on the dangers of pushing back the implementation of climate goals since the outbreak of the war in Ukraine. The considerations presented here obviously do not exhaust the entirety of the problems, but represent a selective reflection on some of them. It seems that they can open new fields and directions of research exploration.

3. Results

3.1. Decarbonization and climate neutrality

An important element of sustainable development is the acquisition and use of energy. Seventeen goals have been adopted as part of the new 2030 Agenda for Sustainable Development. Goal seven proclaims to ensure affordable access to stable, sustainable and modern energy for all. Energy is necessary, among other things, for doing work, providing security, producing food and fighting climate change. Sustainable energy is an opportunity for a better human future, a satisfactory state of the economy, a clean planet and saving the climate (SDG, 2022). Exactly four days after the Russian aggression against Ukraine, the second part

of the Sixth Summary Report of the Intergovernmental Panel on Climate Change (IPCC) was released (IPCC, 2022). In it, the expert team formulated a warning about the need for immediate preventive measures related to the systematically escalating climate crisis. Specifically, the issue is the burning of fossil fuels, which leads to anthropogenic carbon dioxide emissions into the atmosphere. In it, experts point out the disturbing fact that the aggression against Ukraine has pretty much overshadowed the problem of the worsening climate crisis. Scientists from the Polish Academy of Sciences have also published a communiqué on addressing the climate crisis, but it has been relegated to the background in the wake of the outbreak of war in Ukraine. The achievement of the European Union's climate neutrality, set for 2050, was adopted in the "Fit for 55" Climate Solutions Package, announced on July 14, 2021. It primarily assumed reform of the EU's emissions management system for new economic sectors, and a higher share of renewable energy sources in the European Union's diversified energy mix. It also envisaged tightening emission standards for the land transport sector. In turn, the imposition of a carbon tariff on countries with no climate policy should have strengthened the competitiveness of the EU economy. Among other things, the implementation of the climate goals was to involve the systematic abandonment of Russian hydrocarbons such as gas, oil and coal. This was an important part of decarbonization relevant to climate protection. This process was accelerated by Russia's invasion of Ukraine. The war has undoubtedly caused a variety of additional problems. First, the war is causing a tremendous amount of damage to the lives, health, psyche and well-being of people living in Ukraine, but also in other parts of the world. Second, the impact of the warfare itself on the climate has not yet been studied. It seems that the fires still breaking out after rocket attacks in cities, warehouses of various toxic substances, factories, ammunition or fuel depots are indifferent to the environment. Thirdly, a serious problem has arisen in terms of further energy development and safe energy management. The cutoff of fuel supplies from Russia and their rising prices have shaken the fuel market. Russia is a major supplier in the global energy market and accounts for 18% of global coal exports, 11% of oil and 10% of gas (3trzy3, 2022). The system, which had been under construction in Europe for several decades, was based on buying large quantities of them from Russia. Giving up Russian hydrocarbons, first of all, will have a positive impact on the environment and will partially halt and perhaps even reverse adverse climate change. This situation, paradoxically, on the one hand, may be a lifesaver for our climate and may mobilize Europe to abandon fossil fuels more quickly in general and accelerate work toward renewable energy sources and the atom. The search for an energy path of our own, independent of Russia, could become the impetus for accelerating the Green Deal. Expensive energy forces radical improvements in energy efficiency and accelerates the development of RES due to the fact that renewables are not burdened by fuel and CO₂ costs. According to PAN scientists, both renewables and nuclear power are not only beneficial for the climate, but also needed in the context of independence from Russia and the problems associated with cutting off fossil fuel supplies. The role of RES and nuclear in the coming decades will undoubtedly be crucial,

they stress. The need for independence from Russian gas, among others, was recently emphasized by the International Energy Agency (IEA), which presented a list of 10 points that countries could benefit from while accelerating their energy transition (Bełdowicz, 2022). It represents a plan to make the European economy independent of fossil fuels from Russia (AEO, 2022). On the other hand, there was the crucial question of how to reconcile ensuring the security of energy supply for the residents of the European community while not abandoning measures to pursue the goal of climate neutrality.

3.2. Energy security in Ukraine

In late February, EU energy ministers met in Brussels to discuss the energy situation in Ukraine. They identified the current state of energy supplies, stocks and flows in Ukraine and Europe in the context of the Russian Federation's aggression. The need to secure supplies, optimize stockpile management and improve coordination among member states was expressed. There was also discussion of ways to reduce the impact of energy prices on industry and individual households. A readiness to provide energy assistance to Ukraine was declared (EU a, 2022). Given the real threat of missile attacks, there was a need to ensure the security of Ukraine's nuclear facilities, with the support of the International Atomic Energy Agency (EU b, 2022). The area of hostilities in Ukraine coincides with the area of the most numerous coal, gas and nuclear power plants. There are frequent failures of transmission networks. The Russians are trying to capture key facilities, hoping to take over the energy infrastructure. In Ukraine, work on the construction and expansion of renewable energy sources, has developed dynamically. About 5% of Ukraine's total energy comes from them. Since the location of wind farms and photovoltaic installations are large clusters, so they are vulnerable to destruction or takeover. They are mostly located near Moldova and near the border with Romania. If this territory is cut off from Ukraine, the photovoltaic farms will be disconnected from the grid and the ability to supply energy to a large part of the country. The development of renewable energy sources has come to a standstill because of the war. For example, a huge photovoltaic farm was to be built near Chernobyl, but work had to be stopped. The Chernobyl area was occupied by the Russians, who destroyed a research laboratory and high-emission samples of isotopic materials. With the cessation of work on renewable energy development, climate protection is bound to suffer severely. Experts are already pointing to toxic materials being released into the air, soil and water from ruined buildings, exploding pipelines, damaged sanitation systems and fuel and chemical dumps (RP a, 2022). There is also a real threat of contamination and environmental catastrophe on a massive scale if nuclear power plants are destroyed.

3.3. War situation vs. EU energy action

The very next day after the start of the aggression against Ukraine, the European Union began discussions on banning the sale, supply, transfer and export to Russia of certain goods and technologies for oil refining. Discussions were also held on the introduction of restrictions on the provision of related services. The idea was to hamper the Russian oil sector and prevent Russia from modernizing its refineries, in order to limit Russia's export revenues. In 2019, for example, they amounted to €24 billion (EU c, 2022). In early April, the idea of a ban on the purchase, import or transfer of coal and other solid fossil fuels to the European Union originating in or exported from Russia emerged, which would take effect in August 2022. Coal imports to the European Union are currently worth €8 billion a year. Bulgaria was granted a temporary derogation for the import of Russian oil transported by sea, and Croatia for the import of vacuum gas oil. European Union leaders have assessed progress in increasing the Union's energy independence and agreed on further steps to ensure security of energy supply (EU d, 2022). The Russian invasion of Ukraine caused another increase in prices, which were already very high, and there were concerns that the European Union could have a serious problem securing a sufficient supply of energy. At an informal summit in March, EU leaders decided to gradually but steadily make the European Union less dependent on Russian fossil fuels. At the end of May, at an extraordinary summit of the European Council, EU leaders decided that the Union would stop importing almost 90% of its oil from Russia by the end of 2022 (EU e, 2022). Also in May, EU energy ministers, at an extraordinary Council meeting, exchanged views on possible measures to be taken in the event of an energy supply crisis, due to Gazprom's suspension of gas supplies to some member states. They also recalled solidarity with Ukraine (EU f, 2022). The Council and the European Parliament have tentatively agreed on new gas storage regulations, namely that member states are to fill their storage facilities before winter and make them available to other member states in a spirit of solidarity. Underground storage facilities on the territory of member states should be filled at least 80% before the winter of 2022/2023 and 90% before subsequent winters. In 2022. The European Union will try to fill underground storage facilities to a total of 85%. Since not all member states have gas storage facilities on their territory, it was agreed that member states without storage facilities will be able to use reserves stored in other member states (EU g, 2022). The ministers and the Commission decided to continue coordinated contacts with international partners and reliable suppliers, and to quickly establish a European gas purchasing platform to guarantee energy supplies to the EU at affordable prices (EU h, 2022). In early June, the Council adopted a sixth package of sanctions, a ban on imports of oil and refined petroleum products from Russia, with limited exceptions. The temporary exemption will apply to oil imported by pipeline to European Union member states that are particularly dependent on Russian supplies due to their geographic location and have no other viable options (EU I, 2022).

3.4. Europe's energy transition

Europe's energy transition slowed considerably during the 2020 pandemic. In 2021, relative stability was followed by an energy crisis in Europe, with gas and CO₂ costs rising sharply. The dynamic increase in energy commodity prices, translated into energy prices. The outbreak of war in Ukraine triggered another crisis. Most countries in Europe are dependent on the supply of energy resources from Russia. One of the most dependent countries in Europe on Russian supplies is Germany, but right behind it is Poland. Therefore, accelerating the energy transition in line with the European Union's climate policy is crucial. One of the most pressing climate issues is the need to move away from fossil fuels. According to the U.S. Environmental Protection Agency (EPA), emissions from fossil fuel combustion and industrial processes accounted for about 78 percent of the total increase in greenhouse gas emissions from 1970 to 2011 (RP b, 2022). It makes little sense to support coal-fired power generation, which is practiced by some countries, such as Poland, because of its destructive impact on the climate, but also because of the high cost of mining coal, which is not enough and must be imported from Russia. On top of that, there are high emission fees. The only reasonable solution, according to experts, seems to be the development of wind and solar power. Thus, the development of photovoltaics and onshore wind energy should be unblocked. This, of course, involves working on the reconstruction of the grid, which could accept electricity from these sources (PAN, 2022). At present, it is not possible to talk only about the climate neutrality of the world, Europe or the country, but it is necessary to emphasize the role of climate neutrality of each individual household. According to Prof. Popczyk, it is necessary to autonomize the electricity supply. Another important element is a mechanism for verifying the cost of electricity. It results from the environmental impact of a given technology in the form of the so-called carbon footprint. Experts believe that the creation of such solutions can significantly increase the security of electricity supply (OI, 2022). Energy savings are also influenced by improving the energy efficiency of buildings and installing heat pumps. This can be achieved by launching relevant programs for municipalities. It is also not without significance to carry out a parallel large-scale information campaign, making the public aware of how much savings, also in financial terms, can be given by lowering the indoor temperature even by one or two degrees in winter, or an analogous increase in temperature for air-conditioned rooms. The development of renewable energy sources in Poland has been slowed by unfavorable political decisions. In 2021, more than 75% of Poland's electricity was generated from coal, and electricity generated from renewable energy sources amounted to only 16.1% of total production. In March 2022, as much as 84% of Poland's electricity was generated from fossil fuels, including almost 76% from coal. After the Russian invasion of Ukraine, energy commodity prices skyrocketed, and almost all Western countries have declared a gradual shift away from Russian raw materials. Declarations by European Union countries show the likely trend for the coming years, which is to cut Russia off from its most significant

influence. However, in energy, Russian raw materials are difficult to eliminate entirely in the short term. In addition, there has been a real threat of their supply being interrupted by the Kremlin's decision, necessitating a revision of energy plans to prevent an even bigger crisis. In this connection, Belgium has put on hold for 10 years the closure of its nuclear reactors that produce about 40% of the country's energy. Germany has written into its strategy the construction of gas ports and an even stronger increase in renewables, reaching 80% as early as 2030 (ARE, 2022). One way to save energy could be to reduce energy consumption. However, the problem is that every consumer wants to meet their electricity needs. Another option is to strategically increase cooperation with the Ukrainian electricity system, which has been synchronized with the grid of continental Europe for some time. This is possible, provided that the priority of action is the common good, and not just individual needs or the shallow nationalism of decision-makers. Political decisions are often subject to a large margin of error and, as L. Michnowski points out, "the lack of knowledge of numerous - at first glance invisible, often qualitatively new feedbacks - interdependencies and side effects of political decisions, (...) causes their consequences radically different from the intended ones" (Michnowski, 2007, pp. 79-81). In order to avoid pregnant mistakes, it is necessary to equip politicians with the necessary knowledge and provide them with up-to-date scientific information on a given topic. The importance of the duty to think is also stressed, allowing for predictions about the future and calculations of risk at every level of life. In this particular case, the ability to peacefully manage energy and unleash war is a major risk. This risk factor is unquantifiable, due to human incalculability. No one knows what people are capable of in undertaking morally good or morally bad acts (Jonas, 1996).

4. Discussion and conclusions

The issues addressed in this article are merely an exemplification of the problems, concerning further development of energy and implementation of the concept of environmental sustainability, caused by the unjustified invasion of Ukraine by the Russian Federation. From the analysis of the available information, it can be concluded that, on the one hand, the effect of this aggression on the realization of the concept of sustainable development may be to accelerate, for example, decarbonization, but, on the other hand, it is a very complex problem, as it may cause a crisis, the scale and consequences of which we are not yet able to determine. First of all, it seems that the European Union is too entangled in supplies from Russia, and the construction of gas connections independent of Russia, will not happen in a short time, which may cause various problems. Certainly, the abandonment of Russian fuel supplies will make energy more expensive, at least for a while, which will affect the economy and livelihood of people around the world. In this context, sustainable development cannot be limited to

political strategies and attempts to operationalize them. The basis for solving emerging environmental, social and economic problems is the formation of the right type of social awareness, called sustainability consciousness. This is because it is easier to implement the principles of sustainable development if we have the openness and involvement of the entire society, which is not accustomed to treating nature instrumentally. It is about responsibility in the broadest sense. After all, sustainable development is directed toward action for future generations. Acting responsibly "for the future" means being ready to accept the consequences of one's own actions and behavior. It is not only about the civil-legal space, but also a reference to technological actions, the consequences of which are spread over many generations. Active responsibility is for those who are ready to arouse imagination-rich perspicacity and also sensitivity to become explorers of new forms of responsibility (Marszałek-Kotzur, 2019). In addition, only the interaction of the spheres of science, politics, business and society as a whole can produce tangible results in realizing the basic concept of sustainable development. The lack of free access to cheap energy resources is an opportunity for European science and industry, for which it can become a flywheel to accelerate development. However, unity and solidarity of the West is essential in this regard, which must consistently respond to Russian aggression with one voice. Russia's takeover of Ukraine and, in the long run, the subjugation of our part of the European Union, would mean the end of the pursuit of Europe's climate neutrality and the further realization of the idea of sustainable development (OF, 2022). This article is intended to highlight the problems arising in this context and encourage detailed research.

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GRESILIENT SUPPLY CHAIN – A CASE STUDY OF GLOBAL FLOWS

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Purpose: Nowadays there is still low awareness of creating specific supply chain hybrids in a planned manner. This paper focuses on a hybrid of the gresilient chain, which reflects the trend to act for the well-being of the environmental to eliminate disruptions in the flow of goods. The aim of the study is to determine the interdependence of the factors shaping the resilience of the supply chain and to determine which of them contribute the most to the creation of a green chain.

Design/methodology/approach: AHP and DAMATEL were used as research tools. A study focused on the cognitive chain is extremely interesting, because it is a global chain in which the main coordinator is relatively small. The subject of the research is the international supply chain of a company that conducts research on engine oils, coolants and fuels for gas engines driving turbines, electric and wind turbines, hydraulic transmissions, etc.

Findings: As a result, among other things, it was established, that speed is the factor that is most sensitive to the influence of other factors and, at the same time, the most important from the point of view of recipients. In addition, it was proven that redundancy is essential for creating resilience in the analyzed chain, while transparency is necessary for creating the green chain. It has also been shown that redundancy and cooperation work simultaneously to a great extent for the benefit of both chains.

Research limitations/implications: Every supply chain requires a separate study.

Practical implications: The results can help managers in implementing the gresilient strategy or in modifying it if it has already been implemented. The work carried out may contribute to the creation of a general matrix containing paths to the expected types of supply chains, taking into account the specificity of input and output connections.

Social implications: Gresilient chains are part of the idea of corporate social responsibility.

Originality/value: From the standpoint of building up resilience, this is an interesting case, because it is the discussed case does not fit into the concepts of popular models in which agility is promoted as the one that guarantees the resilience of the chain. The study is an expanding knowledge in the field of the gresilient chain, in which research is lacking due to the initial stage of science in this area.

Keywords: Transportation, Logistics, Resilient Supply Chain; Green; AHP, DEMATEL

Category of the paper: research paper, case study.

1. Introduction

In the context of the recent financial, pandemic or geopolitical crises, the trend of making chains more resistant is of particular importance. This is to lead to eliminating disruptions in the flow of goods. The literature emphasizes that, above all, agility, flexibility and transparency are the factors that make it possible to strengthen chains.

The second strong trend in the supply chain is its greening, i.e. striving to ensure that the processes are carried out keeping the well-being of the environment in mind. On the basis of comprehensive research covering a wide spectrum of activities, it can be seen that the measures taken relate primarily to the shortening of supply chains at the entrance in order to reduce CO₂ emissions. Efforts are made to optimize the level of inventory in the context of their environmental impact, and environmental certificates are required from suppliers. The growing pressure to decarbonize operations and reduce the carbon footprint, the need to adapt to the Fit for 55 program further intensifies the discussed phenomena among the links of supply chains and the transport and logistics industry that supports them.

There is therefore a need to consider these trends simultaneously and implement chains of so-called resilient.

2. Literature review and identifying the research gap

Currently, research on chains of this type is at an early stage of development. Among others Sen, Datta & Mahapatra (2017) and Xiong et al. (2020) proposed a decision support framework to address supplier selection issues while considering ecological and resilience criteria. Azevedo et al. (2013) developed the Ecosilient index for environmental and resilience performance and illustrated its application with a case study on the automotive supply chain. Souza, Bloemhof-Ruwaard and Borsato (2019) on the other hand, noticed, from a case study of the sugar beet supply chain, that the strategy of minimizing environmental impacts also increases the fragility of the chain. The authors showed how changes in the chain configuration affect the elasticity and durability of the chain in economic and environmental terms.

Nasrollah et al. (2023) understood the problem of designing a supply chain network on the example of an oxygen concentrator device, taking into account the two spheres discussed. The authors have proven that the increase in disruptions in the supply chain causes an increase

in carbon dioxide emissions. Ghomi-Avili et al. (2018), based on a case study of the filter industry, also referred to this issue. The authors concluded that it is important for competitiveness to anticipate the risk of disturbances in flows, as well as to reduce CO₂ emissions by implementing appropriate production processes. In turn, Yavari and Ajalli (2021) found that the amount of released CO₂, cost and lost demand in the resilient model are far less than the non-resilient model. For the downstream supply chain, using multi-sourcing has a slight improvement in the performance of the supply chain under disruption risks. The authors focussed their attention on the milk supply chain.

Hasani, Mokhtari and Fattahi (2021) showed, however, that the centralization of points in the supply chain is beneficial due to the reduction of CO₂ emissions. This is due to the shorter distance between objects. The research was carried out on the example of a manufacturer of medical devices. The scattering of points that can reinforce a chain is therefore in conflict with environmental issues. Foroozesh, Karimi and Mousavi (2022) also addressed the issue of carbon intensity and resilience on the example of the food supply chain.

Warmbier and Kinra (2022) extended the research by combining the issues of a resilient and sustainable chain. Based on the literature review, the authors revealed the great potential of combining the two discussed research domains. They determined that they should be considered along four dimensions: supply chain capabilities, practices, risk and performance. A similar research team (Warmbier, Kinra, Ivanov, 2022). found that there are many common activities for the development of these chains. It was also found that, for example, redundancy is the element that creates contradictions between both chains. Similar thematic studies were conducted by Negri et al. (2021). The authors recognized that research on immunity is less mature and that the relationship between the two topics is often inconsistent. In their opinion, it is not clear what practices could jointly contribute to the development of both areas. The time horizon of the conducted research is also important. Some authors, in this broader context, focus on selected processes, such as supplier selection (Amindoust, 2018).

Considerations of both types of chains are also conducted in the comparison of agile and lean chains. For example, Sharma and co-authors (2021) in research on various chain hybrids, including the hybrid in question, noted that the types of chains should be studied through the prism of the production strategies (Make-To-Stock – MTS, Made-To-Order – MTO, Assemble to Order – ATO, Engineer to order - ETO) and that the applied chain measures affect the choice of given hybrids. Studies of this type may be an inspiration to introduce moderators in the analysis of gresilient chains.

Summing up, it can be concluded that there is a large research gap in the field of gresilient chains. In the few studies mentioned earlier, problems resulting from reconciling the creation of resistant and green chains were shown. In particular, it was pointed out that attempts to strengthen the chains lead to worse environmental effects. This is especially important in a situation where we are dealing with economic, natural, epidemiological or geopolitical crises.

Then, it is critical for enterprises to maintain liquidity in the flow of goods and profitability, while pro-environmental issues remain in the background.

It is therefore vital to determine which of the factors, important from the point of view of the resilience of a given supply chain, is also important for greening IT. Therefore, the aim of the study was:

- to give an indication of the strength of the interaction of the factors increasing the resistance of the chain, from among those that are most important for a given, specific case,
- to determine which of these factors and to what extent, positively correlate with the creation of green chains. Therefore, a new approach was used in this study, where the starting point was the resilience activity, which was activated first. In addition, the need to rely on a group of factors appropriate for the discussed case was emphasized, and not the one that is most often proposed in research models. A preliminary study of the relationship between the initial factors was recommended before referring them to pro-environmental aspects, and the above issues were illustrated on a configurationally stable formula for supplying materials, which, despite the turbulence in the environment, may be an attractive path to competition.

3. The subject of research and the nature of its supply chain

In the analysed supply chain, mainly engine oils are moved, which are primarily used for the operation of gas engines, electric and wind turbines, and hydraulic transmissions. It is a global chain in which individual links of the company are linked by capital and finances. Major suppliers are closely related, and this results from the need to conduct their audits and certification. As the main customers are global concerns such as Chevron, Shell, and Mobil, which are present on all continents, their service requires efficient flows in long supply chains. In total, 165,000 customers are served. The analysed company is one of the seven subsidiaries of the company that conducts laboratory tests. It is also the only link of the concern, which is located in Europe, in Poland. The other six units are located in South, Central and North America. Therefore, the supply chain is extremely specific because at the beginning of the chain comes material for analysis from Europe, North Africa and Asia from a very large number of customers. Samples from smaller customers are delivered to three consolidation sites located in Europe (Germany, Belgium, and Great Britain). This delivery mode covers 45% of the samples. Larger customers send samples directly to the Polish laboratory.

Equipment parts are also moved within international supply chains. However, reagents and small equipment (pipettes, glass, oil-absorbing mats - the so-called sorbents, etc.) and clothing are purchased from regional companies. As the laboratory is accredited based on ISO17025,

the reagents are purchased from distributors of renowned world producers, e.g. Sigma-Aldrich, and Merck. Other accessories, such as pipettes, glass, and sorbets, are supplied from commercial units. Because the company's strategy assumes the development of Asian clients and clients from the Persian Gulf region, the number of clients from outside the European Union is slowly increasing. The share of European customers and the number of ordered samples are also growing. Therefore, the role of logistics is growing, both in the context of the extension of supply chains, geographic diversification, and the volume of goods moved. This string is non-standard. It is a global chain with a large amount of material movement. At the same time, the described company constituting the epicenter of the chain is a small company, employing only a dozen or so of people, where infrastructure such as offices and warehouses, and transport units (mainly air transport units) are not owned by the enterprise. The company is small, so there is no separate logistics department, and decision-making management in the area of logistics is primarily the responsibility of the manager.

In order to diagnose weak points in material flows, an interview was conducted. IDI (Individual In-depth Interview) was used as the basic research method. The contact person for the transmission of information was the company manager who is responsible for contact with other participants in the supply chain and with companies located around the world. At the same time, the manager had the opportunity to collect information from other employees to provide reliable answers.

Based on the interview, it was found that during emergencies, for example during the pandemic, problems arise with the timely delivery of components to the machines, as well as with the supply of sufficient laboratory materials. For example, there have been disruptions in the supply of reagents, pipettes, or test tubes. Due to the necessity to obtain supplies from certified suppliers or monopolistic competition, in many cases their possible change is very difficult. Due to the complexity of the equipment, the waiting time for spare parts is extended, because in most cases the elements are imported from abroad.

These delays force an increase in the level of inventory to maintain the continuity of laboratory tests, and thus increase costs. Regional chains have a radius of up to 400 km, so disruptions occur in the availability of goods, not in the speed of transport. However, in case of materials intended for research, disturbances concern possible transportation problems, as in this case there is no alternative means of transportation. Due to the high turnover of employees, there is also a problem with the failure rate of the machines, which translates into the speed with which the material is provided. Each employee requires several months of training because the supported equipment is highly specialized. In the event of a machine failure, long service orders may occur.

To diagnose how to deal with the prevention of interruptions in the performed tasks, the relationships between individual factors were investigated in more detail using multi-criteria methods. Then, it was examined whether these factors also serve pro-environmental aspects.

4. Factors shaping resilience of the analysed supply chain – research methodology

In the literature, research on strengthening chains in models or theoretical studies is most often referred to as resilience. Nevertheless, literature items containing the terms mitigation (Barroso, Machado, Machado, 2011) or vulnerability (Ekanayake et al., 2022), or disruption/disturbances (Ozdemir et al., 2022) also concern resistance. The study assumes that “a resistant chain is a chain that, as a result of disruptions to internal or external factors, can quickly reach the starting position or change it (through location and product configuration, links with contractors, internal reorganization, etc.) so that it will not significantly disrupt business continuity. Therefore, it is a certain ability to resist shocks that occur in the supply chain” (Maryniak, Pogorzelec-Glaser, 2022).

Based on an extensive literature review, it was determined what set of factors used to build a resilient supply chain (Maryniak, Bulhakova, Lewoniewski, 2021). Then, out of twenty selected factors, most often mentioned in the research models, it was determined which of them are adequate for the examined enterprise. The research results were published in a paper of (Maryniak, Pogorzelec-Glaser, 2022).

Model approaches emphasize that agility and flexibility are the key factors in the construction of resistant chains (Christopher, Peck, 2004; Brusset, Teller, 2017; Cui, Idota, Ota, 2019; Mohammed, 2020). However, the conducted research did not prove this.

The dependencies between individual factors (table 1) that are the subject of consideration constitute a new cognitive thread about various supply chains, both in a universal mode, and in the context of a selected research subject.

A new topic is also checking which of these factors are most conducive to building pro-environmental chains, i.e. creating resilient chains.

Table 1.

Most important factors for resilience of the analyzed supply chain

| No. | Factor | Used in |
|-----|---|--|
| 1 | Transparency The visibility of data in the company-client relationship but not in the company-supplier relationship | Christopher, Peck, 2004; Kong, Li, 2008; Jüttner, Maklan, 2011; Johnson, Elliott, Drake, 2013; Ganguly, Kumar, 2019; Dubey et al., 2020; Ivanov, Dolgui, 2021; Ekanayake et al., 2022; Kazemian et al., 2021; Ivanov, Dolgui, 2021; Karbassi Yazdi et al., 2022. |
| 2 | Collaboration The durability of relationships and joint problem solving by suppliers and customers | Christopher, Peck, 2004; Barroso, Machado, Machado, 2011; Jüttner, Maklan, 2011; Johnson, Elliott, Drake, 2013; Ganguly, Kumar, 2019; Dubey et al., 2020; Belhadi et al., 2021; Ivanov, Dolgui, 2021; Johnson, Ivanov, Dolgui, 2021; Kazemian et al., 2021; Shen, Sun, 2021; Ekanayake et al., 2022; Karbassi Yazdi et al., 2022; Kaur, Singh, 2022. |
| 3 | Redundancy Concerns all supplies but not the efficiency of machines | Christopher, Peck, 2004; Barroso, Machado, Machado, 2011; Azadeh et al., 2013; Ganguly, Kumar 2019; Hosseini, Al Khaled, 2019; Karbassi Yazdi et al., 2022. |

Cont. table 1.

| | | |
|---|--|--|
| 4 | IT Applies to traditional and more advanced systems | Kong, Li, 2008; Khan, Estay, 2015; Naghshineh, Lotfi, 2019; Singh, Singh, 2019; Gu, Yang, Huo, 2021; Hundal et al., 2021; Ivanov, Dolgui, 2021. |
| 5 | Information sharing Refers to transferring data through IT systems and 4.0 technologies | Barroso, Machado, Machado, 2011; Papadopoulos et al., 2017; Ganguly, Kumar, 2019; Naghshineh, Lotfi, 2019; Shen, Sun, 2021; Karbassi Yazdi et al., 2022; Kazemian et al., 2021; Tasnim et al., 2022. |
| 6 | Trust Concerns a relationship between a company and a supplier as well as between a client and a company | Kong, Li, 2008; Johnson, Elliott, Drake, 2013; Papadopoulos et al., 2017; Naghshineh, Lotfi, 2019; Johnson, Elliott, Dubey et al., 2020. |
| 7 | Velocity Concerns analysis, material handling and additional services | Christopher, Peck, 2004; Jüttner, Maklan, 2011; Azadeh et al., 2013; Johnson, Elliott, Drake, 2013; Karbassi Yazdi et al., 2022; Ozdemir et al., 2022. |

Source: own work based on the literature of the subject.

5. Application of the DEMATEL and AHP method in the research area

The AHP and DEMATEL techniques were used in the study. These methods belong to the group of so-called multi-criteria decision-making (MCDM) and are also used concerning supply chain research. Among other things, they are used to assess the complexity of the supply chain (Chang et al., 2016), to study the bullwhip effect (Ortiz-Barrios, 2019), supplier selection (Wu, Tsai, 2012; Hladiy, Hrytsyshyn, 2020), suppliers with two different strategic perspectives: lean and agile (Li, Diabat, Lu, 2020), ordering various parameters that affect the performance of the supply chain (Najmi, Makui, 2010).

In the context of resilient chains, these methods were used, among others, by Das et al. (2022). The authors found that cost optimization is a critical factor in the process of enhancing supply chain performance and operational capability. They also noted that this affects the sustainable development and socio-economic well-being of all stakeholders involved in the entire network. These methods were also used by Sahu et al. (2022) to study chain resistance and its balance. The authors developed a framework that serves as a decision support tool in the area of entry logistics, that is, supplier selection. These methods are also used separately in terms of chain resistance. For example, the AHP method was used to identify and analyse the drivers of resilient healthcare supply chain (HCSC) preparedness in emergency health outbreaks to prevent disruption in healthcare services delivery (Hossain, Thakur, Kazancoglu, 2022). It has also been used to assess the factors that influence the chain, as well as to take appropriate mitigation strategies to strengthen supply chains. The authors proved that suppliers of critical parts, suppliers' location and long supply chain lead times are essential to ensuring continuity of supply. It has also been shown that not only long and complex supply chains but also the practices employed by companies determine their weaknesses.

The DEMATEL method in combination with the Gray theory was applied by Rajesh & Ravi (2015). According to the authors, to increase the resilience of the supply chain, factors that enable the reduction of risk in the supply chain must be taken into account and implemented in practice. There are more papers that use these methods on green chains. This is due to the long tradition of this topic. For example, Jayant & Agarwal (2019) provided a green supplier selection decision tool. Gandhi et al. (2016) proposed a structural framework for evaluating structural funds for supply chain greening by shaping tactical, operational, and strategic flexible decision-making strategies through the combined AHP-DEMATEL approach. The use of these techniques in the study of green supply chains is also indicated in reviews (Soda, Sachdeva, Garg, 2016). In turn, Bhatia, Jakhar & Dora (2020), using AHP and DEMATEL, examined the barriers to implementing a closed supply chain (CLSC), which fits in with the idea of a green chain, whereas Huang et al. (2022) applied these methods to the implementation of a circular economy based on Blockchain technology, which is also related to pro-environmental policy in the supply chain.

6. Resilient supply chain - evaluation of the mutual relationships of factors strengthening the supply chain using the DEMATEL method

In our study, we used the DEMATEL method to assess the mutual influence of the seven selected factors, which are the basis for building the resilience of the analyzed supply chain. To extend the research, in the next step we used the AHP method to determine the importance of individual factors for the formation of a resilient chain.

The input data were obtained from the survey in the analyzed company. As a research method, we have used a structured direct interview, supplemented with contextual data on the specifics of the supply chain.

The DEMATEL method was developed in the 1970s as a procedure to solve problems of identifying cause-and-effect relationships (Gabus, Fontela, 1972; Fontela, Gabus, 1974). With time, this method has been adapted for more general usage in multi-criteria decision-making. A detailed description of the DEMATEL method and a survey of its applications can be found in (Sheng-Li et al., 2018).

The procedure starts with n factors among which we want to identify casual relationships. Interdependencies between factors are assessed on the basis of the questionnaire. For each pair of different factors, an expert has to answer how one of them influences the other and vice versa. DEMATEL uses a 5-point scale to evaluate interdependence and feedback: from *no influence* (0), to *very high influence*. The intermediate steps are: *low influence* (1), *moderate influence* (2), and *high influence* (3). Based on the expertise, the direct relationship matrix D is constructed:

$$D = \begin{bmatrix} 0 & d_{12} & \cdots & d_{1n} \\ d_{21} & 0 & \cdots & d_{2n} \\ \vdots & \cdots & \ddots & \vdots \\ d_{n1} & d_{n2} & \cdots & 0 \end{bmatrix} \quad (1)$$

where d_{ij} is the measure of the influence of factor i on factor j , obtained from the survey. The initial matrix is then normalized by dividing the maximal sum in rows, and one obtains matrix X :

$$X = \frac{1}{\max_i \sum_{j=1}^n d_{ij}} D \quad (2)$$

The “total influence matrix” T was calculated by adding all the direct and indirect effects:

$$T = X + X^2 + X^3 + \cdots \quad (3)$$

The matrix T can be calculated using the equation

$$T = X(I - X)^{-1} \quad (4)$$

To simplify the information about total influence one can use truncation and keep information only about the strongest connections between system elements. To this end, one uses a positive impact threshold θ and one eliminates the weakest connections from the structure. The reduced total impact structure is expressed by the reduced form of the total impact matrix \bar{T} , whose elements are determined according to the following formula:

$$\bar{t}_{ij} = \begin{cases} t_{ij}, & \text{if } t_{ij} \geq \theta \\ 0, & \text{if } t_{ij} < \theta \end{cases} \quad (5)$$

The threshold is calculated as an average of elements in matrix T (see, for example, Hsin-Hung, Ya-Ning, 2011; Ortiz-Barrios et al., 2019):

$$\theta = \frac{1}{n^2} \sum_{i,j=1}^n t_{ij} \quad (6)$$

In our case, the threshold level was equal to 1.181. The total impact matrix is given in the following table (the order of factors is the same as in Table 1):

$$\bar{T} = \begin{bmatrix} 0.000 & 0.420 & 0.387 & 0.000 & 0.205 & 0.352 & 0.470 \\ 0.000 & 0.000 & 0.000 & 0.000 & 0.188 & 0.000 & 0.366 \\ 0.000 & 0.000 & 0.000 & 0.000 & 0.000 & 0.000 & 0.227 \\ 0.275 & 0.249 & 0.000 & 0.000 & 0.273 & 0.264 & 0.432 \\ 0.255 & 0.442 & 0.349 & 0.000 & 0.000 & 0.370 & 0.484 \\ 0.000 & 0.272 & 0.000 & 0.000 & 0.000 & 0.000 & 0.224 \\ 0.000 & 0.291 & 0.000 & 0.000 & 0.000 & 0.244 & 0.000 \end{bmatrix} \quad (7)$$

At the end of the analysis, the appropriate indicators are calculated. Let r_i be the sum of all elements in row i of matrix \bar{T} and c_i be the sum of column i :

$$r_i = \sum_{j=1}^n \bar{t}_{ij} \quad (8)$$

$$c_i = \sum_{j=1}^n \bar{t}_{ji} \quad (9)$$

Then one defines the importance indicator ($r_i + c_i$) and the relation indicator ($r_i - c_i$) of factor i . The importance indicator represents the degree of importance of factor i in the entire system. The relation indicator describes the net effect that factor i contributes to the system.

Factors with positive relation indicators ($r_i - c_i > 0$) are classified as dispatchers (causes). On the other hand, factors with negative values of this indicator are receivers (effects). The results are presented in Table 2. The R + C variable in the table signifies the total influence potential or importance of a factor, and R–C value indicates the net influence potential of a factor.

Table 2.
Importance and relation indicators of the factors

| Factor | R+C | R-C- | Type | Rank |
|---------------------|-------|--------|------------|------|
| Transparency | 2.363 | 1.304 | dispatcher | 3 |
| Collaboration | 2.229 | -1.119 | receiver | 4 |
| Redundancy | 0.963 | -0.510 | receiver | 7 |
| IT | 1.493 | 1.493 | dispatcher | 6 |
| Information sharing | 2.566 | 1.233 | dispatcher | 2 |
| Trust | 1.725 | -0.733 | receiver | 5 |
| Velocity | 2.739 | -1.669 | receiver | 1 |

As one can see, three of the factors (Transparency, IT and Information sharing) can be classified as dispatchers. The other four factors (Collaboration, Redundancy, Trust and Velocity) are receivers. The most influential causal factor is IT. On the other hand, the Velocity is the factor that is, the highest degree, influenced by others.

Figure 1 presents the graphical representation of the factors, based on the cause-and-effect group, depicting the relationship between the influence indicators and the relationship indicators

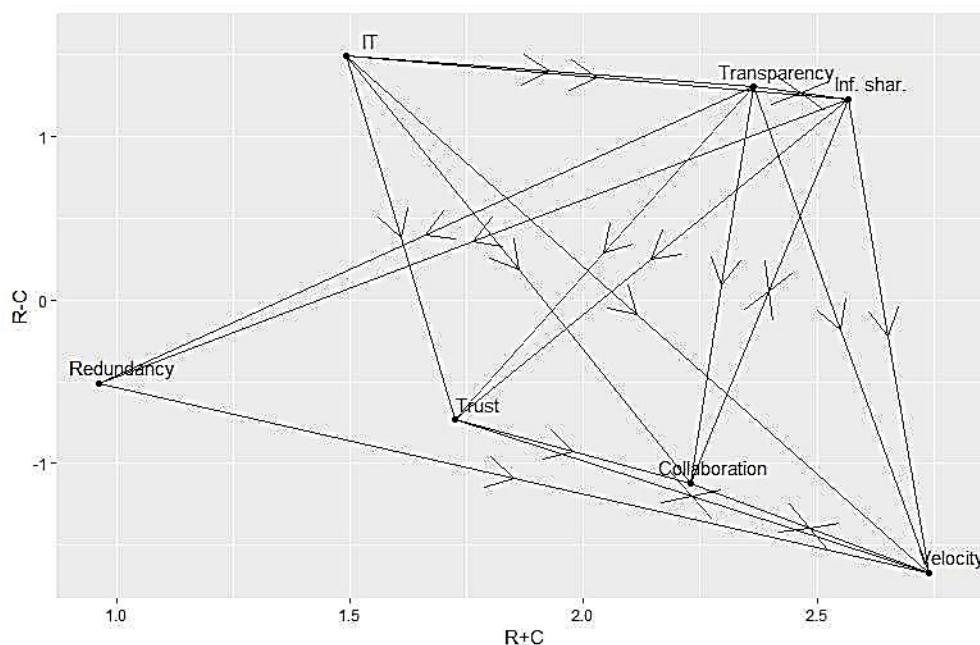


Figure 1. Impact-digraph map for seven factors of the supply chain.

The results obtained are consistent with the chain profile, as the company guarantees very short time, i.e., 48 hours, for testing the submitted samples. Equally important is the short transportation time of the samples. Therefore, the company uses airlines, despite the high costs

of transportation. Therefore, it is a critical point that influences the trust of customers and the company's brand. Due to the specific nature of the company, it is very important to cooperate both at the level of suppliers who are audited and certified and at the level of customers who, despite their often dispersed global networks, must precisely define their needs.

These two factors are influenced by transparency and information sharing, whose sources are modern IT systems and technologies. Researchers' devices and procedures are unified at the level of the entire corporation, including the tested unit, which ensures the comparability of results, regardless of the destination of the materials sent. The corporation has a Computerized Maintenance Management System (CMMS) for laboratory equipment management, periodic inspections, calibration, validation, and for the communication of messages. In turn, enterprise asset management (EAM) is used to keep devices in motion. After the tests, the algorithm collects the data and forecasts whether the parameters have changed, whether the equipment can be further used, or whether materials need to be tested more often. In addition, the company uses technologies such as cloud computing (CC), the Internet of Things (IoT), artificial intelligence (AI), and machine learning (ML). All these technologies improve the processes of sharing information and thus increase the transparency of activities.

7. Gresilient supply chain - assessment of the importance of factors using the AHP method

The literature emphasizes that to achieve sustainable competitiveness, supply chains should not only be resilient in terms of logistics but also be pro-ecological to create image strength and increase the level of trust (Rajesh, 2019). These are the so-called gresilient chains. Therefore, there is a need to develop an integrated approach that simultaneously takes into account the need to create resilient and environmentally friendly chains (Mohammed et al., 2019). In economic reality, there are situations where sustainability initiatives and practices can affect the ability of the supply chain to deal with unforeseen disruptions. Some environmental practices can increase chain resilience, for example, by attempting to increase resource efficiency and reduce the number of warehouse points and warehouse space along the supply chain. On the other hand, for example, the limited availability of safety stocks can lead to disruptions at the moment of fluctuations in supply and demand (Fahimnia, Jabbarzadeh, 2016).

Therefore, in the next stage, it was examined whether the elements that make up the resistance model in the analyzed chain also allow for shaping the green chain. Thus, the validity of the factors was checked on a peer-to-peer basis and weights were assigned for the development of resistant chains. Then, adopting the same path, it was checked whether the identified factors also contribute to the formation of green chains. For this purpose, the AHP method was used.

AHP (Analytic Hierarchy Process) is a method proposed by Saaty (1980) to solve multi-criteria decision-making (MCDM) problems. The aim of this technique is to calculate weights of the factors and construct a ranking list of them. The AHP allows the decision-maker to simplify a complex, multi-criterial problem into one ranking list, which allows one to compare factors quantitatively. The main properties of AHP are the following:

1. AHP allows to evaluate the proposed factors according to several criteria.
2. The criteria can form a hierarchical structure (criteria and sub-criteria).
3. The comparisons between factors and between criteria at each level of the hierarchy are made pairwise and qualitatively. Decision makers compare a pair of objects (factors or criteria) each time and evaluate them descriptively. The descriptions are then transformed into numbers.
4. The final result is a linear measure of the weights for all factors.

The AHP technique is summarised in several steps (Saaty 1980), given as follows.

Step 1: Define the decision problem. Identify the goals, criteria and sub-criteria.

Step 2: Establish the hierarchy of criteria.

Step 3: Develop pairwise assessments of relative importance. This step includes collecting data to form pairwise evaluations among factors. To collect the data, one has to perform a set of questionnaires. For each pair of alternatives, i, j , one has to obtain the answer to the following two questions: (1) "Which alternative (i or j) is more important?" and (2) "How strong is this importance?". The strength of importance is measured according to the Saaty scale, as presented in Table 3.

Table 3.

The Saaty's AHP scale

| Scale | Description | Interpretation |
|-------------|-------------------|--|
| 1 | Equally important | alternatives i and j are equally important |
| 3 | Moderately | experience and judgment slightly favor i over j |
| 5 | Strongly | experience and judgment strongly favor i over j |
| 7 | Very strongly | experience and judgment very strongly favor i over j |
| 9 | Extremely | the evidence favoring i over j is of the highest possible order of affirmation |
| Reciprocals | Opposites | alternative j is more important than i |

Source: (Saaty, 1980).

Step 4: Establish pairwise a comparison matrix. Based on the pairwise comparisons from step 3, create a square matrix $A = [a_{ij}]$, where a_{ij} is the result of the comparison of alternatives i and j , according to the scale from Table 1. The matrix A has thus the form:

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ a_{21} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \quad (10)$$

If there exists a consistent measure of importance of factors and v_i is the weight of the alternative i , then the relative measures of importance are equal to $a_{ij} = v_i/v_j$. In this case, the vector $v = (v_1, v_2, \dots, v_n)^T$ would be the highest eigenvector of the matrix A with the eigenvalue equal to n .

Step 5: Calculate the normalized eigenvector of A , i.e. the vector $w = (w_1, w_2, \dots, w_n)^T$ that fulfills:

$$Aw = \lambda_{max}w, w_1 + w_2 + \dots + w_n = 1 \quad (11)$$

where λ_{max} is the highest eigenvalue of A . As all elements of A are positive, according to the Frobenius-Perron theorem, the elements of w are also positive. The numbers w_1, \dots, w_n are the weights of subsequent alternatives.

Step 6: Check the consistency of the assessment. The closer λ_{max} is to n , the more consistent the obtained scale is. To check it, calculate the consistency index (CI):

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (12)$$

and compare it with a random consistency index (RI), obtained from randomly generated matrices, to obtain a consistency ratio (CR):

$$CR = \frac{CI}{RI} \quad (13)$$

The values of RI are given in Table 4.

Table 4.

Random consistency index (RI)

| | | | | | | | | | | |
|------|---|---|------|------|------|------|------|------|------|------|
| n | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| RI | 0 | 0 | 0.52 | 0.89 | 1.11 | 1.25 | 1.32 | 1.41 | 1.45 | 1.49 |

Source: (Saaty 1980).

Step 7: Integrate the assessments. If you decide that assessments are consistent enough, calculate the overall weights corresponding to each alternative by multiplying the vectors from individual matrices along with the relative weights of the criteria and the sub-criteria.

In the survey, the factors were evaluated according to two criteria: Resilience and Eco-friendliness (EF – how pro-environmental the factor is). In the survey, Resilience was indicated as a factor strongly preferred over EF, which gave the weight 83% to Resilience and 17% to EF. The CR values for the Resilience and EF criteria were 0.22 and 0.17, respectively.

The results of the analysis are presented in Table 5. As one can see, Redundancy and Collaboration are considered as the most important factors for Resilience. For creating environmental-friendly chains, the most important factors are Collaboration and Transparency.

Table 5.
Weights of the factor according to the AHP analysis

| Factor | Resilience | Rank | EF | Rank | Overall | Rank |
|---------------------|------------|------|-------|------|---------|------|
| Transparency | 1.8% | 7 | 42.7% | 1 | 8.6% | 6 |
| Collaboration | 24.9% | 2 | 20.0% | 2 | 24.1% | 2 |
| Redundancy | 38.6% | 1 | 2.0% | 6 | 32.5% | 1 |
| IT | 9.7% | 4 | 11.5% | 4 | 10.0% | 3 |
| Information sharing | 8.2% | 5 | 17.0% | 3 | 9.7% | 4 |
| Trust | 6.9% | 6 | 4.8% | 5 | 6.6% | 7 |
| Velocity | 9.9% | 3 | 2.0% | 7 | 8.6% | 5 |

The importance of the different factors varies most among redundancy, transparency, and speed. The identified differences reveal that the general weights for both types of chains cannot be used as a guide when deciding to simultaneously develop competencies in the context of creating resistant and green chains. Depending on the urgency of your needs, you should decide which factors to focus on first.

In this chain, the issues of resistance and pro-environmental approach are mutually overlapping. This is because disturbances in the chain can have a significant impact on environmental aspects. The analysed company tests oils to extend the failure-free operation of machines. The company contributes to extending the life cycle of assets, minimizing the cost of repairs and replacement of parts due to the possibility of predicting the date of necessary equipment maintenance. It also provides consulting and monitoring of machines to ensure the continuity of their work. If necessary, when it is not possible to implement it by remote support, an employee of the company comes to the customer's place. Therefore, both the timely delivery of the tests' results and the possibility of quick service after the completion of the main service leads to less pollution in the form of a reduction in the number of used oils, and extends the life of often large and very expensive equipment. The tested material does not return to the contractor. Therefore, it is necessary to utilize them systematically and efficiently, and accurately register them in the so-called BDO system of a given type of waste. Waste is collected by a specialized company with a permit every three to four weeks. Waste transfer cards are also filled in electronically concerning waste in the form of oil from which energy is partially recovered.

Taking into account the analysed factors, one can perceive their simultaneous role in the creation of a resilient chain. For example, information sharing enables one to quickly diagnose and fix problems in the flows. At the same time, information on carbon footprint and reverse logistics projects result in greater customer confidence and greater awareness of threats among all participants in the supply chain. However, some factors are clearly conducive to one type of chain or may even contribute to inhibiting the development of the other type of chain. For example, due to the fact that the company competes with speed and quality, but not with costs, it is difficult to use in this case intermodal or sea transport channels, which are more environmentally friendly.

8. Conclusions and theoretical and managerial implications

Based on the research it has been proved, despite the statements about dynamically changing external conditions and the need to act on the brink of chaos, that in economic reality there are also stable supply chains in terms of their configuration with suppliers and main customers, and in terms of the method of logistics service. In such chains, during disruptions in flows, collaboration, transparency of activities, speed of service, and redundancy of basic materials are essential. However, these activities are undertaken within the same systems, procedures and flow paths. The implementation of information technology and technology 4.0 and the unification of activities throughout the corporation accelerate processes and constitute the basis for developing cooperation and trust among business partners.

Research has established that redundancy and collaboration are important for the gresilient chain in this case.

In the future, the research perspective can be extended to the relationships of resistant chains with sustainable ones (Zahiri, Zhuang, Mohammadi, 2017), as well as to analysis in the context of the linkage of resilience aspects between dynamically integrated abilities and sustainable competitive advantage (Ponomarov, Holcomb, 2009). It is also legitimate to develop research towards multiple case studies to include various moderators in the study, such as chain complexity, geographic differentiation (Brandon-Jones et al., 2014), and a micro- and macro-economic approach (Azadegan, Dooley, 2020).

The study deliberately selected research methods (DEMATEL, AHP) that are available and appropriate for smaller companies. More advanced proposals appearing in the literature are adequate for analyses performed at the corporate level, where it is easier to find staff with sufficient competencies.

Currently, there are research models for building supply chain resilience, focused on selected elements that are generally considered important. The conducted research introduces a contextual thread regarding the specificity of the supply chain and its desired nature. This is important because, as research shows, the degree of ranking their importance varies. The conducted study contributes to the literature by:

- proving that conducting empirical research on the extraction of appropriate factors constituting a resistant chain for specific networks of links should only be an initial phase preceding deeper analyses,
- proposing simultaneous consideration of the possibility of building chains of various types using the DEMATEL and AHP methods, because in an economic reality there are usually hybrid supply chains, so separate recognition of these perspectives is not appropriate,

- proving that it is important to isolate the factors that activate work on one type of chain and at the same time contribute to the activation of work another type of chain, because some factors in this area do not correspond with each other, - expanding knowledge in the field of the resilient chain, in which research is lacking due to the initial stage of science in this area, - embedding considerations in the supply chain, which has not yet been considered in literature and is interesting due to its non-standard nature.

The work carried out may contribute to the creation of a general matrix containing paths to the expected types of supply chains, taking into account the specificity of input and output connections. The research complements our current understanding by indicating which variables can be used to formulate resilient chains in stable links in regards to deliveries and unified relations with regular or new customers.

The obtained results show managers how the factors building the resilience of the supply chain affect each other and what the strength of the interaction between them is. In addition, they show which of the factors building the resistance of flows can, at the same time, be useful for increasing the level of its environmental friendliness. Therefore, the results can help managers in implementing the resilient strategy or in modifying it if it has already been implemented. This is important because, as research shows, in economic reality, we usually do not compete with only one type of chain. It is also significant that not every environmentally friendly activity serves to create a resistant chain and vice versa. Therefore, the discovery of these relationships is important. It helps get to both operational and environmental performance faster. This research also raises awareness of the need to include these types of examinations in strategies, which are rarely undertaken in economic practices at the logistics level. As a rule, these are ad hoc actions in response to crises or marketing needs.

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EVALUATION OF QUALITY POLICY OF SELECTED COMPANIES IN THE CONTEXT OF QUALITY MANAGEMENT INDEPENDENCE

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Purpose: The primary purpose of the article is to present a study whose subject was the assessment of the quality policies implementation in selected enterprises.

Design/methodology/approach: The deliberations are based on the related subject literature and an analysis of the long-term survey results. The practical results of the research described in this article are based on a survey of supervisory employees and middle managers, who represented the enterprise by filling out a single survey sheet. The survey was conducted in 2015-2022 among 240. enterprises operating in Poland. During the survey, independence in setting quality policy was identified for 237. enterprises. These were manufacturing and service enterprises from various industries. Enterprises were selected on the basis of proposals issued to conduct a survey. The surveyed group does not have the character of a research sample. When analyzing the survey results, no parameter estimation was made on the population of Polish enterprises. The quality policy survey sheet described 35. aspects (behaviors) characteristic of a strongly quality-oriented organization, close to the TQM philosophy (The article contains results for only 10 aspects). Respondents indicated how the behavior described in the survey is characteristic of the organization where they work. The described aspects were rated by respondents on a scale of 1 to 5. The scale adopted reflects the strength of the similarity of the behavior described in the survey to the situation in each organization.

Findings: In close to every studied Quality Policy aspects, higher score was received by companies where the standards are imposed by foreign management boards. This is connected obviously not just with standards but also with the governance. The reasons for this should become a subject of further analyses. A certain potential can be observed for national companies relating to the foreign good practice implementation.

Originality/value: Knowledge of quality management issues has been increased. The article raises the issue of implementing quality policies in companies. The quality policy was characterized by selected aspects. An evaluation of these aspects in selected enterprises was carried out, and differences dividing quality policies among independent and dependent enterprises in the implementation and supervision of quality standards were identified.

Keywords: quality policy, quality management, quality management system, improvement, Total Quality Management.

Category of the paper: research paper.

1. Introduction

The increasing customer requirements concerning quality of products and services and the pursuit of improved organizational efficiency are the two main challenges for modern managers. This challenge is the major cause of determining the relevant company strategy and resulting Quality Policy. Quality Policy is the term defined in ISO 9000 standards which describe comprehensive approach to quality management in business organizations. In the current version of the said standard, the Quality Policy is defined as *the intentions and direction of the organization expressed formally by the top quality management* [ISO 9000:2015]. The said formalization makes the policy equated solely with a document. It has little to do with adopted standards and managerial practices. The study and assessment of the actual Quality Policy implemented in the organization is a difficult and complex process. This is why the best way to study the Quality Policy is the survey of the organization representatives' opinions.

In the literature, we find a number of studies on evaluating the effectiveness of quality management systems in organizations or an activity such as quality management (Roszak, 2021; Wolniak, 2011, 2021; Ligarski, 2014). Among them, we do not find research results on comparing the effectiveness of these systems among companies with different independence in establishing, implementing and supervising their quality standards. This cognitive gap is the reason for the research results described in this article.

The primary purpose of the article is to present a study whose subject was the assessment of the quality policies implementation in selected enterprises. The quality policy's results were compared among 3. groups of companies. The first group (I) are independent enterprises, forming their quality policies and standards independently. These are enterprises without external supervision. The second group (II) is enterprises with national dependence. Its quality policy and standards are set externally for them. The center of authority and supervision is located on Polish territory. The last group (III) is enterprises dependent on a power center located abroad. Quality policies were compared for each group using statistical analysis.

The fundamental research question is: are there differences in the level of quality orientation of the studied groups of companies? It can be assumed that the requirements of the global market are valid in Poland. Therefore, differences in the implemented quality policy should not be apparent. In order to verify this thesis, surveys were conducted among selected enterprises. The research methodology was described at the beginning of the article.

2. The essence of the Quality Policy and its impact on the state and results of the organization

The Quality Policy should exert a strong impact on the organization operation and results. It will be possible if it does not remain just a declaration (ISO 9000:2015), if it is developed carefully and implemented effectively in the organization (Molenda, 2015, 2019). The Quality Policy should be considered a method of the organization management and operation relating to quality. A documented Quality Policy is just a short description of this method concept evidenced in other areas of the organization management and operation.

The Quality Policy taking the form of an official document plays an important role in communication between different organizational structure levels. When communicated throughout the organization, it offers improved understanding of the top management's approach to the quality aspects. Consequently, the Quality Policy is a source of information and fosters employees' involvement.

The Quality Policy integrates the quality management system with a general organization management system (Claver, Tari, 2003). The Quality Policy becomes grounds to develop and verify quality objectives. The consistency of the Quality Policy and quality objectives enables to integrate the strategic management level fully with the quality-related operational management level (Pacana, Stadnicka, 2017)

It can be assumed that the Quality Policy is a way to shape customers' trust in the organization. The Quality Policy text will tell the customers how the organization operates and if it is likely to meet their expectations. Thanks to that, the Policy shapes a positive image of the organization in the customers' eyes and improves its credibility.

The reference works claim that the Quality Policy has an impact on many organization operations' aspects determining the efficiency and effectiveness of the organization quality-related strategies and the ultimate market success (Sułkowski, Wolniak, 2016). Another non-negligible aspect is the improvement function characteristic of companies having an effective QMS (Bugdol, Hajduga, 2023; Bugdol, 2018; Escrig-Tena et al., 2018).

In practice, the Quality Policy affects the structure and operation of the quality management system in the organization (Pacana, Ulewicz, 2020). In the simplest form, it affects the structure of its processes and formal as well as informal internal regulations adopted by the company which should be considered a concept of the Quality Policy implementation method. The implemented formal documents should be a basis for an actual manner of quality management in an organization (Ligarski, 2020; Mourougan, Sethuraman, 2017; Midor, 2013).

The Quality Policy should be reflected in the way of thinking, practice, and organizational behavior. Employees behave in a certain specific way and solve problems related to the insufficient product quality as per the actual expectations and attitudes of managers. In this context, the Quality Policy helps to shape the organizational culture (Miller, Wroblewski,

Villafuerte, 2014). To put it simply, it is a whole system of values, behaviors and artifacts that support the organizational development and that are shared by organizational community. The culture heavily oriented on quality is convergent with TQM philosophy (Sharma, Jain, Pruthi, 2013; Silva, Gomes, Lages, Pereira, 2014; Calvo-Mora, Pico'n, Ruiz, Cauzo, 2014; Chen et al., 2016).

The described practice resulting from the actual Quality Policy affects the actual condition of the organization and its results in the technical, economical, and market areas. The Quality Policy can also be assessed based on quality cost indicators which shape the ultimate financial result of the company. It is worth stressing as well that the customer satisfaction indicators stem from the adopted and implemented Quality Policy.

3. Research results in the implementation of Quality Policy

One of the determinants of Quality Policy is the independence of the senior management when it comes to policy establishment and implementation. It is no secret that the external authorities apart from imposing quality standards quite often also supervise and enforce them. During the research, the independence of an enterprise when it comes to creating Quality Policy was identified. The studied enterprises were classified into one of the following groups described in section 2 herein. Table 1 presents mean values of policy aspect assessment for all the analyzed companies.

Table 1.

Survey results for selected 10 Quality Policy aspects – mean values and standard deviations

| QP aspect | | Mean value [n=237] |
|-----------|---|-----------------------|
| #A1. | Degree of the Quality Policy determination and communication to employees by top management. | 3,67 |
| #A2. | Degree of Quality Policy implementation by top management. | 3,61 |
| #A3. | Degree of the management's decision making based on facts/reliable data and information. | 3,62 |
| #A4. | Degree of employee incentives relating to implementing the Quality Policy provided by top management. | 3,08 |
| #A5. | Degree to which the top management initiate activities improving the company and product quality. | 3,52 |
| #A6. | Degree of employees' knowledge of their obligations and responsibilities. | 3,69 |
| #A7. | Degree to which HR policy consisting in continuous employee qualification development is implemented. | 3,07 |
| #A8. | Degree to which the organization selects verified suppliers/partners to cooperate. | 3,96 |
| #A9. | Degree to which the organization cares for relationships with partners and suppliers. | 3,77 |
| #A10. | Degree to which every employee, regardless of their position, is respected in the organization. | 3,41 |

Source: own study.

The study results of selected Quality Policy aspects in the form of arithmetical means obtained for all 237 companies can be found in Figure 1. For the studied companies, the highest-scoring Quality Policy aspects include:

- #A8 – degree to which the organization selects verified suppliers/partners to cooperate (3.96),
- #A9 – degree to which the organization cares for relationships with partners and suppliers (3.77) and
- #A6 – degree of employees' knowledge of their obligations and responsibilities (3.69).

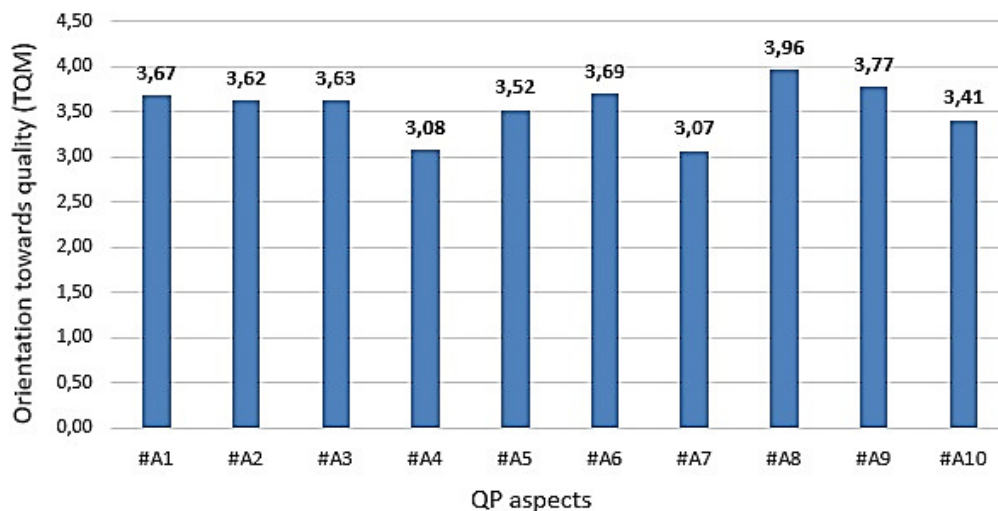


Figure 1. Rating for 10 selected Quality Policy aspects — mean values for all companies.

Source: Own study.

The lowest rating is received for the following Quality Policy aspects:

- A7 – degree to which HR policy consisting in continuous employee qualification development is implemented (3.07), employee involvement in improving their work place.
- A4 – degree of employee incentives relating to implementing the Quality Policy provided by top management (3.08).

The highest rating in the studied companies' group is awarded to the Quality Policy aspect of cooperation with suppliers, while the lowest one to the personnel management area.

4. Evaluation of Quality Policies among companies with different supervisory independence

One of the Quality Policy determinants can be the independence of Quality Policy development and surveillance of its implementation. The managers of companies subject to external authorities usually follow the imposed Quality Policy. In such companies, more intense supervision of the policy implementation can be observed, e.g. in the form of audits. During the studies, the independence of companies from any external management relating to the determination of quality procedures and standards was identified. The studied enterprises were classified into one of the following groups according to:

- full independence – procedures and standards of quality are determined by the management of the enterprise (group 1),
- national dependency – the procedures and standards of quality are determined by external national management (group 2),
- foreign dependency – the procedures and standards of quality are determined by external foreign management (group 3).

The analysis results presented in Figure 2 concern 237 companies for which the dependency form relating to the quality standard determination was identified. In three cases, the dependency was more complex. In the studied group of companies, 91 claimed full independence, 47 stated national dependency, and 99 declared their quality-related dependency on foreign management.

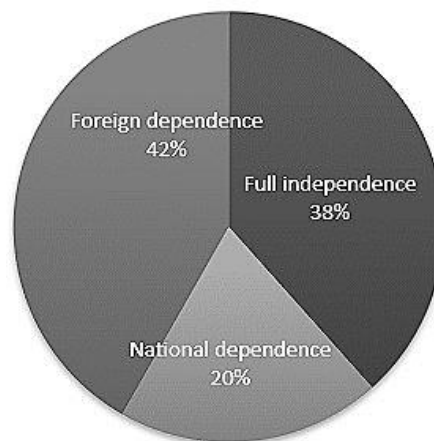


Figure 2. Structure of the studied companies due to the independence format.

Source: Own study.

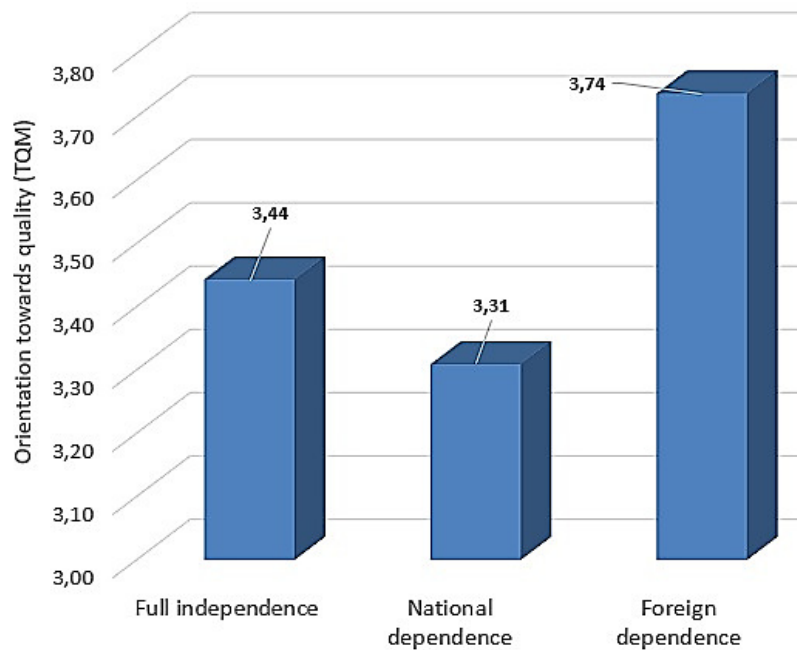


Figure 3. Comparing the quality focus in the studied group, divided based on independence of quality standard development.

Source: Own study.

Mean values of quality orientation for all the aspects in each group prove that the companies subject to foreign headquarters have the most quality-oriented policy (3.74 points). Independent companies obtained an average of 3.44 points. The least quality-oriented policy is followed by companies dependent on external headquarters in Poland (3.31). The results are presented in Figure 3.

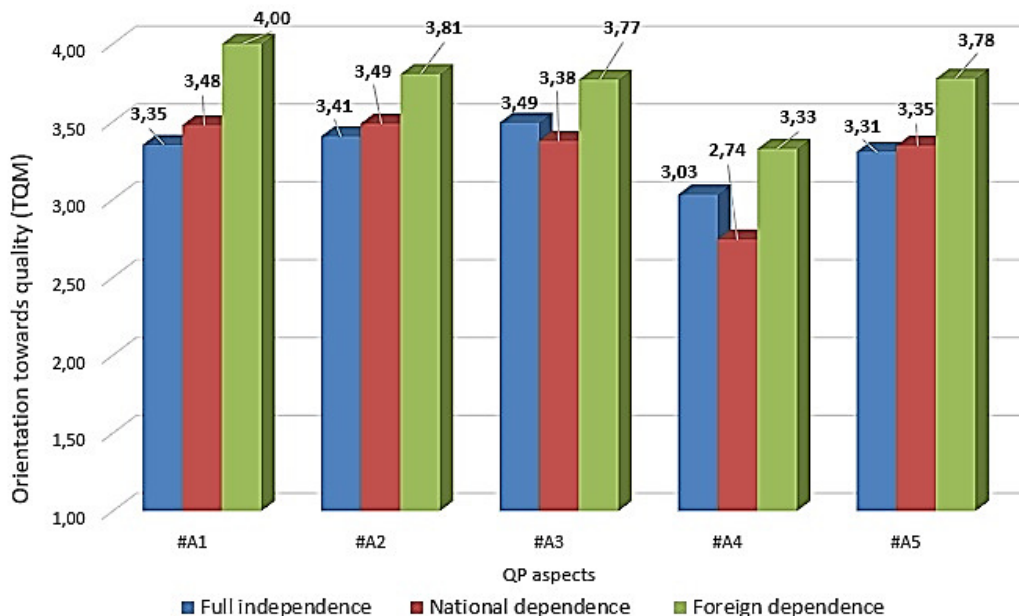


Figure 4. Comparing the quality orientation for aspects #A1 to #A5.

Source: Own study.

#A1 aspect – degree of the Quality Policy determination and communication to employees by top management is the aspect which is to show the top management's approach to the Quality Policy. The results in this respect show the significance of communicating Quality Policy as perceived by the managers. The best results are recorded for the “foreign dependency” group of companies. The “national dependency” companies achieved lower values, with the mean of 3.48. The lowest significance is attached to the Quality Policy in independent companies (3.35). Study results for #A1–#A5 aspects are presented in Figure 4.

The second aspect referred to studying the degree of Quality Policy implementation by top management. It depicts the managers' determination relating to the adopted policy implementation. Mean values in this range are highly convergent in all groups when compared to the first aspect. In this aspect, the approach to quality in companies with foreign standards received the highest rating as well.

#A3 aspect – degree of the management's decision making based on facts/reliable data and information presents the organization managers' approach to the quality management rule no. 6 (ISO 9000). This is the assessment of respondents from the middle organizational structure tier. The best results are obtained by the “foreign dependency” companies (3.77). In this aspect, independent companies achieved results slightly better than those belonging to the second group.

#A4 aspect – degree of employee incentives relating to implementing the Quality Policy provided by top management presents top-tier management's managerial activities aimed at motivating employees to follow the Quality Policy. For all the analyzed companies, this is one of the aspects with the lowest rating (see Figure 1). Group 3 companies received the best result, 3.33 points on average. The lowest rating in this aspect was received by group 2, i.e. “national dependency” companies.

An aspect characterizing the company quality orientation is the degree to which the top management initiate activities improving the company and product quality (#A5). The best orientation in this respect was observed for “foreign dependency” companies (3.78 points). Companies dependent on national headquarters recorded inferior results (3.35 points). Initiating improvement actions was rated a bit lower for independent companies (3.31 points).

In each quality-oriented company, a key role is played by the employees' knowledge of their obligations and responsibilities (#A6). The results of these aspect ratings are presented in Figure 5. These aspect ratings are most convergent and the best result differs from the worst by 0.14 points. Study results for #A6–#A10 aspects are presented in Figure 4.

#A7 aspect – degree to which HR policy consisting in continuous employee qualification development is characteristic of organizations oriented on personnel development. This is one of the aspects with the lowest score (3.07 points on average). The lowest mean value was obtained by “national dependency” companies (2.48 points). This is also the lowest score when you consider all the compared aspects.

Quality-oriented organizations should assess and select verified suppliers/supply partners. (#A8) assessment referring to the degree in which the organization selects reliable suppliers/partners is the aspect with the highest rating (3.96 points). This proves that this is one of the most important Quality Policy aspects for the analyzed organizations. The best results in this respect were observed for “foreign dependency” companies (4.13 points).

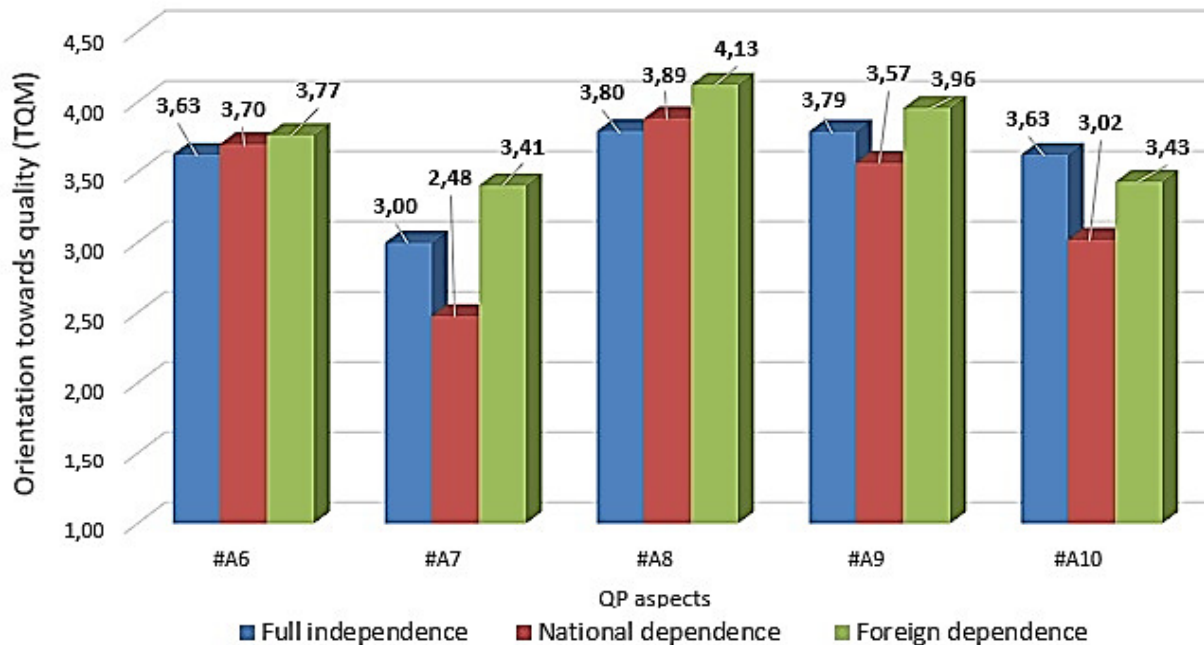


Figure 5. Comparing the quality orientation for aspects #A6 to #A10.

Source: Own study.

The company Quality Policy should be aimed at ensuring good relationship with business partners. Managing relationship with key suppliers is an end-quality determinant. #A9 aspect, i.e. the degree to which the organization cares for relationships with partners and suppliers, receives a bit inferior rating on average than the previous aspect. The lowest score was obtained by companies in the second group (3.57). “Foreign dependency” companies care for relationships with suppliers most (3.96 points).

The last aspect analyzed in this article refers to the Quality Policy in the social and cultural area. #A10 aspect refers to the degree to which all employees, regardless of their position, are respected in the organization. Interestingly, the best results in this respect (mean value of 3.63 points) were obtained by independent companies. This proves that the respect policy is best when there are direct relations with company authorities.

5. Conclusions

The impact of the Quality Policy declaration adopted by the top managers and its success relating to quality are significant, at least in theory. The Quality Policy should be a basis for establishing quality goals, developing process structure, and internal quality standards. It should also determine the actual quality management, managerial practices and employee behavior. As a consequence, it should determine the perception of the company on the market and the ultimate business success. The study results presented herein prove that the Quality Policy is most quality oriented in the supply management aspects, meaning the selection of verified suppliers/partners and taking care of good relations with suppliers/partners relating to supplies. Another area where companies get high score is the high level of employees' knowledge concerning their obligations and responsibilities. In close to every studied Quality Policy aspects, higher score was received by companies where the standards are imposed by foreign management boards. This is connected obviously not just with standards but also with the governance. The reasons for this should become a subject of further analyses. A certain potential can be observed for national companies relating to the foreign good practice implementation.

Foreign supervision of the surveyed group of domestic companies has increased their quality orientation. The results of the survey show that the best-rated aspect of the quality policy is (#A8) the aspect dealing with procurement processes, i.e. reliable evaluation and selection of the best suppliers. The policy has a strong focus on quality (3.96 points) in each of the considered groups of companies. The least targeted quality policy is in the area of personnel policy (#A7). Certainly, the continuous development of employee skills is not the strongest point of the surveyed companies. The average score for this aspect was 3.07 points.

Overall, it can be said that policies more focused on quality and TQM are observed in enterprises supervised by foreign power centers. High international standards and foreign supervision are the main reason for this. The largest differences between groups of enterprises were observed in aspect #A7 - personnel development policies. Enterprises supervised by foreign power centers scored 0.93 more than enterprises supervised by management located in the country. The smallest differences were observed in evaluations of aspect #A6 - the degree of employees' knowledge of duties and responsibilities. The difference between the studied groups is only 0.14 points. Regardless of the degree of independence, the policies are similar.

The findings highlighted the need for further research in the form of reasons for a stronger quality orientation among companies overseen by foreign boards.

It should be remembered that the group studied was not a survey sample. The values obtained are not estimators for the entire population of companies in Poland.

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THE IMPACT OF COVID-19 ON THE PRO-SOCIAL ACTIVITY OF SMALL AND MEDIUM COMPANIES

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Purpose: The conditions in which enterprises from the SME sector have to operate are not easy. The enormous changeability of the environment contributed to a shift in the ways of managing a company. In these uncertain and quite difficult times, the key variable when verifying the conducted activity is pro-social or pro-ecological activity in the form of CSR activities. The aim of the study is to define CSR models implemented by entrepreneurs from the SME sector.

Design/methodology/approach: The research task was carried out based on the literature on the subject and the results of a survey from the first half of 2021, conducted among 164 enterprises based in the Slaskie Voivodeship. Due to the nature of the obtained data (qualitative features), the correlation studies used the φ - Youla correlation coefficient based on the χ^2 statistic.

Findings: The conducted analyses have shown that the pandemic has led to changes in the approach of entrepreneurs to the subject of CSR. The conducted research has shown that the importance of CSR activities increases with the increase in the size of the enterprise. The conducted research allowed us to verify the adopted hypotheses. The results showed that the pandemic has indeed led to changes in the approach of entrepreneurs to the subject of CSR, as there is a decrease in the positive perception of CSR as an important element of the functioning of the company on the market.

Originality/value: The conducted study allowed to identify the tendency towards pro-social activity of enterprises from the SME sector in the time of the COVID 19 pandemic. In the course of the research, an upward trend was determined in the case of medium-sized enterprises, stable in the case of small enterprises and a downward trend in the case of micro-enterprises. The study also allowed for a model approach to CSR activities in selected groups of enterprises.

Keywords: enterprises from the SME sector, social responsibility, CSR models, COVID-19, stakeholders.

Category of the paper: Research paper.

1. Introduction

The COVID-19 crisis has caused major disruptions in the economy, and thus in the activities of a number of companies, which in turn has led to major changes in their functioning. Today's businesses face many challenges, including temporary closures, limited capacity, unexpected workforce changes, and supply shortages. In fact, many economic actors have been forced to close, leading to "unprecedented trade disruption across most industry sectors" (Donthu, Gustafsson, 2020). Moreover, the pandemic has created a situation of endemic uncertainty and confusion about the risks to workers, measures and best practices that organizations should adopt (Bryce et al. 2020). It should be remembered that enterprises from the SME sector are more vulnerable to the crisis. They have far fewer resources and tools to adapt to the changing context. For this reason, these enterprises are struggling with difficult questions about how to survive and thrive in the times of COVID-19, while meeting public expectations regarding corporate actions to fight the virus (Lee, Cho, 2022).

In view of the above, the question arises whether SMEs should care about the public good and concerns in this pandemic or not. On the one hand, the crisis caused by the COVID-19 pandemic has changed the way modern companies pursue their economic, social and environmental goals (García-Sánchez, García-Sánchez, 2020). On the other hand, according to Ou et al. (2021), declines in customer traffic, profits and purchases made many enterprises focus on CSR initiatives. It can be said that in this new scenario, enterprises should adopt CSR strategies in order to establish business commitment towards society and vulnerable groups. Taking care of employees' health, a flexible approach to work or undertaking support activities are the foundation of a new view of CSR.

Taking into account the presented premises, this study aims to fill the research gap by attempting to define the CSR strategy in enterprises in the SME sector during the crisis caused by the COVID-19 pandemic. Secondly, the author has developed a model of activities of enterprises from the SME sector in the field of CSR activities.

2. Literature review and conceptual framework

There is no doubt that social responsibility (CSR) should be considered through the prism of economic, legal, ethical and discretionary (later philanthropic) expectations that society has towards the organization at a given moment (Carroll, 1979, Carroll, 1991). It can be said that CSR is a modern business model in which enterprises make coordinated efforts to act in a way that improves and does not degrade society and the environment (Singh et al., 2019). It should be noted here that the outline of social responsibility both in the theory and practice of

management from the very beginning aroused numerous debates and controversies, at the same time arousing the interest of scientists dealing with management, sociology, strategy, law and other fields (Kabir, Chowdhury, 2022).

In the literature on the subject, CSR has been identified as a key factor in the success of an organization (Beck et al., 2018; Mutuc, Cabrilo, 2022), affecting mainly: financial results (Mutuc, Lee, 2019; Chen et al., 2017), organizational culture (Yu, Choi, 2016; González-Rodríguez et al., 2019), stakeholders (Boronat-Navarro, Pérez-Aranda, 2019; Tong et al., 2021; Sidhoum Serra, 2017; Tang, Tang, 2018), image (González -Rodríguez et al., 2015; Darwish, Naggat, 2021), job engagement and satisfaction (Chan, Hasan, 2019; Farrukh et al., 2020).

Although CSR has become a common business model, it remains unclear how companies will engage in CSR activities in the face of a major crisis. Therefore, the question arises whether enterprises, despite serious disruptions (economic, health and social) related to the outbreak of the COVID-19 pandemic, are able to carry out socially responsible activities. He, Harris (2020) found that CSR activities during the pandemic provided companies with an excellent opportunity to strengthen their relationship with society. A slightly different view was presented by Crane, Matten (2021), according to whom the COVID-19 pandemic not only questioned the existing assumptions, concepts and practices of CSR, but also changed the expectations of stakeholders in this area. Supporting the common good of society (fighting the COVID-19 pandemic) has become as important a goal as ensuring shareholder value and profitability for organizations of any size. It can be said that the COVID-19 pandemic has brought with it a new face of CSR. Following Moura-Leite, Padgett (2011), it should be stated that CSR is not a panacea for social problems of all enterprises, especially in times of crisis, but it contains an important premise that the entrepreneur should follow in the future. Lang (2022) reports that during the COVID-19 crisis, many enterprises actively engaged in various CSR activities, especially those that can offer immediate help and support in the fight against the virus. Unfortunately, some enterprises were unable to continue the planned CSR activities. This was due to the fact that many of them struggled with financial problems resulting from the imposed restrictions.

Therefore, the following are the research questions that this study seeks to answer:

- (A) Has the COVID 19 pandemic led to a change in the way enterprises from the SME sector implement CSR activities.
- (B) Does the size of the company matter in the implementation of CSR activities.

3. Research methodology and research sample

The study used a structured questionnaire, divided into two parts. The first identified the respondents (entities from the SME sector), the second substantive identified the impact of COVID-19 on their pro-social activities.

To decide on the size of the sample, reference was made to the work of Boubakary, Moskolaï, (2016), who used a sample of 126 enterprises from the SME sector to study CSR. According to the authors, this sample size remains statistically acceptable. And so, 164 entrepreneurs with their registered office in the Silesian Voivodeship took part in the study. Data collection took place from March 2021 to June 2021.

The characteristics of the tested environment showed that:

- 38.4% of the surveyed group are medium-sized enterprises, 29.3% of the total are micro-enterprises, 22.6% are small enterprises, 9.8% run their own business,
- 47.6% of enterprises are medium-sized service companies, 17.1% of all respondents are small trade enterprises, 14.6% are medium-sized production enterprises, 9.8% are service and trade companies, 6.1% are service companies - trade and production, 2.4% each went to entities with the following profiles: production and trade and service and trade,
- 30.5% of the surveyed entrepreneurs operate on the local market, 28.3% on the European market, 24.1% on the regional market and 10.7% on the European market, 6.4% on the global market.

It should be noted that the developed questionnaire was completed by business owners or by a person appointed by them holding a managerial position.

Due to the fact that CSR is a voluntary action strategy, the limits of the sample cannot be defined. Therefore, purposeful sampling was used in this study (Li, Chen, 2023). According to Johnson, Christensen (2019), the use of purposeful sampling allows you to create a research sample with specific characteristics. Therefore, this study identifies those enterprises from the SME sector that engage in CSR activities. Thus, 11.3% of the surveys declared that there is a long-term CSR strategy in their company. 9.5% of the respondents reported that their company has an annual or even two-year CSR action plan. In turn, in other enterprises, CSR activities are undertaken on an ad hoc basis, depending on the needs and capabilities of the enterprise.

4. Results¹ and discussions

In the conducted study, the areas of activity of small and medium-sized enterprises in the aspect of CSR before and during the COVID-19 pandemic were analyzed. The analysis of the collected material showed that:

- before the outbreak of the COVID-19 pandemic, for 46.3% of enterprises (especially medium-sized), CSR activities were an important element of management, for 25.6% of enterprises (mainly micro-enterprises) it was not a strategic aspect of their activity on the market, and for 28% of enterprises it was not convinced of the role previously played by the CSR strategy in their company,
- after the outbreak of the COVID-19 pandemic, the approach of enterprises from the SME sector has changed, which is particularly visible in the group of enterprises considering CSR as an important element of the company's functioning on the market (a decrease of 46.3% to 40.9%, which can be considered a negative phenomenon from the point of view of from the point of view of CSR), a positive phenomenon (increased interest in CSR activities) is noticeable in the group of enterprises considering the CSR strategy as of little importance, there is also a noticeable increase in ignorance regarding the role of CSR in the enterprise.

Bernardi, Stark (2018) are of the opinion that the implementation of CSR is a form of social contract fulfillment, as well as an attempt to build its legitimacy in the eyes of stakeholders. For this reason, building relationships and creating value for a wide range of stakeholders is becoming increasingly important. Organizations are expected to take care of their employees, suppliers, customers and fulfill their obligations towards local communities and the entire society, including the natural environment (Barić, 2017). The obtained research results showed that in the case of customers, employees and the natural environment, the activity of the surveyed enterprises decreased. On the other hand, in the area of suppliers, as well as business partners and local communities, an increase in CSR activities was recorded. In turn, determining the relationships that occur between individual areas of CSR activities (Figure 1), a statistically significant correlation also occurred between the implementation of CSR activities in the area of suppliers and the size of enterprises ($\varphi = 0.187$; $\chi^2 = 5.741$; $p = 0.017$). It shows that the increase in the size of enterprises will lead to greater involvement in future CSR activities in the mentioned area.

The analysis of the collected material showed that the COVID-19 pandemic divided the surveyed companies into three main groups:

¹ The presented research results are a fragment of the author's research, which is the basis for the monograph: K. Olejniczak-Szuster (2021). Socially responsible entrepreneur - motives and strategies of action in the era of the COVID-19 pandemic. Sources, concepts, models. PCZ Publishing House, Częstochowa.

- the first is made up of enterprises that declared the implementation of CSR activities planned earlier (before the pandemic), increasing their scale by implementing initiatives related to the fight against the pandemic,
- the second is made up of enterprises that have suspended CSR activities, including the strategy in this area,
- the third, which is made up of enterprises that do not implement the social responsibility activities planned before the pandemic, focusing only on survival.

Moreover, the obtained results allowed to determine the model of conduct of the surveyed enterprises in the field of CSR during the COVID-19 pandemic. With regard to the CSR models proposed by Walton (1967), the obtained results showed that in the era of the COVID-19 pandemic:

- every second company implements the Household model, in which CSR activities relate mainly to employees,
- every third company implements the Austere model, in which the CSR activity has receded into the background. Their efforts mainly relate to maintaining their own business during the current crisis,
- every fifth enterprise implements the Vendor model, whose activities are aimed at customers.

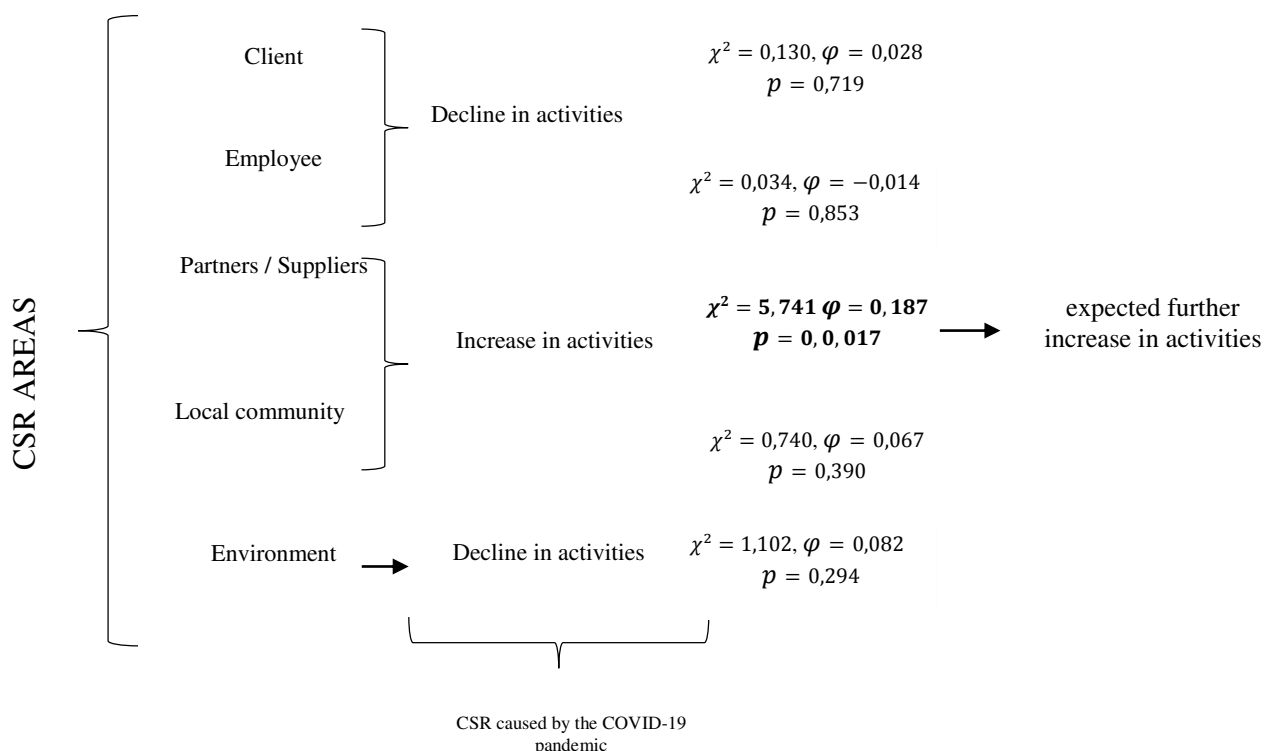


Figure 1. Areas of CSR activities during the COVID19 pandemic.

Source: own study.

The conducted research also showed the dependencies that occurred between the size of enterprises and changes in the field of CSR during the pandemic period. Thus, a statistically significant correlation was observed in terms of:

- suspension of some of the CSR activities carried out and planned for this year ($\varphi = 0,172$; $\chi^2 = 4,842$; $p = 0,028$),
- undertaking new initiatives related to the active fight against the pandemic ($\varphi = 0,216$; $\chi^2 = 7,652$; $p = 0,006$),
- changes in strategy and future CSR activities ($\varphi = 0,248$; $\chi^2 = 10,115$; $p = 0,001$).

In these cases, these activities were observed more often in small and medium-sized enterprises. On the other hand, the opposite situation ($\varphi = -0.216$; $\chi^2 = 7.601$; $p = 0.006$) was observed for micro-enterprises and the self-employed in terms of possible lack of impact on CSR activities. It can be assumed that these enterprises dealt with problems in areas other than CSR in the analyzed period.

Taking into account the above-mentioned size of the company, it was noticed that depending on the size of the company, a different stance towards CSR activities is implemented (Figure 2).

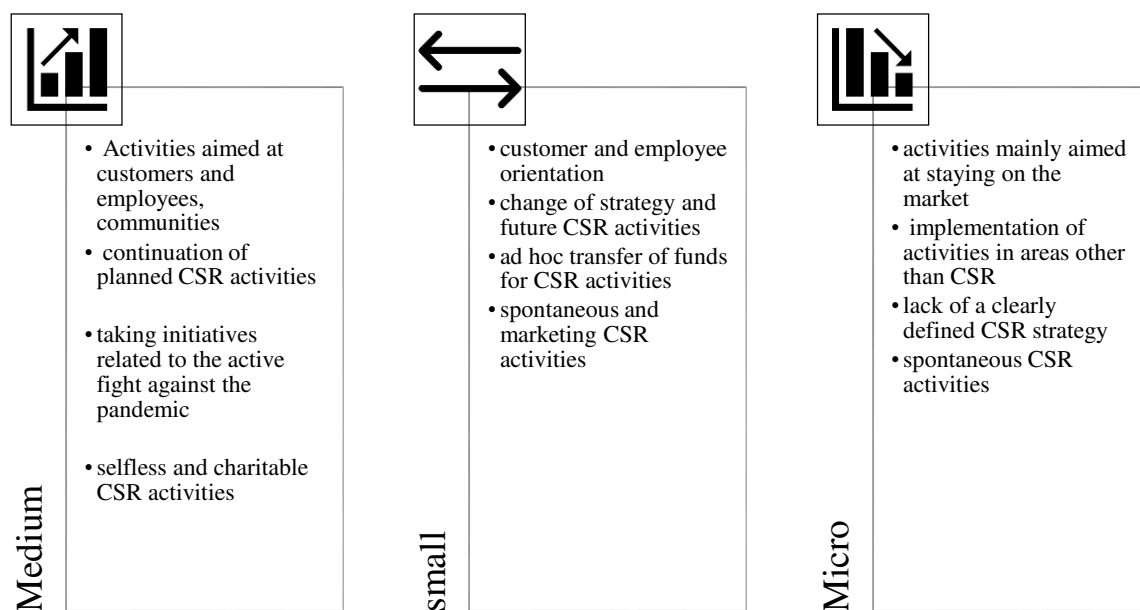


Figure 2. Models of CSR activities during the COVID19 pandemic, broken down by company size.

Source: own study.

In summary, it can be said that despite various trends in the implementation of CSR activities by entrepreneurs, several common aspects can be identified. Firstly, entrepreneurs relate their activities to the fulfillment of social duties, and their actions are spontaneous. Secondly, the surveyed entrepreneurs mostly do not have strictly defined CSR strategies, and the actions are ad hoc, usually dependent on financial capabilities. Thirdly, CSR activities are primarily aimed at employees and customers.

Summary

The outbreak of the Covid-19 pandemic has set big challenges for the implementation of the CSR initiatives. It can be said that Covid-19 pandemic has put many of them to the test in terms of pro-social and pro-ecological involvement. From a practical point of view, the results of this study show the exchanges that occurred in the areas of the implementation of CSR initiatives. It can be said that the global crisis forced enterprises from the SME sector to intensify and adapt CSR activities. In the course of research, it was found that: an increase in the size of enterprises determines to orient the surveyed enterprises for greater involvement in CSR activities in relation to implemented activities before pandemic. What's more, studies have shown changes in the attitudes of enterprises from the SME sector on socially responsible activities during the Covid 19 pandemic crisis.

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ANALYSIS OF THE IMPACT OF SELECTED LEAN MANUFACTURING TOOLS ON THE PARAMETERS OF THE PRODUCTION PROCESS – CASE STUDY

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Purpose: The aim of the research was to present the impact of the use of selected Lean Manufacturing tools (5S and Poka Yoke) on the efficiency of the production process and the number of non-conforming products generated during the manufacturing process. The research was carried out on the basis of data from a production plant in the automotive industry.

Design/methodology/approach: The article presents a statistical analysis of the impact of the implementation of Lean Manufacturing tools on the production process - a case study.

Findings: The obtained results allowed to present the scale of changes coming in the manufacturing process, confirming at the same time the positive effect of the implementation of Lean Manufacturing tools on the efficiency of the manufacturing process and the quality of manufactured products. As a result of the implementation of the 5S and Poka Yoke tools, an increase in efficiency was found in all production operations.

Social implications: The analysis carried out can increase awareness of the importance of the impact of Lean Manufacturing on the production process.

Originality/value: In the article, an original statistical analysis was carried out, indicating an increase in the efficiency of the production process due to the implementation of selected Lean Manufacturing tools.

Keywords: Lean Manufacturing, 5S, Poka Yoke.

Category of the paper: Case study.

1. Introduction

The aim of the study is to present the changes taking place in the employment structures of production plants, occurring as a result of the implementation of modern production management and control systems as well as the automation of production processes that fit into the framework of Industry 4.0. The conducted analysis was based on the analysis of data from production plants with a high level of automation and computerization of production processes,

in line with the philosophy of Industry 4.0. The collected information will allow to present the current situation on the labor market and the needs of production plants for a strictly defined profile of an employee. In the era of a highly competitive market and the rivalry of companies with similar production capacities, their work organization plays an important role. In many cases, the factor that allows for the increase of competitiveness is the appropriate selection of organizational tools that have an impact on improving the efficiency and/or quality of the manufactured product or the services provided (Rohani, Zahraee, 2015). One of the methods of work organization management is the implementation of the Lean Manufacturing (LM) concept in enterprises. It should be noted, however, that the correct implementation of the LM philosophy is a complex process with many problems. Studies conducted in production plants in Great Britain (Baker, 2002) and in companies from the automotive industry from the United States and India indicate a low level of effectiveness in the results achieved despite the implementation of the Lean concept (Mohanty et. al., 2007). While in the article (Venkat, 2020) based on the analysis of the impact of LM on the efficiency of the assembly line production process in the electrical industry, an increase in productivity of almost 23% was found. Similar conclusions indicating the improvement of the achieved parameters were presented in the paper (Samuel, 2021). The reason for different results in the effectiveness of the impact of the LM concept on the generated parameters of the production process may therefore be the way they are implemented in the enterprise, which was described in (Mostafa et al., 2013).

In research (Pavnaskar et al., 2003), it was found that one of the most important factors affecting the correct implementation of the LM concept is the use of a project approach focusing on the implementation of one Lean tool at a time. It is necessary to constantly control the effects of the implementation of selected LM tools and evaluate the results obtained.

The aim of the research was to present the impact of the use of selected Lean Manufacturing tools (5S and Poka Yoke) on the efficiency of the production process and the number of non-conforming products generated during the manufacturing process. The research was carried out on the basis of data from a production plant in the automotive industry.

2. Lean Manufacturing

The Lean Manufacturing concept, which was initiated by Toyota, allows for quality improvement, cost reduction and an increase in the speed of response to numerous changes resulting from the dynamics of external and internal factors occurring in various types of processes (Mohan Sharma, Lata, 2018). The benefits resulting from the use of tools in accordance with the LM philosophy caused that they were implemented in numerous production plants around the world (Rahman, 2013). High flexibility in the implementation of individual LM tools meant that they were used in many industries and industries such as:

healthcare, construction and pharmaceuticals (Buggy, Nelson, 2005; Aziz, Hafez, 2013). With the use of Integrated Lean Concepts, organizations are able to achieve the assumed quality goals while reducing production documentation (Jewalikar, Shelke, 2017).

Lean Manufacturing allows for the reduction or elimination of waste (Nandakumar et al., 2020; Ghosh, 2013). Waste is understood as all activities that do not bring a positive value to the created product or object being the subject of the ongoing process (Chowdary, George, 2016). The elimination of waste as a result of the implementation of the Lean philosophy is based on the introduction to the existing process of tools characterized by specific features that affect selected aspects of the process, causing previously expected results.

The reduction of waste as a result of the implementation of LM tools leads to an increase in efficiency by shortening the execution times of individual production operations (Wahab, 2013; Abdulmalek, Rajgopal, 2007), improving the quality of manufactured products (Pettersen, 2019) and shortening the delivery time of products to the customer (Ghosh, 2013). There are many LM tools, including: value stream mapping (VSM), kaizen, 5S, Jidoka, SMED, Poka-Yoke, TPM, Heijunka, Just-In-Time (JIT) or Kanban.

Then it is necessary to correctly implement the tool and evaluate the results obtained. It should be noted that the result of the implementation of LM tools is not the same for every process and depends on many factors, which include, among others: the complexity of the process, the technological aspect, the correctness of the implementation of Lean tools or the awareness of employees at every level of the organization (Palange, Dhattrak, 2021). An important role in the proper implementation of Lean Manufacturing tools in the organization is played by the management. The authors of works (Mohammad, Oduoza, 2019; Zargun, Al-Ashhab 2014), defined the key factors determining the effectiveness of the implementation of the Lean philosophy and grouped them into four main areas, two of which are "Leadership and management" and "Strategy". Proper management of the organization allows for the implementation of the Lean culture, which emphasizes relations between employees at every level of the company (Ghodrati, Zulkifli, 2012; Pepper, Spedding, 2010).

3. Methodology and research area

The analysis was based on data collected in the production plant where the manufacturing process of products used for the production of automotive components is carried out. The analyzed process consisted of seven operations carried out on individual, specialized production stations, technologically adapted to the implementation of the tasks - in accordance with the guidelines contained in the technological documentation. Operations carried out as part of the manufacturing process were carried out manually with the use of simple tools adapted to the assumed technology of performed activities. The production process was not automated.

The arrangement of workstations was in the form of a linear form of production organization and was consistent with the order of operations performed. The production process, due to the type of production and the reproducible size of the production batch, was carried out in a series-parallel system. Employees performing production operations had full training and their number was constant throughout the period of the analysis. The average production volume per month was 10,000 units. Transport operations between the stations were carried out using automated conveyor belts and transport trolleys. Before starting the analysis, the LM technique in the form of the Kanban tool was implemented in the production process organization system. Operation execution times were determined using the MTM I method at the process planning stage, Table 1.

Table 1.

Production operations execution times, determined at the production planning stage

| Operation number | Description of the operation | Theoretical execution time of the operation [s] |
|------------------|--|---|
| 10 | Execution of steel connectors with bend | 48 |
| 20 | Production of steel hooks with a hole \varnothing 8 | 27 |
| 30 | Making the core insert | 54 |
| 40 | Making soldered connections | 17 |
| 50 | Assembling the sub-assembly from parts of the components | 134 |
| 60 | Mounting the subassembly with bracket | 25 |
| 70 | Pressing | 9 |

The process of implementing LM tools was gradual. First, the 5S tool was implemented on all production stations. The implementation of the 5S tool was carried out in accordance with the accepted standards covering a five-stage procedure, i.e. selection, systematics, cleaning, standardization and self-discipline, Figure 1. Since the implementation of the 5S tool, regular control of the correctness of the implemented procedures was carried out, confirming the correct implementation of the 5S tool.

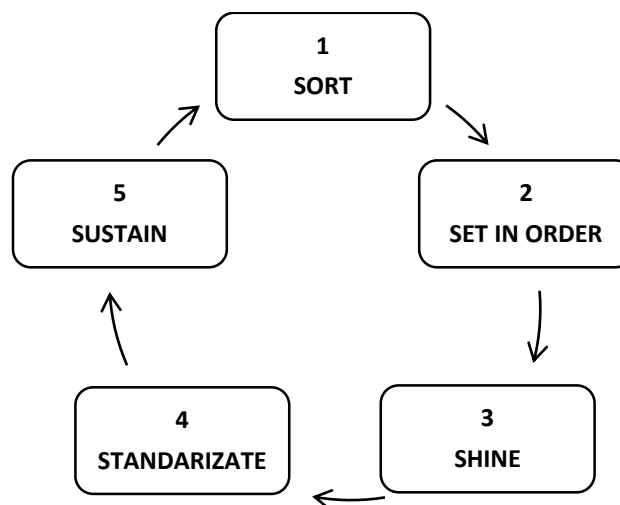


Figure 1. A Scheme of the 5S method.

The period of implementation of the mentioned tool was 3 months. Then, 14 months after the implementation of the 5S tool, systems preventing errors by employees (Poka Yoke) were implemented at two production stations (operations 10 and 50). On the remaining stations, the implementation of the Poka-Yoke tool was not possible due to technological reasons. During the analysis, data was collected on: the time of execution of operations and the number of production shortages. The measurement of the analyzed parameters was carried out for a total of 37 months and covered the time before the introduction of Lean Manufacturing tools (9 months), after the implementation of the 5S method (14 months) and after the implementation of Poka-Yoke (14 months).

The analysis of the impact of Lean Manufacturing tools on the efficiency of the production process and the level of generated defects was carried out in the order described below. First, an analysis of data on the parameters characterizing individual operations and their performance was carried out before the implementation of techniques in accordance with the LM concept. The efficiency of the production process was determined on the basis of the analysis of the actual times of the operation in relation to the theoretical time determined at the planning stage of the production process. The real-time measurement was carried out in accordance with the principles of working day photography. The efficiency of the production process was determined on the basis of the Eq. 1.

$$E = \frac{t_r}{t_n} * 100\% \quad (1)$$

where:

E – actual performance index [%],

t_r – real time of operation execution [s],

t_n – normative time to perform the operation [s].

Then, an analysis of data on the number of non-conforming products (deficiencies) occurring after the implementation of the 5S method and Poka Yoke, Eq. 1 was carried out.

$$D = \frac{n_d}{s} * 100\% \quad (2)$$

where:

D – defects [%],

n_d – number of defects in the process [pcs],

s – size of the production batch [pcs].

Then, for the obtained data on the efficiency of the process and the number of errors on individual operations, a statistical analysis was carried out in order to determine the statistical significance of the observed differences in individual scales. Kruskal-Wallis ANOVA, Mann Withney U and POST-HOC tests with Dunn Bonferroni correction were used for statistical analyses. The assumed confidence level α for each of the conducted analyzes was 0.05.

4. Research results

In order to carry out the analysis, first, production plants were selected, characterized by a high level of automation of production processes and an extensive IT network allowing for remote control of production processes and information flow. Then, the current state was compared with the historical state recorded in each of the production plants. Due to the different date of establishment of the analyzed plants, the period of historical data was between 5 and 10 years. For the purposes of the research, nine production plants with various levels of employment were analyzed (Figure 1). As a result of the conducted analysis, data on the actual execution times of production operations obtained in the period of 9 months were determined. On the basis of the obtained data, the actual performance index and the percentage share of non-conforming products generated by individual production operations were determined. These data, presented in Table 2 was taken as reference data.

Table 2.

Parameters of the production process before the implementation of Lean Manufacturing tools

| Operation number | 10 | 20 | 30 | 40 | 50 | 60 | 70 |
|----------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Theoretical time [s] | 48 | 27 | 54 | 17 | 134 | 25 | 9 |
| Average real time [s] | 61 | 43 | 63 | 22 | 209 | 36 | 10 |
| Median | 72 | 65 | 80 | 28 | 263 | 47 | 12 |
| MAX operation execution time [s] | 51 | 27 | 55 | 18 | 158 | 28 | 9 |
| MIN operation execution time [s] | 60 | 41,5 | 62 | 21 | 205 | 34 | 10 |
| Actual performance index [%] | 80 | 68 | 86 | 78 | 66 | 72 | 89 |
| Non-compliant products [%] | 11 | 4 | 5 | 4 | 17 | 5 | 2 |

Based on the analysis of the parameters of the production process before the implementation of Lean Manufacturing tools, it was found that the highest level of efficiency was characterized by operation 30 and 70 and were 86% and 89%, respectively. The lowest level of efficiency was recorded in operation 50 and amounted to 66%, such a low level of efficiency in operation 50 was related, among others, to its level of complexity and the number of activities that must be performed. In the case of the analysis of the level of deficiencies in individual production operations, the highest percentage of non-conforming product occurred in operations 10 and 50 and amounted to 11% and 17%, respectively.

After the implementation of the 5S method, in the next 14 months, production data was collected, which was used to determine the values of operation execution times and their efficiency, which are presented in Table 3. After another period of implementation of the Poka Yoke tool on operations 10 and 50, analogous data were collected and determined for the next 14 months, which are presented in Table 4.

Table 3.*Parameters of the production process after the implementation of the 5S tool*

| Operation number | 10 | 20 | 30 | 40 | 50 | 60 | 70 |
|----------------------------------|----|------|------|------|-----|------|----|
| Average real time [s] | 54 | 37 | 63 | 21 | 179 | 32 | 10 |
| Median | 54 | 36,5 | 62,5 | 20,5 | 172 | 32,5 | 10 |
| MAX operation execution time [s] | 58 | 43 | 69 | 23 | 223 | 35 | 11 |
| MIN operation execution time [s] | 49 | 28 | 57 | 18 | 158 | 26 | 9 |
| Actual performance index [%] | 89 | 75 | 86 | 82 | 76 | 79 | 92 |
| Non-compliant products [%] | 10 | 5 | 6 | 4 | 16 | 5 | 2 |

Table 4.*Parametry procesu produkcyjnego po wdrożeniu narzędzia Poka Yoke (5S + Poka Yoke)*

| Operation number | 10 | 50 |
|----------------------------------|----|-----|
| Average real time [s] | 51 | 176 |
| Median | 51 | 168 |
| MAX operation execution time [s] | 52 | 211 |
| MIN operation execution time [s] | 48 | 152 |
| Actual performance index [%] | 95 | 77 |
| Non-compliant products [%] | 2 | 6 |

As a result of the implementation of the Poka Yoke tool, the efficiency of operations 10 was increased to 95%. There was also a decrease in the level of deficiencies in operations from 10 to 2%, and in the case of operations from 50 to 6%.

A comparative analysis was carried out for the real efficiency index and the share of defects. The results did not confirm statistically significant differences for each of the operations ($p > \alpha$) after the implementation of 5S. Then, in order to determine the statistical significance of each of the above-mentioned indicators after the introduction of Poka Yoke on operations 10 and 50, the POT-HOC test was performed, the results of which are presented in Tab. 5 and 6. It was found that there were significant differences in efficiency and the number of deficiencies after the implementation of the 5S and POKA YOKE tools in relation to the state before the implementation of the above mentioned tools.

Table 5.*POST-HOC results for operation 10*

| P Value | Without LM | 5S Tool | 5S Tool+POKA YOKE |
|------------------------------|------------|---------|-------------------|
| Actual performance | | | |
| Without LM | | 0,255 | <0,001 |
| 5S Tool | | | 0,028 |
| 5S Tool+POKA YOKE | | | |
| Share of deficiencies | | | |
| Without LM | | 1 | 0,001 |
| 5S Tool | | | 0,001 |
| 5S Tool+POKA YOKE | | | |

Table 6.
POST-HOC results for operation 50

| P Value | Without LM | 5S Method | 5S Tool+POKA YOKE |
|------------------------------|------------|-----------|-------------------|
| Actual performance | | | |
| Without LM | | 0,070 | 0,019 |
| 5S Tool | | | 1 |
| 5S Tool+POKA YOKE | | | |
| Share of deficiencies | | | |
| Without LM | | 1 | 0,001 |
| 5S Tool | | | 0,001 |
| 5S Tool+POKA YOKE | | | |

5. Research results

The results obtained, indicating an increase in the efficiency of the production process as a result of the implementation of the 5S tool, confirm the observations presented in the article (Sharma, Singh, 2015) and (Fernandes et al., 2018). After the implementation of the 5S tool, an increase in efficiency was recorded on six production operations, the highest increase in efficiency was recorded on the 50th operation and reached 76%. The increase in efficiency resulted from tidying up the workplace, but also from the introduction of standards for cleaning the workplace after its completion. The implemented solutions in the form of a shadow table and formalized instructions for cleaning the stations ensured their order and, consequently, eliminated time delays in the implementation of production operations. In the analyzed case, the statistical difference between the generated process parameters before and after the implementation of 5S using the Mann Withney U test did not confirm the statistically significant differences, however, the downward trend of the obtained results was noticeable. The above results indicate the need for the production plant to consider the possibility of implementing further LM tools, which will contribute to further improvement of process efficiency in individual operations. This thesis is confirmed by the results described below for operations 10 and 50, on which the Poka Yoke tool was implemented.

As a result of the analysis of efficiency and generated deficiencies for operations 10 and 50 after the implementation of 5S and Poka Yoke, the value of the p statistic was less than the adopted confidence level α . The results obtained in the analysis of the level of efficiency for operation 10 indicated that in the case of comparing the process efficiency parameters before the implementation of the Lean Manufacturing tools and the 5S tool with the implementation of the Poka Yoke technique, there is a statistically significant difference, which is graphically presented in Fig. 2-5. In the case of operation 50, a statistically significant difference was found only in the case of comparing the parameters generated by the production process before the implementation of the 5S tool with the implementation of the Poka Yoke tool.

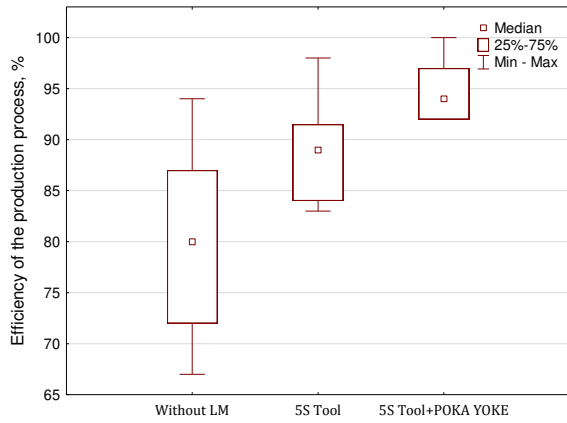


Figure 2. Efficiency of the production process - operation 10.

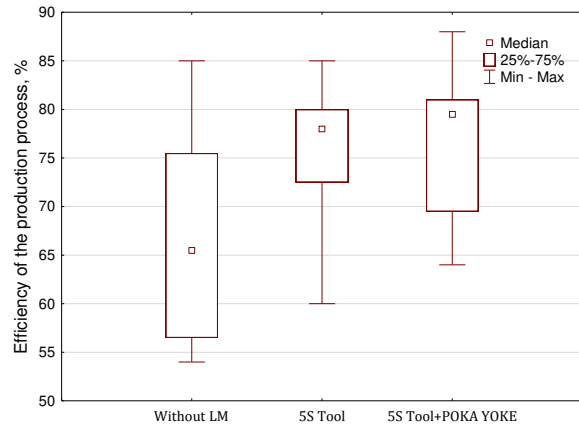


Figure 3. Efficiency of the production process - operation 50.

The results obtained in the analysis of the level of deficiencies generated on operations 10 and 50 indicated that in the case of comparing the parameters of deficiencies generated before the implementation of the Lean Manufacturing tools and the 5S tool with the implementation of the Poka Yoke technique, there is a statistically significant difference.

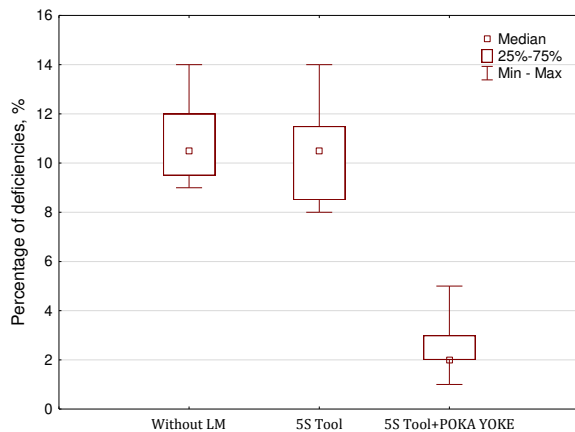


Figure 4. Percentage of deficiencies-operation 10.

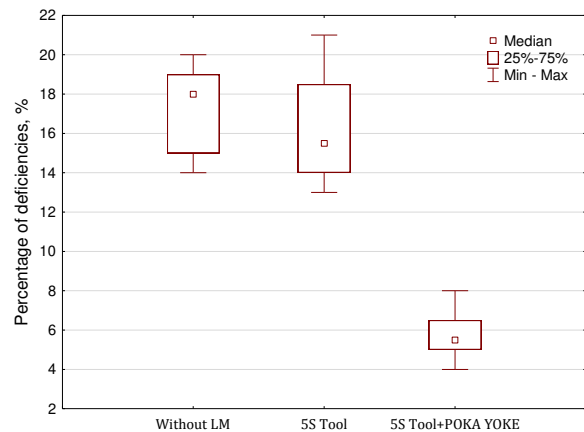


Figure 5. Percentage of deficiencies-operation 50.

In the case of the analysis of the parameters obtained as a result of the implementation of Poka-Yoke, a decrease in the level was noted, which is confirmed by the studies described in the articles (Sonil, Yadav, 2018) and (Fatah, 2022). The large decrease in the level of rejects on operations 10 and 50 is due to the introduction of safeguards to avoid error by the employee. A large number of parts used during the operation caused numerous errors of employees, which had a direct impact on the level of process efficiency, and in the absence of identifying a defect in the product, it generated deficiencies analyzed in this article and the need to perform the operation again.

6. Conclusion

The key element in the timely implementation of production is to create such conditions that the operations included in the production process are carried out with the least number of time disruptions and the highest quality of manufactured products. Due to the high level of competition in the manufacturing industry, the creation of working conditions that allow for smooth implementation of production processes is one of the conditions determining the proper functioning of the company. All production processes are exposed to the threat of delays and quality problems. However, the effects of delays and shortages are most burdensome in the case of variable production with a small degree of automation. One of the solutions to reduce or eliminate the negative impact on the production process is the implementation of a management system based on the Lean Manufacturing philosophy. As mentioned in the introduction of the article, the control of the generated parameters of the production process at the stage of implementing Lean Manufacturing tools and after their implementation is a key element that allows you to assess the effectiveness of the actions taken.

This article presents the results of changes in the level of generated parameters resulting from the implementation of the 5S and Poka Yoke tools. The obtained results allowed to present the scale of changes coming in the manufacturing process, confirming at the same time the positive effect of the implementation of Lean Manufacturing tools on the efficiency of the manufacturing process and the quality of manufactured products. As a result of the implementation of the 5S and Poka Yoke tools, an increase in efficiency was found in all production operations. In the case of the implementation of the 5S tool, an increase in efficiency was recorded on six production operations, the highest increase in efficiency was recorded on the 50th operation and reached 76%. As a result of the implementation of the Poka Yoke tool, the efficiency of operations 10 was increased to 95%. There was also a decrease in the level of deficiencies in operations from 10 to 2%, and in the case of operations from 50 to 6%. As a result of the statistical analysis, statistically significant differences were confirmed before and after the implementation of the Poka-Yoke tool.

The data on the basis of which the analysis was carried out come from one production plant (case study), which does not allow defining an unambiguous rule describing the impact of LM tools on production processes. The obtained results, however, allow to confirm the assumptions of the legitimacy of the implementation of selected LM tools for individual parameters of the manufacturing process. Conducting analyzes of the impact of selected LM tools on the manufacturing process seems to be a legitimate activity. A detailed analysis of the results obtained and comparison of the results from other production plants may allow to identify the reasons for better adaptation of LM tools and their impact on the production process.

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LEADERSHIP IN POINT OF VIEW OF EFFECTIVITY

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Purpose: Exemplification of the possibility of achieving effective leadership in theoretical terms.

Design/methodology/approach: The article presents contemporary trends in leadership development with an emphasis on its (leadership) effectivity. Then, an original concept of leadership efficiency was proposed, the basis of which is value for the client. The proposed concept was developed using the deductive method, i.e. inferring from what is general about what is special.

Findings: An original concept and model of business leadership effectivity.

Practical implications: Ability to choose the leadership cap. It allows leadership to be placed at an effective level.

Originality/value It can be a kind of a signpost for orientation as to the direction of actions aimed at improving the efficiency of leadership.

Keywords: leadership, effectivity, value, customer.

Category of the paper: Research paper.

1. Introduction

The global crisis of leadership that we are dealing with in almost all areas is now a spectacular sign of the times. To make matters worse, there is a proliferation of bad leadership, the effects of which are severely affecting both people and companies (Lachowski, 2013). The challenge of contemporary leadership is therefore its (leadership) effectiveness. The aim of the article is exemplification of the possibility of achieving effective leadership in theoretical terms.

2. Literature review

A recent review of current theories and future directions in the leadership literature noted the emergence of research that attempts to reach beyond the “heroic” or “romantic” view of unitary leadership (Denis, Langley, Sergi, 2012). Some research examines leadership not as a property of individuals and their behaviors, but as a collective phenomenon that is distributed or shared among different people, potentially fluid, and constructed in interaction (Avolio, Walumbwa, Weber, 2009). Specifically, the first stream, “Sharing leadership for team effectiveness”, focuses on a body of research largely based in the organizational behavior tradition that considers leadership as “... a dynamic, interactive influence process among individuals in groups for which the objective is to lead one another to the achievement of group or organizational goals or both” (Pearce, Conger, 2003). The empirical emphasis is on mutual leadership within the context of groups (Denis, Langley, Sergi, 2012). The first stream of research takes a functionalist approach to plural forms of leadership. The main objective is to better understand and find alternate sources of leadership that will impact positively on organizational performance. The studies mainly focus on the identification of antecedents and consequences of “shared leadership”, and they inform variance theories rather than process theories of leadership (Denis, Langley, Sergi, 2012). Organizational behavior is the main source of disciplinary inspiration and empirical work involves hypothesis testing using quantitative methods (Avolio, Walumbwa, Weber, 2009). Scholars generally focus on shared leadership within the context of teams, defined here as “a simultaneous, ongoing, mutual influence process within a team that is characterized by ‘serial emergence’ of official as well as unofficial leaders” (Pearce, 2004). The second stream, “Pooling leadership capacities at the top to direct others”, focuses on empirical situations in which two, three, or more people jointly work together as co-leaders of others outside the group (Alvarez, Svejnova, 2005). This stream is perhaps best associated with the label “collective” leadership and has attracted scholars with a more managerial or sociological orientation. While for many authors, plurality in leadership seems to be associated with conceptions of democracy, empowerment, and participation among members of a team who mutually lead each other, in some situations, plurality in leadership is clearly more structurally embedded (Denis, Langley, Sergi, 2012). Moreover, a structurally plural group can become a collective source of leadership for people outside it. Indeed, by institutionalized mandate or sometimes by common consent, in some organizations, top leadership roles may be formally structured so that no single individual is invested with the power to lead unilaterally. Despite some authors’ resistance to the idea that such a division of roles could be sustainable in the real world (Locke, 2003; Schumpeter, 2010), it remains that in many contexts, including professional organizations, the arts, education, and health care and even in entrepreneurial ventures and large enterprises, not only leadership, but authority may also sometimes be formally divided. The third stream, “Spreading leadership within and across

levels over time”, refers to work that has examined how leadership may be handed over between people from one hierarchical level to another over time as well as across intra-organizational and inter-organizational boundaries. This is the stream that is most associated with the term “distributed leadership” and that has been developed extensively by researchers in education (Spillane, 2006) and those interested in interorganizational collaboration (Huxham, Vangen, 2000). Gronn (Gronn, 2002) traced the distinction between “focused” and “distributed” leadership to Gibb (Gibb, 1954), who argued that it is not the specific traits of individuals that define leadership, but rather the degree to which people assume “leadership functions”. Leadership can, therefore, be seen as a “group phenomenon” distributed among individuals. The body of literature described extends the notion of leadership in the plural beyond teams and beyond small groups at the top to a broad array of people who jointly exert influence. Often, this literature focuses on particular projects or incidents of major change where different individuals may bring to bear their contributions. This literature focuses, in particular, on how people collectively achieve influence by taking turns, although several authors here are beginning to move toward a more relational view where leadership is embedded not so much in people but in relations and situations (Huxham, Vangen, 2000; Spillane, 2006). Most leadership studies, including the streams presented up to now, tend to equate leadership with what specific individuals identified as leaders do, starting with the existence of these distinct individuals and considering various elements such as their qualities, their behaviors, or their effectiveness. These studies extend reflections on the sharing of leadership and power: resolutely anchored in a socioconstructionist epistemology, these studies conceptualize leadership as a social phenomenon, as a collective process in which formally designated individuals may play a role, but from which it is impossible to ignore other actors. The place of individuals is thus reduced: actors are present in leadership— enacting it, influencing it, and creating it—but they are not “containers” of leadership. As many of these studies underline, leadership concepts that attribute leadership to individuals create heroic definitions of leadership; these studies aim to move away from such a heroic view (hence the oft-used label “postheroic leadership”). Because leadership is always collectively enacted in situation, it becomes a consequence of actors’ relations, an effect processually generated by a group of people, a product of their local interactions. Thus, the contributions in this stream can be summarized as proposing a relational or an interactional conceptualization of leadership. Their social constructionist assumptions favor commitments to qualitative analysis. These studies view leadership as a situated activity that takes shape through and emanates from actions and interactions and accordingly focuses on the in situ “performance” of leadership. It is because leadership is conceived as elaborated through social processes and emerging via interactions that it is fundamentally plural. Her view of leadership is also based on the concept of circularity, where “power and authority continually shift and morph to match the situation as it evolves” (Bathurst, Monin, 2010). Paradoxically, leadership occurs when leaders abandon the need to control and dominate, and emerges within the dynamic interactions of daily

organizational existence. But there are times when orders must be given and commands must be followed. In order to contextualize these Follett argues that it is the situation itself that provokes this need. Therefore, it is not the command itself that is important but the social relationships that facilitate the group's identity in the first place. Another influence is Hollander's work, which put forward the idea that leadership may be the property of a group (Hollander, Julian, 1969). By paying close attention to followers, Hollander and Julian's leadership conception can be seen as an antecedent to numerous leadership studies; however, it is by talking of leadership as an interactive and transactional process evolving over time that we can discern an influence on the studies in this category. Finally, Feyerherm (Feyerherm, 1994) can also be seen as a precursor of the relational and interactional studies. In the same line of thinking as Hollander, she suggested that leadership may be seen as a group characteristic and a web of influence covering the groups under study. The fourth stream, "Producing leadership through interaction", moves furthest toward decentering the notion of leadership from individuals entirely, adopting "a view of leadership and organization as human social constructions that emanate from the rich connections and interdependencies of organizations and their members" (Uhl-Bien, 2006). This perspective is most associated with the term "relational leadership". Gibb noted in his treatise on leadership theories of the time that "Leadership is probably best conceived as a group quality, as a set of functions which must be carried out by the group" (Gibb, 1954). The question is, what does leadership efficiency mean? Based on the literature, the following approaches to defining effectiveness can be distinguished (Barłożewski, 2017; Bielski, 2004; Pawłowski, 2007):

1. Theological: it assumes that an organization exists to pursue a specific purpose for which it was established. The implementation of the goal should be carried out in accordance with the praxeological principle of thriftiness, according to which, while striving to achieve goals, one should minimize costs (efficiency formula) or increase results (savings formula). The third possibility is the simultaneous pursuit of maximizing results and minimizing inputs (non-alternative formula). It should therefore be noted that the assessment of the company's effectiveness is based not on one, but on several criteria. In this case, it refers to the categories of effectiveness, economy and benefit.
2. Systemic is based on the following assumptions:
 - the company is perceived as an open system that strives for internal balance, survival and development,
 - organizations are not isolated from the environment, but are integrated with it through numerous connections of various types, including not only the exchange of physical goods, services, labor and capital, but also energy, information and signals,
 - the organization must compete with other entities for resources that it obtains from the environment and which are not unlimited,

- the basis for long-term maximization of an organization's income is its internal efficiency,
 - the organization must also have the ability to learn and improve its performance in order to maintain the ability to adapt to external conditions, which is the basis for its survival.
3. According to the concept of interest groups: this approach emphasizes that due to the existence of a number of different groups of stakeholders, more or less interested in the functioning of a given organization, the assessment of effectiveness must be a multidimensional issue. Each group will evaluate the effectiveness of a given company differently. Therefore, it involves the need to reconcile many different and often conflicting interests, needs, values and time perspectives represented by individual stakeholder groups, as well as the need to take into account the relationships and processes between them.
 4. According to the competitive value model: it combines four different, competing models of performance assessment, which are guided by different values.

In the literature on the subject, there are 5 main trends in leadership efficiency (Hogan, 1994; Austen, 2010; Puszko, 2021a). First, leaders can be judged on the actual performance of their teams or organizational units. And so, in the first case, the efficiency of leadership can be measured by determining the attitude of followers, the level of commitment or motivation to work. In the latter case, leaders are seen as effective when the organization achieves positive results (Eagly, Karau, Makhijani, 1995; Howell, Costley, 2006; Austen, 2010). When reviewing the literature on leadership effectiveness, one can find ambiguous views on the relationship between leadership and organizational performance. The following measures of results are used: profitability, productivity, cost per unit of production. On the one hand, researchers such as Yukl and Van Fleet (Yukl, Van Fleet, 1992) write that leadership is key to organizational performance and profitability, on the other hand, there are also different positions. For example, Thomas (Thomas, 1993) believes that while he believes leadership is related to performance, it is difficult to find convincing evidence. Waldman, Ramirez, House, and Puranam (Waldman, et al., 2001) even state that there is no relationship between leadership and organizational performance. Instead of relating the leader's actions to the organisation's performance, leadership efficiency can be viewed in relation to the success of their projects. In this perspective, however, most researchers evaluate the efficiency of leaders in terms of the consequences of their actions in relation to their followers and other stakeholders. The results of effective leadership may be the development of leaders, groups or organizations, their preparation to deal with a change or crisis, the satisfaction of followers with the leader, employee involvement in the implementation of the organization's goals, high leadership position. Most often, leadership effectiveness is measured by the extent to which its group/ individual achieves its goals (Dhar, Preshant, 2001). Secondly, the leadership efficiency can be assessed by their superiors, subordinates or colleagues of the leaders. Hughes, Ginnett,

and Curphy (Hughes, Ginnett, Curphy, 1999), stated that in order to assess the success of leaders, one should ask subordinates about their level of satisfaction or the perceived effectiveness of the leader. Therefore, determining whether a given leader can be considered effective is often based on the opinion of those working with him (McCauley, 2004). An important indicator is the attitude of followers towards the leader, which refers to the ability to meet the needs and expectations of subordinates, their commitment and respect for the leader. This can be measured by the level of retention, absenteeism, complaints, performance degradation. Sometimes the leader's performance is measured by the leader's contribution to the quality of group processes, group cohesion, increased cooperation and motivation, lowering the level of conflicts between group members, and improving the speed and quality of decisions (McCauley, 2004; Austen, 2010). The third category of studies assesses the potential of leaders on the basis of interviews, simulations, and assessment center. Much of the discussion on leadership effectiveness is devoted to the person of the leader and his characteristics. Among the factors that determine effective leadership, the most important are competences (characteristics of a person resulting in high results), weaknesses (often treated as a lack of competences), behavior (observable actions), knowledge (concerning leadership and the specific context of leadership), experience, level of maturity (understanding oneself and the environment), and the style of leadership. Fourth, it is also possible for leaders to self-evaluate. While this way of judging says little about actual leadership performance, for leaders who tend to overestimate their performance, Hogan and Curphy (Hogan, Curphy, 1994) and Austen (Austen, 2010) consider themselves to be a symptom of leadership deficiencies and show that the lack of competence is usually equated with such factors as lack of trust, reluctance to maintain discipline, inability to make decisions, excessive control. Thus, efficiency can be measured in two ways: objective (process-oriented) measurement is made using financial indicators or the degree of achievement of goals, such as, for example, profit margin, market share, profitability, and subjective (result-oriented) measurement using measures based on the assessments of subordinates, superiors or colleagues (Hartman, 1999; Austen, 2010). The efficiency of a leader may take a direct or an indirect dimension. Direct efficiency refers to the leader's decisions and actions that have a direct impact on what is done and how it is done. Indirect efficiency refers to the leader's decisions and actions that are mediated by other variables (Dhar, Prashant, 2001). Leadership effectivity can be studied in the political, social and business domains. Detailed effectiveness studies are described in: (Puszko, 2021a, 2021b, 2021c, 2021d; Puszko, Ostasiewicz, 2021). The article is a continuation of the author's interests in the field of shaping the effectiveness of leadership.

3. Original concept of business leadership effectiveness

Based on the approach to defining effectiveness according to the concept of interest groups and the competitive value model, modern trends in leadership development, a process approach in management the author proposes the concept of effective business leadership. Leadership effectiveness means having an impact on achieving (the highest) value for the customer in favorable and unfavorable conditions of the company's operation. Favorable operating conditions - occur when the result measured by the difference between effects and inputs is greater than 0. Unfavorable operating conditions - occur when the result measured by the difference between effects and inputs is less than or equal to 0 (Adamczyk, 1995).

P.F. Drucker often emphasized that the enterprise is its customers. Without customers, no business entity can function, and companies that cannot meet customer expectations collapse or are taken over by other entities (Drucker, 1976). External customers who consciously buy products or services offered to them. They are clearly identified, companies have learned to recognize them, reach them with the right offer, support them in using the delivered products, react to their comments and demands (Łunarski, 2008). In the process approach, internal and external customers decide what constitutes the value of a given product (Grajewski, 2007).

In the literature, there are many attempts to define the essence of value in business, often distinguishing its different types, such as enterprise value, customer value, value for the customer, and then value management (Łunarski, 2008). There are three basic concepts of value in economics: classical (value as the amount of labor necessary to produce a good), subjective (the ability of the goods to satisfy subjective needs) and neoclassical (the process of equilibrium resulting from the relations taking place between supply and demand) (Rajzer, 2009). In economic sciences, and more specifically in management sciences, customer value is a marketing category. Although the concept of "customer value" is used today by researchers associated with many different scientific disciplines in the field of economics and management sciences, it should be remembered that the concept of value for the customer was introduced in 1954 to the literature in the field of management sciences by P. Drucker - precursor of marketing theory and marketing management (Drucker, 1954). At the end of the 1960s, this category appeared in the theory of consumer behavior and in the theory of marketing, referring to the concepts of utility (benefits) and satisfaction known from the theory of consumer choice. Later, however, its use in this sense was abandoned, and the concept of "value" appeared only in studies on consumer behavior, understood mainly as values professed, valued or otherwise - preferred by buyers (customer values) (Szymura-Tyc, 2005). It is assumed that value is one of the basic categories of axiology (the science of values), which defines everything that is desirable, worthy and valuable for an individual; what constitutes the goal of human endeavors (Encyklopedia zarządzania, 4.02.2023). T. Falencikowski lists emotional values, technical values, economic values and social and ethical values (Falencikowski, 2013). The listed values and their characteristics are presented in table 1.

Table 1.
Types and features characterizing values for the customer

| Item | Types and features characterizing values for the customer | |
|------|---|---|
| | type of customer value | characteristics |
| 1. | emotional values | beauty, pleasure, desire, love |
| 2. | technical values | durability, efficiency, usefulness, ease |
| 3. | economic values | cheapness, availability, convenient payment terms, delivery time |
| 4. | socio-ethical values | impact on the environment, quality of life, corporate responsibility for the product, marketing manipulation of customers |

Source: (Falencikowski, 2013; Falencikowski, 2017).

On the other hand, the values important for internal customers include: values based on economic mechanisms (wages, employee shares, transfer of ownership rights to employees, which is the key to achieving operational efficiency) and values based on relational mechanisms (they are related to the elements that build trust-based relationships with employees, and thus motivate them to engage in the functioning and development of the company (Wang, He, Mahoney, 2009, pp. 1265-1285). The concept of business leadership effectiveness in the model approach is presented in Figure 1.

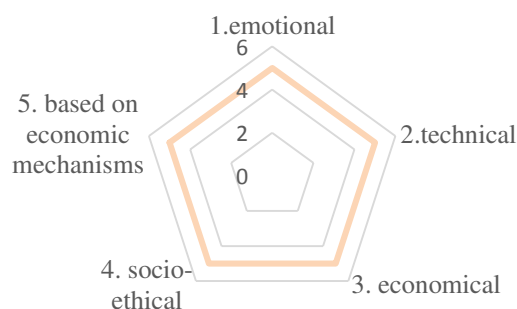


Figure 1. Business leadership effectiveness model.

Source: Own study based one: (Puszko, 2021a; Falencikowski, 2013; Wang, He, Mahoney, 2009).

The effectiveness of leadership is measured by the value for the client indicator, i.e. a measure which is calculated using the ratings according to the criteria and the weights assigned to the criteria and is calculated according to the formula (Bozarth, Hanfield, 2007):

$$V = \sum_{n=1}^N I_n \cdot P_n \quad (1)$$

where:

V- value index,

I_n - weight of n criterion,

P_n - evaluation according to the criterion (Bozarth, Hanfield, 2007).

The proposed concept and model were developed using the deductive method (i.e. based on inferring from what is general about what is specific) (Słownik filozoficzny, 2020).

The developed model gives the possibility to choose the ceiling of leadership. On the basis of the client's assessment, it allows you to locate leadership at an effective level. It can be

a kind of signpost used to orientate oneself as to the direction of actions ensuring the improvement of leadership effectiveness.

4. Discussion

Efficiency is one of the most important economic categories, being a manifestation management rationality. In this context, both economics and management sciences developed for their own needs, separate, but mutually complementary ways of looking at the essence and substantive sense of the efficiency category (Jaki, 2013). The article presents contemporary trends in leadership development with particular emphasis on its (leadership) effectiveness. Then, the author's concept and model of business leadership are described. Effective leadership is based on values that are important to the client, such as: emotional, technical, economic, social and ethical values, values based on economic mechanisms and values based on relational mechanisms. The developed model gives the possibility to choose the ceiling of leadership. On the basis of assessment by the client (external, internal) it allows for locating leadership at an effective level. It can be a kind of signpost used to orientate oneself as to the direction of actions ensuring the improvement of leadership effectiveness. The proposed concept and model were developed using the deductive method (i.e. based on inferring from what is general about what is special) (Słownik filozoficzny, 2020).

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VALUE AS THE BASIS FOR EFFECTIVE LEADERSHIP

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Purpose: Identification of effective leadership, understood as exerting influence on achieving (the highest) value for the client in favorable and unfavorable conditions of the company's operation in empirical terms.

Design/methodology/approach: The article presents the results of empirical research. The basic measuring instrument used in the research was the questionnaire. The research includes verification of the assumed hypotheses.

Findings: Assessment of the significance of criteria, evaluation of leadership according to criteria, value index, arithmetic average, Spearman's rank correlation coefficient. In general, customers rated the value of leadership low in both favorable and unfavorable conditions. This is a signpost for increasing activity for the growth of value for the customer.

Research limitations: Research subjectively assessed by the client.

Practical implications: Positioning of a leadership level. On the basis of evaluation, it allows you to locate leadership at an effective level in favorable and unfavorable conditions.

Originality/value: A statistics application in the domain of effective leadership. It can be a kind of a signpost for orientation as to the direction of activities ensuring the achievement of effective leadership.

Keywords: leadership, effectivity, value, customer.

Category of the paper: Research paper.

1. Introduction

Efficiency, as an attribute of human action, has been the subject of interest in management theory and practice for centuries. In the literature there are comparisons of this tendency to the "terror of efficiency" (Boj, 2014). This is due, inter alia, to the capacity and multidimensionality of the term efficiency. Also, the emergence and dynamics of the spread of new phenomena and the increase in their role in management processes open up new research problems in the field of efficiency (Dudycz, Osbert-Pociecha, Brycz, 2015; Puszko, 2021). The aim of the article is identification of effective leadership, understood as exerting influence on achieving

(the highest) value for the client in favorable and unfavorable conditions of the company's operation in empirical terms.

The article assumes the verification of the following hypotheses:

1. Value for external and internal customers leads to achieving and increasing effective leadership.
2. Emotional and socio-ethical values are of significant importance, while economic and technical values are relatively less important from the point of view of the external customer in favorable conditions.
3. Economic and technical values are more important, while emotional and socio-ethical values are relatively less important from the point of view of the external client in unfavorable conditions.
4. In favorable conditions, internal customers attach more importance to values based on relational mechanisms, while in unfavorable conditions, values based on economic mechanisms become more important to them.
5. Values covering issues desired by the client (internal, external) are rated higher than values not related to the client's expectations (internal, external).
6. Higher customer value ratios are achieved due to the correlation of customer-relevant values with the customer's assessment (internal and external) both in favorable and unfavorable conditions.
7. There is a very weak and negative correlation between the customer value index achieved under favorable conditions and the customer value index achieved under unfavorable conditions.

2. Characteristics of empirical research

Empirical research was carried out in the period June 2022 - February 2023. The aim of the research was to identify effective leadership from the perspective of external and internal clients in favorable and unfavorable conditions.

The basic measuring instrument used in the research was a questionnaire. The study population, understood as a finite community about which the researcher wants to obtain specific data (Kaczmarczyk, 2005), covered 48 respondents from the following voivodeships: Lodz, Mazowieckie, Lesser Poland, Silesian, Lublin, Subcarpathian, Podlaskie, Świętokrzyskie, Lubuskie, Greater Poland, West Pomeranian, Lower Silesia, Kuyavian-Pomeranian Voivodeship, Pomeranian and Warmia-Masuria Province. The respondents were internal and external customers of enterprises. The synthetic characteristics of customers are presented in table 1.

Table 1.
The synthetic characteristics of customer

| Respondent number Customer type | The synthetic characteristics of customers |
|------------------------------------|---|
| | type of customer value |
| 1. internal | 1, 4, 5, 7 10, 19, 36, 44, 47, 48 |
| 2. external | 2, 3, 6, 8,9, 11, 12, 13,14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 45, 46 |

Source: Own study based on research results.

79% of external customers and 21% of internal customers took part in the research. The criterion for selecting the sample was the consent of the respondent. Such a sample does not meet the criterion of a statistical sample. It is also not a random sample. The time horizon of the research covered the years 2012-2023. Favorable operating conditions - occur when the result measured by the difference between effects and inputs is greater than 0. Unfavorable operating conditions - occur when the result measured by the difference between effects and inputs is less than or equal to 0. Based on the presented conditions, the study should be treated as a case study. The effectiveness of leadership was measured using the value for the client indicator, i.e. a measure which is calculated using the ratings according to the criteria and the weights assigned to the criteria and is calculated according to the formula (Bozarth, Hanfield, 2007):

$$V = \sum_{n=1}^N I_n \cdot P_n \quad (1)$$

where:

V- value index,

I_n - weight of n criterion,

P_n - evaluation according to the criterion (Bozarth, Hanfield, 2007).

The respondents were asked to assess the significance of the criteria on a scale of 1 ("completely unimportant") to 5 (decisive) in favorable and unfavorable conditions, assigning weights to them. The assessment of the significance of the criteria in favorable conditions is presented in table 2.

Based on the information contained in table 2, it can be seen that economic and technical values are very important for external customers, while values based on economic mechanisms are very important for internal customers. Respondents then rated leadership on a scale of 1 ("low rating") to 5 ("very high"). The assessment of leadership in favorable conditions is presented in table 3. Based on the information contained in table 3, it can be concluded that external customers rated the economic and technical values relatively low. On the other hand, internal customers rated values based on economic mechanisms as low. The data obtained made it possible to calculate the indicators of value for the customer in favorable conditions. The calculation results are presented in table 4.

Table 2.*Evaluation of the significance of the criteria in favorable conditions*

| Evaluation of the significance of the criteria in favorable conditions | | | | | | |
|--|------------------|------------------|-----------------|----------------------|-------------------------------------|---------------------------------------|
| Respondent number \ Criterion | emotional values | technical values | economic values | socio-ethical values | values based on economic mechanisms | values based on relational mechanisms |
| 1. | | | | | 5 | 4 |
| 2. | 3 | 4 | 5 | 1 | | |
| 3. | 3 | 5 | 4 | 2 | | |
| 4. | | | | | 5 | 1 |
| 5.10.19. | | | | | 5 | 3 |
| 6. | 2 | 4 | 3 | 5 | | |
| 7.47. | | | | | 5 | 2 |
| 8. | 3 | 2 | 4 | 5 | | |
| 9. | 5 | 3 | 4 | 1 | | |
| 11. | 5 | 3 | 4 | 2 | | |
| 12. | 1 | 5 | 4 | 3 | | |
| 13. | 4 | 5 | 3 | 2 | | |
| 14. | 3 | 4 | 5 | 2 | | |
| 15. | 5 | 4 | 3 | 1 | | |
| 16. | 2 | 3 | 5 | 4 | | |
| 17. | 2 | 5 | 4 | 3 | | |
| 18. | 2 | 3 | 5 | 4 | | |
| 20. | 2 | 3 | 4 | 5 | | |
| 21. | 3 | 5 | 4 | 1 | | |
| 22. | 3 | 2 | 5 | 4 | | |
| 23. | 3 | 4 | 5 | 1 | | |
| 24. | 3 | 2 | 5 | 4 | | |
| 25. | 2 | 5 | 4 | 3 | | |
| 26. | 3 | 5 | 4 | 2 | | |
| 27. | 3 | 4 | 5 | 2 | | |
| 28. | 2 | 1 | 3 | 4 | | |
| 29. | 4 | 5 | 3 | 1 | | |
| 30. | 3 | 4 | 5 | 1 | | |
| 31. | 2 | 5 | 4 | 3 | | |
| 32. | 1 | 4 | 5 | 3 | | |
| 33. | 5 | 4 | 3 | 2 | | |
| 34. | 3 | 5 | 4 | 2 | | |
| 35. | 3 | 2 | 4 | 5 | | |
| 36. | | | | | 5 | 5 |
| 37. | 3 | 4 | 5 | 2 | | |
| 38. | 2 | 5 | 4 | 3 | | |
| 39. | 4 | 3 | 5 | 2 | | |
| 40. | 2 | 5 | 4 | 3 | | |
| 41. | 3 | 5 | 4 | 2 | | |
| 42. | 5 | 4 | 3 | 2 | | |
| 43. | 2 | 4 | 5 | 3 | | |
| 44.48. | | | | | 5 | 4 |
| 45. | 4 | 5 | 2 | 3 | | |
| 46. | 4 | 2 | 5 | 1 | | |

Source: Own study based on research results.

The presented ratios indicate that customers, especially internal customers, do not receive values that are of particular importance to them, which is reflected in lower value ratios. In the case of external customers, lower value ratios are caused by a particularly low assessment of

economic and technical values. In unfavorable conditions, the expectations of internal customers in terms of values based on relational mechanisms increase.

Table 3.
Evaluation of leadership in favorable conditions

| Evaluation of leadership in favorable condition | | | | | | |
|---|------------------|------------------|-----------------|----------------------|-------------------------------------|---------------------------------------|
| Leadership assessment Respondent number | emotional values | technical values | economic values | socio-ethical values | values based on economic mechanisms | values based on relational mechanisms |
| 1.4. | | | | | 2 | 1 |
| 2. | 3 | 1 | 2 | 4 | | |
| 3. | 4 | 2 | 3 | 5 | | |
| 5.10. | | | | | 4 | 3 |
| 6. | 4 | 1 | 2 | 3 | | |
| 7. | | | | | 3 | 2 |
| 8. | 3 | 2 | 1 | 3 | | |
| 9. | 4 | 2 | 3 | 1 | | |
| 11. | 5 | 1 | 2 | 2 | | |
| 12. | 1 | 1 | 2 | 3 | | |
| 13. | 5 | 3 | 2 | 1 | | |
| 14. | 2 | 3 | 4 | 2 | | |
| 15. | 5 | 2 | 3 | 1 | | |
| 16. | 3 | 1 | 2 | 4 | | |
| 17. | 2 | 4 | 4 | 1 | | |
| 18. | 2 | 2 | 3 | 3 | | |
| 19. | | | | | 1 | 2 |
| 20. | 3 | 2 | 1 | 4 | | |
| 21. | 5 | 3 | 2 | 1 | | |
| 22. | 3 | 2 | 1 | 4 | | |
| 23. | 4 | 1 | 2 | 3 | | |
| 24. | 3 | 2 | 2 | 3 | | |
| 25. | 3 | 2 | 1 | 3 | | |
| 26. | 3 | 4 | 2 | 1 | | |
| 27. | 3 | 2 | 1 | 2 | | |
| 28. | 2 | 1 | 2 | 4 | | |
| 29. | 4 | 3 | 3 | 1 | | |
| 30. | 3 | 2 | 4 | 1 | | |
| 31. | 2 | 3 | 1 | 5 | | |
| 32. | 1 | 2 | 1 | 3 | | |
| 33. | 5 | 2 | 3 | 4 | | |
| 34. | 3 | 1 | 2 | 2 | | |
| 35. | 4 | 1 | 2 | 5 | | |
| 36.44.48. | | | | | 2 | 3 |
| 37. | 4 | 2 | 3 | 1 | | |
| 38. | 2 | 1 | 4 | 3 | | |
| 39. | 4 | 3 | 1 | 2 | | |
| 40. | 2 | 1 | 4 | 3 | | |
| 41. | 4 | 1 | 3 | 2 | | |
| 42. | 4 | 2 | 1 | 3 | | |
| 43. | 4 | 1 | 2 | 3 | | |
| 45. | 5 | 4 | 2 | 3 | | |
| 46. | 4 | 3 | 2 | 1 | | |
| 47. | | | | | 4 | 2 |

Source: Own study based on research results.

Table 4.
Value ratio - favorable conditions

| Value ratio - favorable conditions | | | | | | | | |
|------------------------------------|-----------------|-----------------|-----------------------------|-----------------------------|----------------------------|---------------------------------|--|--|
| Respondent number | Value indicator | value indicator | including: emotional values | including: technical values | including: economic values | including: socio-ethical values | including: values based on economic mechanisms | including: values based on relational mechanisms |
| 1. | | 14 | - | - | - | - | 10 | 4 |
| 2. | | 27 | 9 | 4 | 10 | 4 | - | - |
| 3. | | 44 | 12 | 10 | 12 | 10 | - | - |
| 4. | | 11 | - | - | - | - | 10 | 1 |
| 5. | | 29 | - | - | - | - | 20 | 9 |
| 6. | | 33 | 8 | 4 | 6 | 15 | - | - |
| 7. | | 19 | - | - | - | - | 15 | 4 |
| 8. | | 32 | 9 | 4 | 4 | 15 | - | - |
| 9. | | 39 | 20 | 6 | 12 | 1 | - | - |
| 10. | | 29 | - | - | - | - | 20 | 9 |
| 11. | | 40 | 25 | 3 | 8 | 4 | - | - |
| 12. | | 23 | 1 | 5 | 8 | 9 | - | - |
| 13. | | 43 | 20 | 15 | 6 | 2 | - | - |
| 14. | | 42 | 6 | 12 | 20 | 4 | - | - |
| 15. | | 43 | 25 | 8 | 9 | 1 | - | - |
| 16. | | 35 | 6 | 3 | 10 | 16 | - | - |
| 17. | | 43 | 4 | 20 | 16 | 3 | - | - |
| 18. | | 37 | 4 | 6 | 15 | 12 | - | - |
| 19. | | 11 | - | - | - | - | 5 | 6 |
| 20. | | 36 | 6 | 6 | 4 | 20 | - | - |
| 21. | | 39 | 15 | 15 | 8 | 1 | - | - |
| 22. | | 34 | 9 | 4 | 5 | 16 | - | - |
| 23. | | 29 | 12 | 4 | 10 | 3 | - | - |
| 24. | | 35 | 9 | 4 | 10 | 12 | - | - |
| 25. | | 29 | 6 | 10 | 4 | 9 | - | - |
| 26. | | 39 | 9 | 20 | 8 | 2 | - | - |
| 27. | | 26 | 9 | 8 | 5 | 4 | - | - |
| 28. | | 27 | 4 | 1 | 6 | 16 | - | - |
| 29. | | 41 | 16 | 15 | 9 | 1 | - | - |
| 30. | | 38 | 9 | 8 | 20 | 1 | - | - |
| 31. | | 38 | 4 | 15 | 4 | 15 | - | - |
| 32. | | 23 | 1 | 8 | 5 | 9 | - | - |
| 33. | | 50 | 25 | 8 | 9 | 8 | - | - |
| 34. | | 26 | 9 | 5 | 8 | 4 | - | - |
| 35. | | 47 | 12 | 2 | 8 | 25 | - | - |
| 36. | | 25 | - | - | - | - | 10 | 15 |
| 37. | | 37 | 12 | 8 | 15 | 2 | - | - |
| 38. | | 34 | 4 | 5 | 16 | 9 | - | - |
| 39. | | 34 | 16 | 9 | 5 | 4 | - | - |
| 40. | | 34 | 4 | 5 | 16 | 9 | - | - |
| 41. | | 33 | 12 | 5 | 12 | 4 | - | - |
| 42. | | 37 | 20 | 8 | 3 | 6 | - | - |
| 43. | | 31 | 8 | 4 | 10 | 9 | - | - |
| 44. | | 22 | - | - | - | - | 10 | 12 |
| 45. | | 53 | 20 | 20 | 4 | 9 | - | - |
| 46. | | 33 | 16 | 6 | 10 | 1 | - | - |
| 47. | | 24 | - | - | - | - | 20 | 4 |
| 48. | | 22 | - | - | - | - | 10 | 12 |
| \bar{x} | | | 9,0 | 6,0 | 7,0 | 6,0 | 3,0 | 2,0 |

Source: Own study based on research results.

The preferences of external customers in terms of economic and technical values are also growing at the expense of social and ethical values. The assessment of the significance of the criteria in unfavorable conditions is presented in Table 5.

Table 5.

Evaluation of the significance of the criteria in unfavorable conditions

| Evaluation of the significance of the criteria in unfavorable conditions | | | | | | |
|--|------------------|------------------|-----------------|----------------------|-------------------------------------|---------------------------------------|
| Respondent number \ Criterion | emotional values | technical values | economic values | socio-ethical values | values based on economic mechanisms | values based on relational mechanisms |
| 1.44.48. | | | | | 5 | 4 |
| 2. | 3 | 4 | 5 | 1 | | |
| 3. | 3 | 5 | 4 | 2 | | |
| 4.5.10.19.47. | | | | | 5 | 3 |
| 6. | 2 | 4 | 3 | 5 | | |
| 7.36. | | | | | 5 | 5 |
| 8. | 3 | 2 | 5 | 3 | | |
| 9. | 5 | 3 | 4 | 1 | | |
| 11. | 5 | 3 | 4 | 2 | | |
| 12. | 1 | 5 | 5 | 3 | | |
| 13. | 4 | 5 | 3 | 2 | | |
| 14. | 3 | 4 | 5 | 2 | | |
| 15. | 5 | 4 | 3 | 1 | | |
| 16. | 2 | 4 | 5 | 3 | | |
| 17. | 2 | 5 | 4 | 3 | | |
| 18. | 2 | 3 | 5 | 4 | | |
| 20. | 2 | 3 | 4 | 5 | | |
| 21. | 3 | 5 | 4 | 1 | | |
| 22. | 3 | 2 | 5 | 4 | | |
| 23. | 3 | 4 | 5 | 1 | | |
| 24. | 3 | 2 | 5 | 4 | | |
| 25. | 2 | 5 | 4 | 3 | | |
| 26. | 3 | 5 | 4 | 2 | | |
| 27. | 3 | 4 | 5 | 2 | | |
| 28. | 2 | 1 | 5 | 4 | | |
| 29. | 4 | 5 | 3 | 1 | | |
| 30. | 3 | 4 | 5 | 1 | | |
| 31. | 2 | 5 | 4 | 3 | | |
| 32. | 1 | 4 | 5 | 3 | | |
| 33. | 5 | 4 | 3 | 2 | | |
| 34. | 3 | 5 | 4 | 2 | | |
| 35. | 3 | 2 | 4 | 5 | | |
| 37. | 3 | 4 | 5 | 2 | | |
| 38. | 2 | 5 | 4 | 3 | | |
| 39. | 4 | 3 | 5 | 2 | | |
| 40. | 2 | 5 | 5 | 1 | | |
| 41. | 3 | 5 | 4 | 2 | | |
| 42. | 5 | 4 | 3 | 2 | | |
| 43. | 2 | 4 | 5 | 3 | | |
| 45. | 4 | 5 | 2 | 3 | | |
| 46. | 4 | 3 | 5 | 1 | | |

Source: Own study based on research results.

The assessment of leadership in unfavorable conditions is presented in Table 6. Value indicators in unfavorable conditions are presented in Table 7.

Table 6.
Evaluation of leadership in unfavorable conditions

| Respondent number | Evaluation of leadership in favorable condition | | | | | | |
|-------------------|---|------------------|------------------|-----------------|----------------------|-------------------------------------|---------------------------------------|
| | Leadership assessment | emotional values | technical values | economic values | socio-ethical values | values based on economic mechanisms | values based on relational mechanisms |
| 1. | | | | | | 2 | 1 |
| 2. | | 3 | 1 | 2 | 4 | | |
| 3. | | 4 | 2 | 3 | 5 | | |
| 4. | | | | | | 1 | 1 |
| 5.10. | | | | | | 4 | 3 |
| 6. | | 4 | 1 | 2 | 3 | | |
| 7.19. | | | | | | 1 | 2 |
| 8. | | 3 | 2 | 1 | 3 | | |
| 9. | | 4 | 2 | 3 | 1 | | |
| 11. | | 5 | 1 | 2 | 2 | | |
| 12. | | 4 | 1 | 1 | 3 | | |
| 13. | | 5 | 3 | 2 | 1 | | |
| 14. | | 2 | 3 | 4 | 2 | | |
| 15. | | 5 | 2 | 3 | 1 | | |
| 16. | | 4 | 1 | 2 | 1 | | |
| 17. | | 2 | 4 | 4 | 1 | | |
| 18. | | 2 | 2 | 3 | 3 | | |
| 20. | | 3 | 2 | 1 | 4 | | |
| 21. | | 5 | 3 | 2 | 1 | | |
| 22. | | 3 | 2 | 1 | 4 | | |
| 23. | | 4 | 1 | 2 | 3 | | |
| 24. | | 3 | 2 | 2 | 3 | | |
| 25. | | 3 | 2 | 1 | 3 | | |
| 26. | | 3 | 4 | 2 | 1 | | |
| 27. | | 3 | 2 | 1 | 2 | | |
| 28. | | 2 | 1 | 1 | 4 | | |
| 29. | | 4 | 3 | 3 | 1 | | |
| 30. | | 3 | 2 | 4 | 1 | | |
| 31. | | 2 | 3 | 1 | 5 | | |
| 32. | | 1 | 2 | 1 | 3 | | |
| 33. | | 5 | 2 | 3 | 4 | | |
| 34. | | 3 | 1 | 2 | 2 | | |
| 35. | | 4 | 1 | 2 | 5 | | |
| 36.44.48 | | | | | | 2 | 3 |
| 37. | | 4 | 2 | 3 | 1 | | |
| 38. | | 2 | 1 | 4 | 3 | | |
| 39. | | 4 | 3 | 1 | 2 | | |
| 40. | | 4 | 1 | 2 | 3 | | |
| 41. | | 4 | 1 | 3 | 2 | | |
| 42. | | 4 | 2 | 1 | 3 | | |
| 43. | | 4 | 1 | 2 | 3 | | |
| 45. | | 5 | 4 | 2 | 3 | | |
| 46. | | 3 | 2 | 2 | 1 | | |
| 47. | | | | | | 3 | 2 |

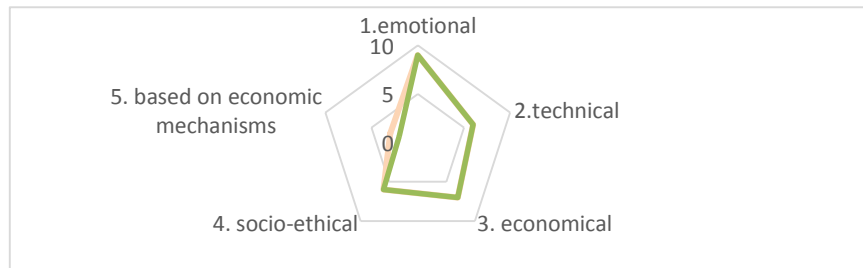
Source: Own study based on research results.

Table 7.
Value ratio - unfavorable conditions

| Value ratio - unfavorable conditions | | | | | | | |
|--------------------------------------|-----------------|--------------------------------|--------------------------------|-------------------------------|------------------------------------|---|---|
| Value Indicator Respondent number | value indicator | including: emotional values | including: technical values | including: economic values | including: socio-ethical values | including: values based on economic mechanisms | including: values based on relational mechanisms |
| 1. | 14 | - | - | - | - | 10 | 4 |
| 2. | 27 | 9 | 4 | 10 | 4 | - | - |
| 3. | 44 | 12 | 10 | 12 | 10 | - | - |
| 4. | 8 | - | - | - | - | 5 | 3 |
| 5. | 29 | - | - | - | - | 20 | 9 |
| 6. | 33 | 8 | 4 | 6 | 15 | - | - |
| 7. | 15 | - | - | - | - | 5 | 10 |
| 8. | 27 | 9 | 4 | 5 | 9 | - | - |
| 9. | 39 | 20 | 6 | 12 | 1 | - | - |
| 10. | 29 | - | - | - | - | 20 | 9 |
| 11. | 40 | 25 | 3 | 8 | 4 | - | - |
| 12. | 23 | 4 | 5 | 5 | 9 | - | - |
| 13. | 43 | 20 | 15 | 6 | 2 | - | - |
| 14. | 42 | 6 | 12 | 20 | 4 | - | - |
| 15. | 43 | 25 | 8 | 9 | 1 | - | - |
| 16. | 25 | 8 | 4 | 10 | 3 | - | - |
| 17. | 43 | 4 | 20 | 16 | 3 | - | - |
| 18. | 37 | 4 | 6 | 15 | 12 | - | - |
| 19. | 11 | - | - | - | - | 5 | 6 |
| 20. | 36 | 6 | 6 | 4 | 20 | - | - |
| 21. | 39 | 15 | 15 | 8 | 1 | - | - |
| 22. | 34 | 9 | 4 | 5 | 16 | - | - |
| 23. | 29 | 12 | 4 | 10 | 3 | - | - |
| 24. | 35 | 9 | 4 | 10 | 12 | - | - |
| 25. | 29 | 6 | 10 | 4 | 9 | - | - |
| 26. | 39 | 9 | 20 | 8 | 2 | - | - |
| 27. | 26 | 9 | 8 | 5 | 4 | - | - |
| 28. | 26 | 4 | 1 | 5 | 16 | - | - |
| 29. | 41 | 16 | 15 | 9 | 1 | - | - |
| 30. | 38 | 9 | 8 | 20 | 1 | - | - |
| 31. | 38 | 4 | 15 | 4 | 15 | - | - |
| 32. | 23 | 1 | 8 | 5 | 9 | - | - |
| 33. | 50 | 25 | 8 | 9 | 8 | - | - |
| 34. | 26 | 9 | 5 | 8 | 4 | - | - |
| 35. | 47 | 12 | 2 | 8 | 25 | - | - |
| 36. | 25 | - | - | - | - | 10 | 15 |
| 37. | 37 | 12 | 8 | 15 | 2 | - | - |
| 38. | 34 | 4 | 5 | 16 | 9 | - | - |
| 39. | 34 | 16 | 9 | 5 | 4 | - | - |
| 40. | 26 | 8 | 5 | 10 | 3 | - | - |
| 41. | 33 | 12 | 5 | 12 | 4 | - | - |
| 42. | 37 | 20 | 8 | 3 | 6 | - | - |
| 43. | 31 | 8 | 4 | 10 | 9 | - | - |
| 44. | 22 | - | - | - | - | 10 | 12 |
| 45. | 53 | 20 | 20 | 4 | 9 | - | - |
| 46. | 29 | 12 | 6 | 10 | 1 | - | - |
| 47. | 21 | - | - | - | - | 15 | 6 |
| 48. | 22 | - | - | - | - | 10 | 12 |
| \bar{x} | | 9,0 | 6,0 | 7,0 | 6,0 | 2,0 | 2,0 |

Source: Own study based on research results.

Based on the information contained in table 7, it can be seen that external customers rated the economic and technical values relatively low. On the other hand, internal customers rated values based on economic mechanisms as low. The calculated arithmetic mean made it possible to illustrate effective leadership in favorable and unfavorable conditions in the model approach (Figure 1).



Note. - model - favorable conditions; - model - unfavorable conditions.

Figure 1. Model of effective business leadership in favorable and unfavorable conditions.

Source: Own study based on research results.

Then, using the Spearman's rank correlation coefficient, the strength and direction of the relationship between the value index achieved under favorable and unfavorable conditions was determined (Ręklewski, 2020). Auxiliary calculations are presented in table 8. Note that the literature indicates that Spearman's rank correlation coefficient is used when the number of observations is $n < 30$ (Ręklewski, 2020). However, there are studies that do not mention this recommendation. For example (Kurkiewicz, Stonawski).

$$r_s = 1 - 6\sum_{i=1}^n d_i^2 / n(n^2 - 1) \quad (2)$$

where:

d_i - difference between trait ranks X and Y i.e. $d_i = x_i - y_i$,

n - number of pairs of features X and Y (Ręklewski, 2020).

$r_s = 1 - 0.002 = 0,98 \Rightarrow 0,8 < |r_s| \leq 1,0$ – very strong.

Therefore, there is a very strong and positive correlation between the value for the customer indicator in favorable and unfavorable conditions ($r_s = 0,98$). This means that an increase in the value for the customer ratio in favorable conditions results in an increase (maintaining) of this ratio in unfavorable conditions (Ręklewski, 2020).

Research limitation is research subjectively assessed by the client.

Table 8.
Auxiliary calculations

| Auxiliary calculations | | | | | |
|---|---|----------------|----------------|-------------------|---------|
| Value ratio - favorable conditions x_i | value ratio - unfavorable conditions y_i | ranks x_i | ranks y_i | $d_i = x_i - y_i$ | d_i^2 |
| 14 | 14 | 1 | 1 | 0 | 0 |
| 27 | 27 | 2 | 2 | 0 | 0 |
| 44 | 44 | 3 | 3 | 0 | 0 |
| 11 | 8 | 4 | 4 | 0 | 0 |
| 29 | 29 | 6 | 6 | 0 | 0 |
| 33 | 33 | 6 | 6 | 0 | 0 |
| 19 | 15 | 6 | 6 | 0 | 0 |
| 32 | 27 | 7 | 7 | 0 | 0 |
| 39 | 39 | 8 | 8 | 0 | 0 |
| 29 | 29 | 9 | 9 | 0 | 0 |
| 40 | 40 | 11 | 11 | 0 | 0 |
| 23 | 23 | 11 | 11 | 0 | 0 |
| 43 | 43 | 11 | 11 | 0 | 0 |
| 42 | 42 | 12,5 | 12,5 | 0 | 0 |
| 43 | 43 | 12,5 | 12,5 | 0 | 0 |
| 35 | 25 | 14 | 14 | 0 | 0 |
| 43 | 43 | 14 | 14 | 0 | 0 |
| 37 | 37 | 14 | 14 | 0 | 0 |
| 11 | 11 | 15 | 15 | 0 | 0 |
| 36 | 36 | 16,5 | 16 | 0,5 | 0,25 |
| 39 | 39 | 16,5 | 18 | -1,5 | 2,25 |
| 34 | 34 | 18,5 | 18 | 0,5 | 0,25 |
| 29 | 29 | 18,5 | 18 | 0,5 | 0,25 |
| 35 | 35 | 18,5 | 19,5 | -1 | 1 |
| 29 | 29 | 18,5 | 19,5 | -1 | 1 |
| 39 | 39 | 20,0 | 20 | 0 | 0 |
| 26 | 26 | 20,0 | 23 | -3 | 9 |
| 27 | 26 | 20,0 | 23 | -3 | 9 |
| 41 | 41 | 21,0 | 23 | -2 | 4 |
| 38 | 38 | 22,0 | 23 | -1 | 1 |
| 38 | 38 | 24,5 | 23 | 1,5 | 2,25 |
| 23 | 23 | 24,5 | 24,5 | 0 | 0 |
| 50 | 50 | 24,5 | 24,5 | 0 | 0 |
| 26 | 26 | 24,5 | 26,5 | -2 | 4 |
| 47 | 47 | 25,5 | 26,5 | -1 | 1 |
| 25 | 25 | 25,5 | 26,5 | -1 | 1 |
| 37 | 37 | 26,5 | 26,5 | 0 | 0 |
| 34 | 34 | 26,5 | 27,5 | -1 | 1 |
| 34 | 34 | 27,0 | 27,5 | 0 | 0 |
| 34 | 26 | 28,0 | 28,5 | -0,5 | 0,25 |
| 33 | 33 | 29,5 | 28,5 | 1 | 1 |
| 37 | 37 | 29,5 | 29,5 | 0 | 0 |
| 31 | 31 | 30,5 | 29,5 | 1 | 1 |
| 22 | 22 | 30,5 | 30 | 0,5 | 0,25 |
| 53 | 53 | 31,0 | 31 | 0 | 0 |
| 33 | 29 | 32,0 | 32 | 0 | 0 |
| 24 | 21 | 33,5 | 33 | 0,5 | 0,25 |
| 22 | 22 | 33,5 | 34 | -0,5 | 0,25 |
| Σ | | | | | 40,25 |

Source: Own study based on research results.

3. Discussion

As Gayle C. Avery notes, although interest in leadership has been around for millennia, it is both the most widely studied and least understood topic (Avery, 2009). According to Warren, "Today we know for sure that an increasingly insecure, stable and predictable world makes the need for leadership in every organization, in every institution stronger than ever" (Warren, 2003). The article identified effective leadership from the perspective of external and internal clients in favorable and unfavorable conditions in empirical terms. Empirical research has proven that hypotheses number 1, 3, 5 were confirmed, hypotheses number 2, 4, 6, 7 were not confirmed. In general, customers rated the value of leadership low in both favorable and unfavorable conditions. This is a signpost for increasing activity for the growth of value for the customer.

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PLANNING ALGORITHMS FOR CYBER-PHYSICAL PRODUCTION NETWORKS IN THE INDUSTRY 4.0 ENVIRONMENT

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Purpose: The paper aims to present the methodology of rapid prototyping of small and medium-sized enterprises' networks operating in the Industry 4.0 environment.

Design/methodology/approach: In the conducted research, the method of literature analysis and mathematical analysis, set algebra, and mathematical logic was used to design algorithms using proposed sufficient conditions, which fulfilment allows for the prototyping of a cyber-physical production network of small and medium-sized enterprises.

Findings: Based on the obtained research results, a general methodology for planning cyber-physical production networks was proposed based on algorithms using a set of sufficient conditions.

Research limitations/implications: The proposed methodology presents only a part of the general model of functioning of the cyber-physical network of enterprises and allows for prototyping of variants of admissible networks. This means the need to integrate the proposed methodology with the planned prototype of e-business platforms, which will be an environment for integrating production companies and potential customers ordering production tasks.

Originality/value: Original achievements obtained during the research include algorithms that allow rapid prototyping of network variants based on available production resources, the cost of their use and transport constraints between companies. Noteworthy is the possibility of obtaining a set of acceptable solutions and choosing the best one due to the cost criterion or the deadline for completing the production order. The proposed approach allows for planning a detailed schedule of production flow, taking into account the load on resources and transport between companies.

Keywords: Industry 4.0, cyber-physical production network, algorithms of networks planning, small and medium enterprises.

Category of the paper: Research paper.

1. Introduction

The fourth industrial revolution is a challenge for the entire economy. It introduces new changes in industry and society (Bauernhansl et al., 2014). The widespread digitization of economic processes forces enterprises to change, especially in using modern communication technologies and building a competitive advantage in the market through intelligent solutions. Combining industrial technologies with modern information and communication technologies (ICT) is the basis of the fourth industrial revolution and the concept of Industry 4.0 (Kagermann et al., 2011). The concept of Industry 4.0 is understood as a combination of intelligent resources and enterprise systems and the introduction of changes in the management of production processes that can increase the efficiency and flexibility of production and guarantee a high level of production personalization (Młody, 2018; Grabowska, Saniuk, 2023). Industry 4.0 builds cyber-physical production systems to integrate information and operational technology in enterprises and supply chains (Lee et al., 2015; Liu et al., 2017).

Today's consumers strongly desire personalized products tailored to their unique preferences and needs (Hu, 2013). As a result, manufacturers must be highly integrated with their clients and involve them in the product development process. This includes offering configurable options for manufactured products and allowing customers to participate in product design. At the same time, customers expect these personalized products to be priced similarly to standard products (Yang, Jun, 2008). To meet this demand for customized products, manufacturers must be flexible and responsive when accepting new production orders. Modern companies must change their business models and focus on developing their product and service offerings. To create additional value for the customer, many companies are adopting a "servitization" or "service infusion" approach, which involves adding services to their standard product offerings (Kowalkowski et al., 2017). Successful companies should focus on developing their know-how and fostering cooperation in today's market rather than solely competing on product offerings. Servitization helps build better customer-producer interaction, better uses resources, and provides networking opportunities (Vargo, Lusch, 2017). 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 (Kliment et al., 2021; Adamik et al., 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). Creating network forms of cooperation is not only an excellent opportunity to produce personalized products and services but also the dynamization of business models as part of the Industry 4.0 concept and an opportunity to increase the competitiveness of enterprises. However, focusing on network services and developing own know-how requires solving several problems resulting from the lack of methods for forming cyber-physical networks of small and medium-sized enterprises (Saniuk and Grabowska, 2021). Hence, research is needed to develop business models and networking concepts that use intelligent resources to implement specific personalized products in customer interaction.

The article's main purpose is to present the methodology of rapid prototyping of small and medium-sized enterprises' networks based on algorithms using the checking of sufficient conditions established to implement personalized production orders.

2. Problem formulation

In the presented case, it is assumed that an e-business platform will be created, bringing together small and medium-sized enterprises equipped with intelligent production resources capable of communicating with the online platform. Enterprises provide information about resources, making them available on the network in real-time. The customer specifies a personalized production order on the e-business platform. Each order specifies the client's expectations concerning the implementation timing and the implementation cost (price).

The production order (project) is understood as a 4-tuple: $P = (Z, T_s, T_k, K)$, where: $Z = \{Z_j = (O_j, L_j, ZN_j) : j \in \{1, \dots, n\} \wedge \text{if } j=1 \text{ then } ZN_1 = \text{nil} \text{ otherwise } ZN_j \neq \text{nil}\}$ – a set of tasks belonging to the order P , T_s – the date from which to begin execution of the order, T_k – the date by which the order must be executed, K – the maximum (permissible) price (cost) of the order.

For the description of the order, the following additional indications are set:

$\text{Pred}(Z_j)$ – a set of predecessors (which deliver their results directly to Z_j).

$\text{Succ}(Z_j)$ – a successor – (which makes use of the results from Z_j).

The task is a 3-tuple: $Z = (O, L, ZN)$, where: O – the task description, L – the number of pallets required to transport the task outcome, ZN – an indicator on the another task that directly uses the result of task Z (if the next task for Z does not exist, then $ZN = \text{nil}$).

In the case under consideration, the answer to the following question is sought: *Is there a cyber-physical network of small and medium-sized enterprises that guarantees the timely execution of a production order due to the available production capacity of resources, and the*

total cost of order execution will not exceed the price specified by the client (maximum total cost)?

Finally, a subset of the enterprise is sought $\Omega = (F_1, \dots, F_n)$ set N – enterprises $\{F_k | k=1, \dots, N\}$, which will be able to execute the production order.

The information from intelligent resources of the enterprises will send online as an offer for the task, it means a 5-tuple: $OZ = (Z, R, F, T_z, K_z)$, where:

Z – is a task,

R – the resources needed to complete the task Z ,

F – company, where there is a resource R ,

T_z – the time required to complete task Z ,

K_z – the cost of realization of task Z (the cost includes the total cost of resource use and cost of materials used). Additionally, the enterprise in real-time determines, for each resource, the range of periods accessible to the networks, of which there are three $W = (R, T_1, T_2)$, where:

R – the resource, $[T_1, T_2]$ – time interval in which the resource R is available for the e-business platform.

3. Algorithms of cyber-physical networks formation

The proposed methodology for a cyber-physical networks planning is based on a sequence of checking sufficient conditions. The proposed algorithm considers the constraints related to the availability of intelligent resources, the cost of their use, and logistic constraints considering the distance between partners and the cost of transporting components in the physical flow of materials. Three phases can be distinguished in the proposed approach to planning cyber-physical networks. An outline of the methodology is presented in Figure 1.

The first phase, called the "application phase", is the development of a personalized product design and the planning of manufacturing operations (tasks) related to the product's production and delivery to the customer. In this phase, the e-platform customer contacts via the online e-commerce application and specifies the product, selecting the available options and variants regarding the product's shape, size, colour or additional specific features. After the customer specifies the product, determines the implementation date and sends it for implementation, the system will automatically create a plan of production operations by selecting the appropriate production technology and documentation.

In the next phase of the "declaration phase", companies with appropriate resources provide real-time information about the availability of production resources and data related to the costs of their use. The transfer of information in real-time is possible thanks to Industry 4.0 technology Industrial Internet of Things (IIoT), Cloud Computing and Big Data.

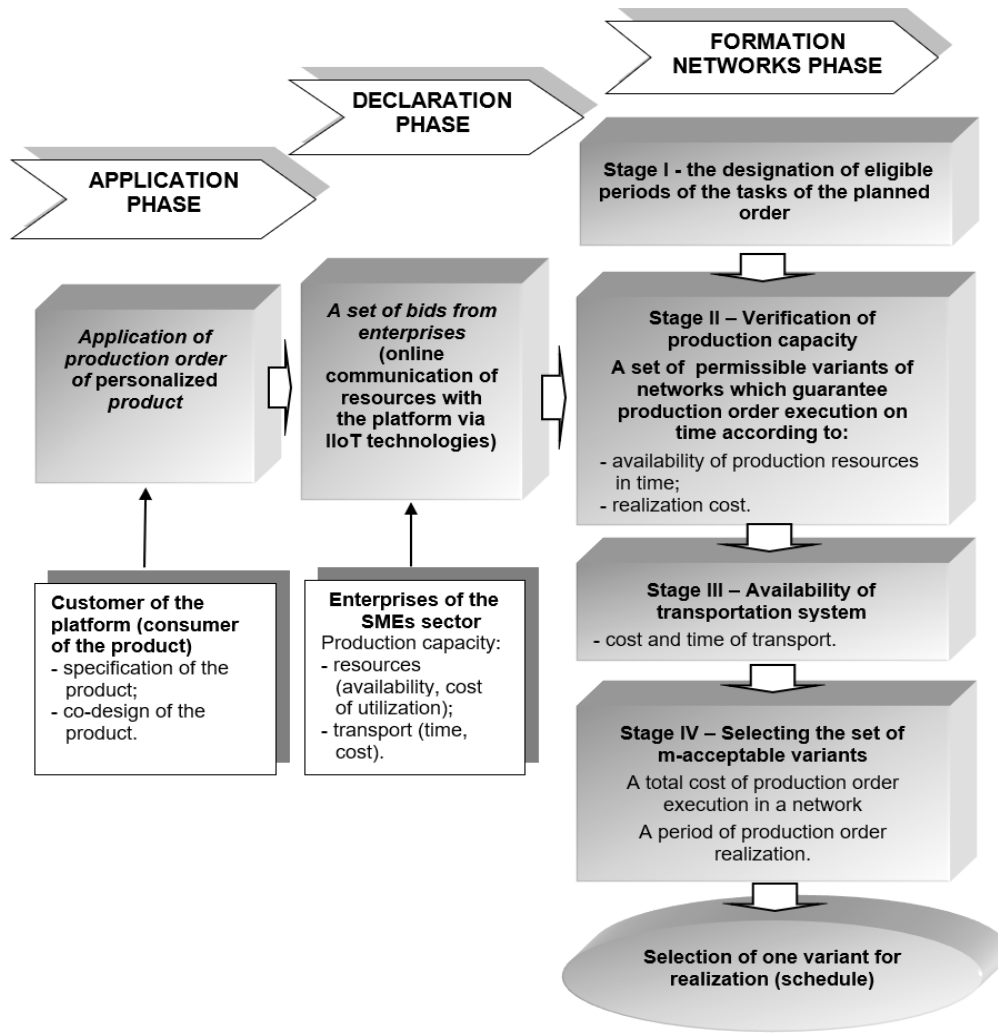


Figure 1. The general scheme of forming a cyber-physical production networks.

In the third phase, multiple network options by carefully selecting production resources and taking into account the logistics involved in transporting materials and components are generated. Then, the expenses associated with fulfilling orders to establish the price of the product are evaluated. Four primary stages of the production network prototyping can be identified in this phase. The first stage is the designation of eligible periods for the implementation of each of the tasks of the planned order based on the submission of tenders in which task durations and the time of execution of transport operations are declared. Upon receipt of all tenders for each information about resources matching the tasks, the number of possible variants of the network can be determined by the formula (1):

$$PDR \prod_{j=1}^n e_{Fj}, \tag{1}$$

where:

e_{Fj} – the number of enterprises offering to performe the j - th task,

n – the number of tasks of considered production order P.

The first stage of the algorithm uses DFS (Depth First Search) to designate which individual tasks within Z_j can be started earliest ($Z_j.earliest_start$) and which can finish latest ($Z_j.latest_end$), so that the realization of the entire production process of the planned order P is possible in a given period $[T_s, T_k]$.

In addition, the stored value is the lowest offer ($Z_j.min_cost$) and a minimum total cost ($Z_j.TK$) to denote the sum of the minimum cost stated in the bids for all tasks preceding task Z_j and minimum transportation costs between the companies, which declared the offer by e-business platform for the tasks Z_i and $Succ(Z_i)$ after all tasks of Z_i , which precedes task Z_j . The algorithm to determine the maximum periods of the tasks within the stipulated period of the planned order is shown in Figure 2.

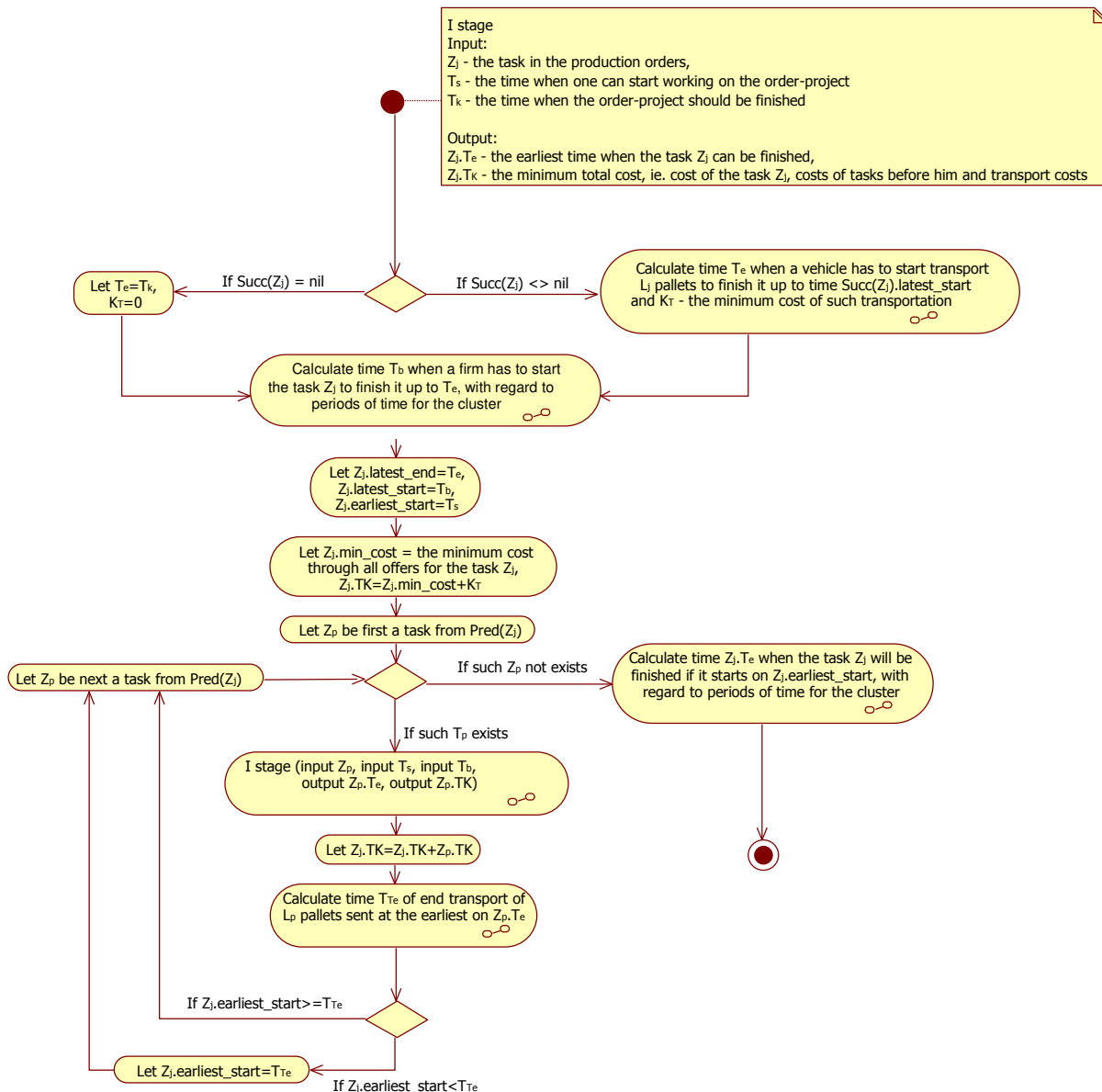


Figure 2. Algorithm of permissible periods planning of task realization.

During the second stage, tenders are allocated to specific periods for completing the task. The number of potential options (PDRI) is then narrowed down by eliminating those that cannot guarantee the availability of resources during designated periods for completing the task. Additionally, any options that exceed the maximum planned cost of the order, including transportation costs, are also eliminated based on the bidder's total cost estimation. Thus, in this stage, all bids for task Z_j are eliminated, which cannot be completed within the prescribed time $[Z_j.earliest_start, Z_j.latest_end]$ and where the declared task completion cost $OZ.K$ is greater than $Z_j.min_cost+(P.K - Z1.TK)$.

At this stage, a sufficient conditions check is included (2) and (3), the fulfilment of which ensures that the proposed offer allows the task to be carried out in respect of the stated delivery time for Z_j , the transport operation between enterprises, and the availability of the resource R . The following condition (2) must be satisfied:

$$\begin{aligned} \forall Z_j, \exists OZ_j = (Z, R, F, T_z, D/Time, K_z), \exists W = (R, T_1, T_2), \\ T_z \leq [T_1, T_2] \cap [Z_j.earliest_start, Succ(Z_j).start - TT_j], \end{aligned} \quad (2)$$

where:

OZ_j – the offer made for task Z_j ,

W – available time of the resource R to realize task Z_j ,

$[T_1, T_2]$ – the period of availability of the resource R planned to carry out the task Z_j ,

T_z – the realization time declared for task Z_j ,

TR_{min} – minimum working time of the resource for one task,

TT_j – the time required to carry out transport operations between the company $OZ_j.F$ and the company performing task $Succ(Z_j)$,

$[Z_j.earliest_start, Succ(Z_j).start - TT_j]$ – the period during which the task Z_j should be completed,

$D/Time$ (Yes/Not) – division of tasks for shorter periods, e.g. in the case of several shorter periods of resource availability.

Similarly, the condition must be that the cost of the task in the offer was accepted. Enterprises with offers, which do not satisfy the condition (3) are rejected.

$$\begin{aligned} r_l = (P.K - Z_l.TK), \\ \forall Z_j \exists OZ_j = (Z, R, F, T_z, D/Time, K_z), \\ OZ_j.K \leq Z_j.min_cost + r_j \text{ and } r_{j+1} = r_j - (OZ_j.K - Z_j.min_cost) \end{aligned} \quad (3)$$

where:

$OZ_j.K$ – the declared cost of offers for task Z_j ,

r_j – an amount, which can help determine if the minimum amount for bids for the task Z_j , can be increased, not to exceed the budget for the entire order (project) P ,

$Z_j.min_cost$ – value of the lowest offer submitted for the task Z_j ,

$P.K$ – the maximum cost (price) of realization of the order P ,

($Z_j.TK$) – the sum of the minimum cost stated in the bids for all tasks preceding task Z_j and minimum cost of transportation offered for this task, therefore $Z1.TK$ – means the minimum (essential) amount required for the implementation of the order P (assuming that each task should be selected to offer the cheapest option).

Elimination of offers of enterprises which do not meet such conditions can reduce the number of feasible solutions based on the formula (4) for PDRII.

$$PDR_{II} \leq \prod_{j=1}^n e'_{F_j}, \quad (4)$$

where:

e'_{F_j} – the remaining number of offers for task Z_j after eliminating offers which do not meet the sufficient conditions for the availability of resources,

n – number of planned tasks for production order P.

In stage III, a set of variants is determined, limited to those that meet the conditions associated with the transport system. Variants in which the transportation cost and delivery time prevent the timely implementation of transport at the given maximum cost of the production order P are rejected. In the proposed approach, it is assumed that an external means of transport is constantly available, along with the possibility of the (optional) use of the enterprise's vehicle. Assessment is subject only to the planned duration of the transport operation between the partners forming the network and the declared cost of the transport. The calculated cost follows directly from a distance between firms and the average rate per kilometre the logistics operator offers in the local market.

In the proposed algorithm shown in Figure 3 for stage II and stage III, the user can restrict the set of feasible solutions sought to a maximum number of variants of expected production networks.

During last stage phase, set of acceptable variants of production networks that represent various resources from different companies are created. Each variant is distinguished by its time and cost of product realization. The customer will choose the final network variant based on these two criteria. Once the customer accepts the price and lead time, the network is formed, and production stages begin in the individual enterprises of the network.

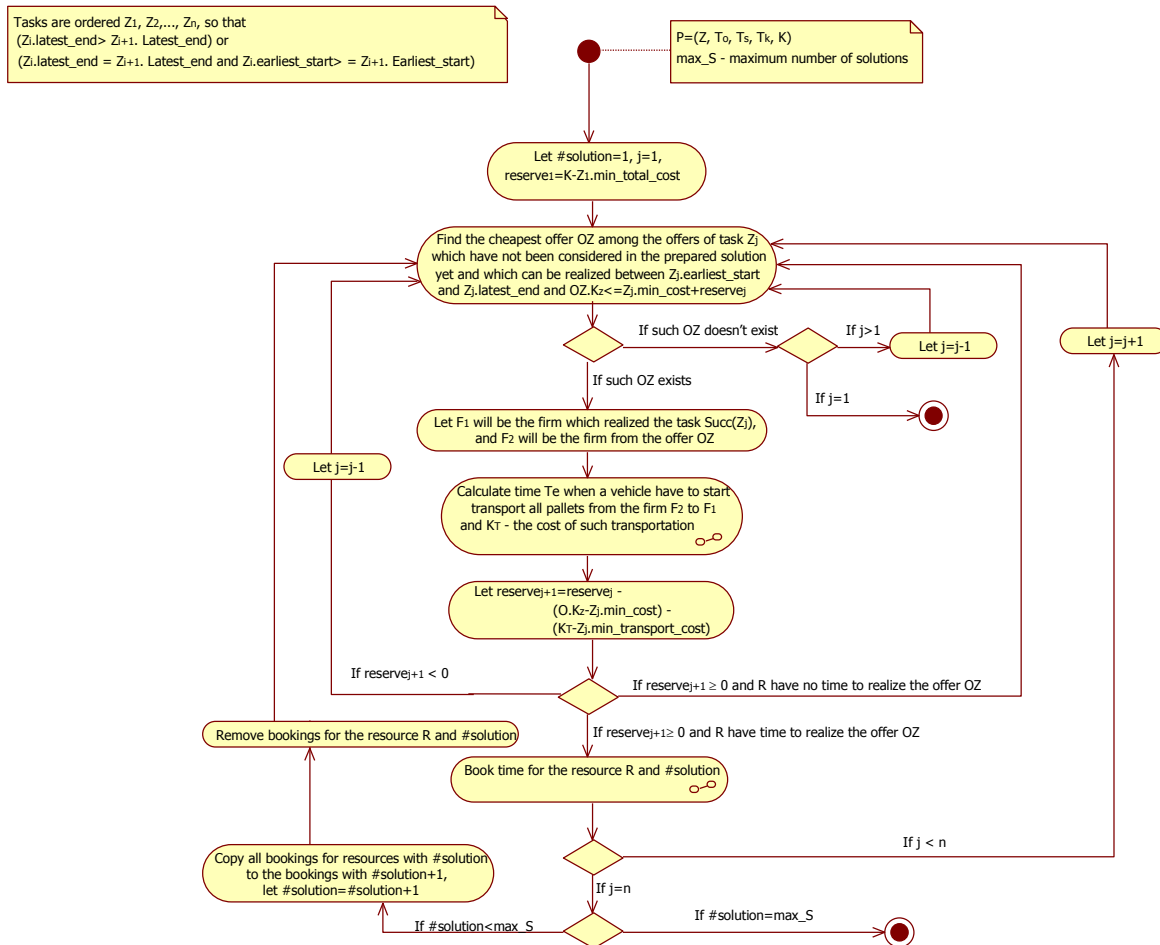


Figure 3. Algorithm for determination of permissible solutions.

4. Discussion and Conclusions

The idea behind Industry 4.0 revolves around seamlessly integrating resources and services offered by different companies involved in production. By adopting servitization, which involves providing additional services along with the core product to enhance customer value, companies can improve their interaction with customers. This approach also allows for optimal utilization of resources and networking opportunities, especially for small and medium-sized enterprises. Unlike large companies, these enterprises can leverage cooperation and narrow specialization for growth in the Industry 4.0 era.

The proposed in the paper sufficient conditions and algorithms for planning a cyber-physical production network of SMEs are an essential element of the model of functioning cyber-physical networks of small and medium-sized enterprises in the Industry 4.0 environment. The methodology allows for the quick generation of a set of acceptable network variants composed of those enterprises whose production capacity proposed guarantees the timely execution of a production order. In the fourth industrial revolution era, we are

increasingly dealing with personalized orders that require the specific know-how of various companies. Hence, the organization of e-platforms bringing together specialist companies is an excellent environment for building interaction at the customer-manufacturer level.

The article proposes a prototyping methodology for cyber-physical production networks that can effectively support e-platforms catering to small and medium-sized enterprises. In today's world, customers expect personalized products, and e-business platforms provide a means of integrating customers with manufacturers. Additionally, with the help of the rapid network prototyping methodology, these platforms can also integrate resources (machines, devices, means of transport, employees), and services from small and medium-sized enterprises within the network. By creating cyber-physical networks using this methodology, cooperating companies can increase the utilization of their resources, resulting in improved productivity for network partners.

In the future, conducted research will prioritize the development of an e-platform that can operate within the Industry 4.0 setting. This involves implementing the suggested algorithms and creating innovative business models, particularly tailored to small and medium-sized enterprises that are investing in digital Industry 4.0 technologies.

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DIGITALIZATION IN POLISH MEDICAL ENTITIES – RESPONSIBILITIES, BENEFITS AND BARRIERS – A CASE STUDY

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Purpose: The article aims to indicate medical entities' obligations in the field of digitalization as well as the associated benefits and barriers, based on a case study of a medical outpatient clinic.

Design/methodology/approach: A review of the literature on digitalization in medical entities was conducted. An analysis of legal acts was also carried out to determine the obligations of Polish medical entities in this regard. The research part draws on a survey interview with a pharmacist and a case study of a medical outpatient clinic.

Findings: The analysis of legal acts allowed specification of the continually increasing digitalization obligations faced by Polish medical entities. The medical entity surveyed complies with all obligations. It also assessed the benefits associated with the digitalization process highly and, as a unit demonstrating an advanced level thereof, does not identify any significant barriers to its implementation. The interview conducted with the pharmacist revealed that the obligation of e-prescribing is already widely fulfilled.

Research limitations/implications: The benefits and barriers were assessed by one medical entity owner, whereas the level of compliance with e-prescription obligations was determined by one pharmacist. This means that the results obtained cannot be generalized to the entire population of entities and all healthcare professionals. This study can be further expanded by including a larger number of entities and comparing the data with foreign entities.

Practical implications: By highlighting the benefits of digitalization by the surveyed entity, the article can mobilize other entities and encourage them to digitize.

Social implications: The article has the potential to raise patient awareness of expectations regarding medical practices.

Originality/value: The article raises the little-recognized but timely topic of digitalization in medical units and is addressed to both medical entities and their patients. Due to the scarcity of publications on digitalization and the scope thereof in medical entities, the paper partially bridges the research gap in this area. The survey also allowed to formulate future research plans, i.e., to extend the study to other medical entities in order to identify the reasons behind the slow pace of digitalization in Polish medical entities, explore for solutions to this challenge, and compare the data with other countries.

Keywords: digitalization, digital transformation, medical entities.

Category of the paper: Case study.

1. Introduction

Technological development is progressing, and it cannot continue without affecting the healthcare sector. The "Future Health Index 2019" report shows that 82% of Polish patients wish to have access to their medical history records on an ongoing basis. Meanwhile, amongst the 35 European countries assessed for the performance of healthcare systems, including e-health, Poland ranked a distant 32nd in 2019 (Szajczyk, 2019). There has been no significant improvement in data sharing and the use of e-services in subsequent years. A survey of the degree of informatization in healthcare providing entities, conducted in 2022, indicated that merely less than 17% of the surveyed units facilitate the use of e-services via a website, which is a result 12 p.p. worse than in the previous year. This highlights the fact that this area of digitalization requires particular improvement. Although it might seem that telemedicine has been set to become widespread after the pandemic, only 25.5% of medical facilities do offer such services. With only 26.1% of the surveyed entities digitally mapping the records kept in paper form, the degree of documentation digitization also needs to be addressed. The survey data also indicate, however, that 89% of the respondent healthcare entities employ Electronic Health Record (HER) systems, representing an increase of more than 20 percentage points compared to the previous year (VI Edycja Badania stopnia informatyzacji..., 2022). The survey cited above thus reveals that the level of digitalization has been increasing in some respects, but other issues still need improvement. These changes will not take place without showing the actors the benefits they can gain from digitalization and familiarizing them with the barriers they may encounter during the implementation.

The aim of the article, therefore, is to identify the digitalization obligations, the benefits thereof as well as the challenges faced by medical entities in this regard. The following research questions were posed during the study:

1. What digitalization obligations are medical entities confronted with?
2. What are the benefits of digitalization?
3. What barriers do entities encounter in implementing digitalization?

Part one of the article outlines the essence of digitalization and provides a review of the literature on digitalization in medical entities. Part two explores the course of the digitalization process in Poland - an analysis of legal acts was carried out to determine the obligations of entities in the field of digitalization. The third part features a description of the research methodology adopted, based on a case study of a medical outpatient clinic and a structured interview held with the unit. The results of the research are presented and discussed as well - the degree of the unit's digitalization and its compliance with the mandatory aspects thereof were verified, followed by a presentation of an assessment of the benefits of digitalization and the challenges associated with it. A semi-structured interview was also conducted with the pharmacy owner to gain insight into the extent of compliance with e-prescribing regulations. Finally, the research conducted has been summarized and research plans have been outlined.

The following research methods were used in the article: literature review, analysis of legal acts, case study and descriptive method.

2. Digitalization in medical entities

2.1. The essence of digitalization

Digitalization, according to the definition of the Dictionary of the Polish language [PL: Słownik Języka Polskiego], entails the dissemination and popularization of digital technology and the large-scale introduction of electronic infrastructure. The process of digitalization thus involves integration of advanced technology into all processes, products and services (Parida, 2018). It is aimed at improving the efficiency of enterprises through changes in their operations that based on information technology. The concept of digitalization is sometimes equated with the term digital transformation. Paavola, Hallikainen, Elbanna (2017) define it as the use of new digital technologies to streamline business processes, in order to improve customer service, inter alia. According to Zimnoch (2021), one of the stages of digitalization is digitization, which the Dictionary of the Polish Language defines as putting written and printed data, stored on magnetic or other carriers, into digital form. The process thus involves the transition to electronic records from the previously paper form of documentation. Similarly, A. Niewęglowski defines this process as the transformation of a particular intellectual content record, which hitherto functioned in analog form, into digital form (Niewęglowski, 2021).

2.2 Digitalization in medical entities - a literature review

To outline the essence and importance of digitalization in medical entities, a preliminary literature review was conducted during the period from January 5 to January 19, 2023. The review covered Scopus and EBSCO databases and, due to the dynamic development of technology, did not include articles written before 2013. Combinations of the following keywords were used:

- a) digitalization, digitization, digital transformation
- b) medical entities.

Out of 56 articles identified, 18 were singled out as noteworthy. The articles selected were divided into three research streams: data, medical records, security; healthcare facility management; and digitalization readiness and effects. In each group, common conclusions and main research areas can be found. An overview of these is presented in Table 1.

Table 1.
Literature review

| Research stream | Autor/s |
|---|---|
| Data, medical records, security | |
| Medical records digitization, data protection and exchange, medical data management, decentralized model of access control. | Rana, S.K., Rana, S.K., Nisar, K., (...), Goyal, N., Chawla, P. (2022) Schönermark, M.P. (2019) |
| Healthcare cyber security, blockchain-based security framework, data control. | Lehto, M., Neittaanmäki, P., Pöyhönen, J., Hummelholm, A. (2022), Siva Rama Krishnan, S., Manoj, M.K., Gadekallu, T.R., (...), Suh, D.Y., Piran, M.J. (2020), Polap, D., Srivastava, G., Jolfaei, A., Parizi, R.M. (2020) Essefi, I., Boussi Rahmouni, H., Solomonides, T., Fethi Ladeb, M. (2022) |
| Use of Entity Resolution to maintain electronic medical records. | Gupta, T., Deshpande, V. (2020) |
| Healthcare facility management | |
| Perceived managerial competence in digital healthcare services. | Ylitalo, A., Laukka, E., Heponiemi, T., Kanste, O.I. (2023) |
| Digital-age changes in facility management and staffing. | Masár, D., Ondria, P. (2022) |
| Digitalization effects and implementation readiness | |
| Digitalization of medicine and healthcare is enabling process streamlining and measurement system optimization. | Kübler, W.F. (2017) |
| U-healthcare enables services to be delivered from anywhere at any time as well as responds to the advances in medical technology and increased demand for healthcare. | Kim, H.-K. (2014) |
| Telemedicine enables collaboration between remote medical units and automation of healthcare process management. | Brzezinski, J., Kosiedowski, M., Mazurek, C., (...), Stroinski, M., Weglarz, J. (2013) Milne, R., Costa, A. (2020) |
| Design and implementation of an international, intelligent hospital information system, with the aim of improving the application of the IT system in the process of diagnosis and treatment, to provide patients with high quality services. | Shen, L., Liu, H., Tian, W., Zhang, S. (2020) |
| Assessment of Polish primary healthcare units' organizational readiness for the e-health concept and the factors influencing the level of e-readiness for digital transformation. | Kruszyńska-Fischbach, A., Sysko-Romańczuk, S., Napiórkowski, T.M., Napiórkowska, A., Kozakiewicz, D. (2022) Kruszyńska-Fischbach, A., Sysko-Romańczuk, S., Rafalik, M., Walczak, R., Kludacz-Alessandri, M. (2022) |
| Application of digital twins in medicine and public health care. | Kamel Boulos, M.N., Zhang, P. (2021), Sharma, C., Gupta, G. (2021) |

Source: own compilation based on Scopus and EBSCO databases.

The literature review allowed identification of several areas under discussion. A total of 7 of the 18 selected publications covered the issues of medical records, data management, data protection and data security. These data include patient medical records, but also drug-related information, namely information obtained from medical devices and in clinical trials. In these publications, the importance of data control and protection has been stressed, and a security framework has been proposed. Two of the articles reviewed focused on the management of medical facilities. In these articles, the changes taking place as a result of digitalization, as well as the perception of managerial competence at different levels of management in digital healthcare services, have been highlighted. The effects of digitalization

have been discussed in 7 publications. These included process streamlining and measurement system optimization, improved service quality, provision of services from anywhere at any time, and remote collaboration between medical entities. Not every entity, however, shows the same degree of readiness for digitalization, as two publications by Polish specialists report. These authors emphasize that an entity's readiness depends on its operational capabilities, which are the sum of valuable and unique resources, the ability to use those resources, as well as technological capabilities conditioning the adoption and use of technological innovations.

The literature review revealed a scarcity of publications describing the obligations, benefits and barriers to digitalization in medical entities, uncovering an existing research gap in this area, which this article aims to partially fill.

3. The state of digitalization in Polish medical entities - a review of legal regulations

Digitalization is present in every area of life. It cannot be absent from the healthcare sector either. Some aspects of medical entity digitalization, initially voluntary, become mandatory over time. The process of digitalization in Polish medical entities is ongoing and continually progressing. Before specifying the legal status of digitalization in the healthcare sector, it is worth defining what medical entities are and what the medical activities they provide consist of. According to the Act of April 15, 2011, on Medical Activity, medical entities encompass:

1. entrepreneurs, within the meaning of the provisions of the Act of March 6, 2018 - Entrepreneurs Act (Journal of Laws 2021, item 162 and 2105; Journal of Laws 2022, item 24), in all forms provides for the performance of business activities, unless otherwise provided by law,
2. independent public healthcare institutions,
3. budgetary units (...) with ambulatory care as well as ambulatory care with an infirmary or primary care physician, primary care nurse or primary care midwife in the organizational structure, within the meaning of the provisions of the Act of October 27, 2017, on Primary Healthcare (Journal of Laws 2021, item 1050),
4. research institutes referred to in Article 3 of the Act of April 30, 2010, on Research Institutes (Journal of Laws of 2020, item 1383; Journal of Laws of 2021, items 1192 and 2333),
5. foundations and associations, the statutory purpose of which is to perform healthcare tasks and the statute of which allows therapeutic activities,
5a) incorporated organizational units of associations referred to in point 5,

6. legal persons and organizational units acting on the basis of regulations on the relationship of the State to the Catholic Church in the Republic of Poland, the relationship of the State to other churches and religious associations, and guarantees of freedom of conscience and religion,
7. military units,
 - within the scope in which medical activities are performed. (Article 4 (1) of the Act of April 15, 2011, on Medical Activity).

The function of medical activity is to provide healthcare services, also by means of ICT or communications systems. Health care services, in turn, entail activities aimed at preserving, saving, restoring or improving health, as well as other medical activities resulting from the process of treatment or separate regulations governing the rules of the performance thereof. (Article 2(1)(10) of the Act of April 15, 2011, on Medical Activity).

Types of medical activities include:

1. stationary and round-the-clock health care services - hospital and non-hospital,
2. outpatient health care services - basic or specialized health care services not required under inpatient and round-the-clock regime, including medical rehabilitation and diagnostic tests.

It is also worth noting that healthcare activity can be commenced after obtaining an entry in the register of health care entities, maintained via an information and communication system (Act of April 15, 2011, on Medical Activity).

Digitalization in medical entities is regulated by a number of laws. The Act of April 28, 2011, on the Healthcare Information System specifies the organization and operation of an information system, in which data essential for the state health policy, improvement of the quality and availability of healthcare services, and financing of healthcare tasks are processed. It includes databases created by the obligated entities, containing information on provided and planned services as well as the providers and recipients thereof.

The information system comprises databases functioning within:

1. the Medical Information System [PL: System Informacji Medycznej] (hereinafter: SIM),
2. field information and communication systems.

The Act of February 17, 2005, on Computerization of the Activities of Entities Performing Public Tasks, which also covers independent public health care institutions performing public tasks, stipulates that ICT systems meeting minimum requirements and ensuring interoperability of systems should be used for the implementation of those tasks. When processing data via an ICT system, entities are obliged to enable the transfer of data in electronic form, using IT data carriers or means of electronic communication (Act of February 17, 2005, on Computerization of Activities...).

The e-Health Center has developed a product - the e-Health system (P1) - forming the basis for the digitalization of medical services. It enables the collection, processing and sharing of data on medical events and extends to all medical entities. The project was implemented in two phases - Phase 1 in 2007-2015 - the design phase and production of subsystems, and Phase 2 - in 2016-2022 - the production of the remaining products and integration thereof with the products of Phase 1, followed by implementation (e-Health System (P1), 2022).

As a result of Phase 2, the following functionalities have been launched (e-Health System (P1), 2022):

- e-prescription,
- e-referral,
- medical events,
- exchange of electronic medical records,
- Internet Patient Account [PL: Internetowe Konto Pacjenta (IKP), and Service Providers and Pharmacies Application [PL: Aplikacja Usługodawców i Aptek (AUiA),
- Publication Platform,
- Data Warehouse,
- E-Registration System,
- Teleconsultation System,
- online prescription ordering.

The legislation regulating the digitalization capabilities and obligations of medical entities has been successively coming into force since 2015. The mandatory aspects contained in the law are presented in Table 2. The mandatory aspects are presented in Table 2. Under the Act of October 9, 2015, amending the Law on the Healthcare Information System and certain other laws, as of December 12, 2015, the legislator has allowed the provision of health care services in the form of telemedicine. Relevant regulations have also been introduced, inter alia, in the Law on Medical Activity and in laws regulating individual medical professions. As of January 1, 2016, sick leave attestation in the form of an electronic document can be issued in parallel with the paper form. (Zoń, 2022). As of December 1, 2018, they are issued exclusively in this form (Act of May 10, 2018, amending the Law on Amendments to the Law on Social Security Cash Benefits...).

On January 1, 2019, pursuant to Article 13a of the Act of April 28, 2011, on the Healthcare Information System as well as the Regulation of the Minister of Health of May 8, 2018, on types of electronic medical records, an obligation to maintain electronic records with information on, inter alia, disease diagnosis, test results, healthcare services provided was introduced. The extension of this obligation to keep records of diagnostic test impressions came into effect on April 25, 2020, followed by inclusion of laboratory test result records, introduced on April 25, 2021 (Regulation of the Minister of Health of October 15, 2019, amending the Regulation on types of electronic medical...).

On January 8, 2020, based on Article 56 of the Act of April 28, 2011, on the Healthcare Information System, an obligation to issue e-prescriptions, in electronic form, was introduced. By virtue of the Act of July 19, 2019, amending certain laws in connection with the implementation of e-health solutions, e-referrals became mandatory as of January 8, 2021. This obligation applies to the issuance of electronic referrals for services specified in a list established by Regulation of the Minister of Health, including, inter alia, outpatient specialized services financed by public funds (Regulation of the Minister of Health of April 15, 2019...).

Table 2.

Digitalization obligations - legal regulations

| Effective date | Legal Act | Introduced obligation |
|-----------------|--|---|
| 1 December 2018 | Act of May 10, 2018, amending the Act on Amendments to the Act on Social Security Cash Benefits in Case of Sickness and Maternity and Certain Other Laws | e-sick leave |
| 1 January 2019 | Act of April 28, 2011, on the Healthcare Information System | maintenance of electronic records on, inter alia, disease diagnosis, test results, healthcare services provided |
| 25 April 2020 | Regulation of the Minister of Health of October 15, 2019, amending the Regulation on types of electronic medical records | maintenance of electronic records of diagnostic test impressions |
| 25 April 2021 | | maintenance of electronic records of laboratory test results |
| 8 January 2020 | Act of April 28, 2011, on the Healthcare Information System | e-prescriptions |
| 8 January 2021 | Act of July 19, 2019, on amending certain laws in connection with the implementation of e-health solutions | e-referrals |
| 1 July 2021 | Act of April 28, 2011, on the Healthcare Information System | reporting of medical events via SIM |
| 10 January 2022 | Act of April 28, 2011, on the Healthcare Information System | National Health Fund (NFZ) settlements with health care providers based on medical events data |

Source: own compilation based on laws and regulations.

As an additional requirement, as of July 1, 2021, every medical entity is mandated to report medical events via the Medical Information System (Article 56(2a) of the Act of April 28, 2011...). The catalog of events subject to reporting has been further expanded on of October 1, 2022 (Regulation of the Minister of Health of June 3, 2022...). Furthermore, as of January 10, 2022, the National Health Fund [PL: Narodowy Fundusz Zdrowia (NFZ)] has been required to settle accounts with healthcare providers on the basis of data on medical events (Article 56(2b) of the Act of April 28, 2011...).

A survey conducted by the e-Health Center in 2021 showed that the digitalization of the healthcare sector did not present high levels of implementation, which means not all entities were complying with the obligations imposed. Only 57.7% of the medical entities surveyed guaranteed access to a computer network in all rooms where medical records are processed, and only in 68% of entities every medical staff member had access to a computer. Medical personnel in 10% of the outpatient units surveyed did not have access to a computer at all (W placówkach medycznych nadal rządzi papier [ENG: Paper still reigns in medical

facilities], 2021). The slow development of digitalization in healthcare was indicated by the fact that in 2021, despite the mandatory reporting of medical events, only 15% of entities reported such events at least once (Obowiązkowa EDM to fikcja... [Mandatory EDM is a sham...], 2022). A survey conducted in the same year found that IT tools for electronic record keeping were available to 67% of specialty clinics and 65% of family clinics. Record-sharing services for other entities, however, were absent in as many as 88% of the entities (Cyfryzacja szpitalom idzie jak po gurdzie [ENG: Digitalization of Hospitals is an Uphill Battle, 2021).

In 2022, as part of the VI Edition of the Survey of the Degree of Computerization in Entities Performing Medical Activities [PL: VI Edycja Badania Stopnia Informatyzacji Podmiotów Wykonujących Działalność Leczniczą], a similar survey was conducted on a group of 11 580 entities (10 195 represented outpatient healthcare services, hereafter: OHS). The data show a 20 percentage point increase in the number of healthcare entities equipped with systems supporting Electronic Medical Recordkeeping (hereafter: EMR), compared to the previous year. For 84% of the surveyed entities, the number of available computer workstations was found to be sufficient to implement EMR. It is noteworthy, however, that when asked whether an IT solution for electronic medical record keeping and electronic medical data processing was in place, 89.0% of the respondents confirmed implementation of such solutions, but 34.2% admitted to only partial availability thereof. Merely less than half of the surveyed entities declared maintenance of EMR of information for physicians referring patients for further treatment, 28.4% of the surveyed facilities maintain EMR of laboratory test results with diagnostic impressions, and 33.2% of the surveyed units maintain EMR of non-laboratory diagnostic test impressions. Only 57.5% of the respondent units have implemented EMR indexing within the e-Health System (P1) and adopted reporting to the medical events system (VI Edycja Badania Stopnia Informatyzacji..., 2022). The studies cited clearly indicate that not all entities are fulfilling their obligations, which in turn means that a portion of medical entities are not ready for the digitalization process. This is further underscored by the fact that, despite the mandatory billing of the National Health Fund to providers based on medical event data, out of more than 180 000 entities, only 23 000 reported data, and even fewer exchanged e-documentation, hence the fulfillment deadline has been postponed to January 2023 (Porażka e-dokumentacji medycznej [ENG: The failure of medical e-documentation], 2022).

Despite the failures encountered, the e-Health Center does not intend to abandon the changes it has begun to make - it also has plans to introduce e-registration at outpatient specialist clinics, as well as standardize and introduce additional digital documents into the e-Health system, including electronic birth charts. School medicine records would also be included in the e-health system. "The National Transformation Plan 2022-2026 [PL: Krajowy plan transformacji na lata 2022-2026]" also envisages development of telemedicine, especially in diabetology, geriatrics, cardiology, obstetrics, psychiatry, palliative care and chronic diseases. The e-Blood system, in turn, is to serve as a management system for the blood collection and distribution process. A system for organ transplantation process management is also planned

(Cyfryzacja ochrony zdrowia w roku 2022 – co nas czeka? [ENG: Digitalization of Health Care in 2022 - what awaits us?, 2022). Additionally, implementation of an electronic patient card - a document containing up-to-date data on every Polish citizen and made available to medical professionals via the system - is planned. In the context of the future of digitalization in Poland, it is also worth highlighting the potential of Artificial Intelligence - it can be used to identify diseases based on X-rays using algorithms (Kister, 2021).

A change in the approach to the digitalization process could positively affect the level of implementation in Polish medical entities and provide an opportunity for further development - instead of treating it as an unpleasant obligation, the benefits thereof should be recognized. Digitalization in medical entities can bring a whole range of such benefits, both for patients as well as for the facilities.

Benefits on the patient side include (Czerska, 2020):

- improvement in the quality of services,
- higher patient data security,
- better access to healthcare and medical data,
- no requirement to accumulate medical records,
- shorter wait time for medical services, hospital admissions,
- availability of online medical consultation, videoconferencing with a doctor.

Benefits on the medical facility side include (Czerska, 2020):

- improvement in data security and data transfer speed,
- higher quality of services,
- elimination of bureaucracy,
- savings in resources as a result of eliminating redundant medical examinations/testing,
- reduction of administrative costs,
- reduction in treatment costs,
- unit management streamlining,
- reduction of medical errors,
- shorter patient visits and hospital stays,
- improvement of entity's image.

The recognition and taming of the possible barriers could also help increase the level of digitalization in medical entities. The digitalization implementation challenges identified entail provision of data security and transparency, as well as integration of various systems with the latest technologies (Czerska, 2020). As J. Chluska points out, substantial barriers to the modernization of information systems also include frequent changes the regulations governing the operation of medical entities, and the constant restructuring and transformation of entities (Chluska, 2015).

4. Methods

To achieve the research objective and obtain answers to the research questions posed, the case study method was employed. It allows for an assessment of the benefits and barriers associated with the digitalization in medical entities, as well as enable an understanding of the perception of digitalization by these entities. The single case study analysis has also served to outline the direction of empirical research to be undertaken in the future and delineate the selection of entities for further in-depth studies (Czakon, 2015).

A structured interview was conducted with the owner of an outpatient clinic, in which part of the questions stemmed from the review of literature and legal acts on digitalization in medical entities. The surveyed questions were divided into three parts. The first covered information specific to the entity, including information on medical event reporting, medical records and the security thereof. The second part covered e-services. Both parts were intended to indicate the stage of the unit's digitalization process and its compliance with the obligations in this regard. The third part involved the unit's assessment of the stage of its digitalization, specification of its level of satisfaction with the process, as well as identification of the benefits of digitalization and the barriers to its implementation. A 0-5 scale was used to assess the benefits, where 0 represents no identified benefit in a given area, and 5 - a substantial benefit to the facility. The barriers to be faced in the process of digitalization were assessed on a scale of 0-5, where 0 - no barriers, and 5 - a substantial barrier difficult to overcome. The survey was conducted on February 15, 2023.

Additionally, a semi-structured interview was conducted with a selected pharmacy owner on February 06, 2023. The questions concerned the current level of fulfillment of entities' e-prescribing obligations. Deviations from the fulfillment of those obligations were also identified.

5. Results

5.1. A case study of an outpatient clinic

The structured interview with the medical entity was conducted on February 15, 2023, in an effort to assess the stage of the entity's digitalization, as well as determine what benefits and challenges of digitalization it identifies, including the assessment thereof. The entity surveyed is a Non-Public Health Care Institution [PL: Niepubliczny Zakład Opieki Zdrowotnej] (hereinafter: NZOZ), operating as a limited liability company. It provides an average of 8000 services per month.

Part One involved questions regarding whether medical event reporting had been implemented and whether billing with the National Health Fund is carried out based on medical event data, both of which were answered in the affirmative. This issue is of importance, as only 56% of OHS units implemented reporting, while billing with the National Health Fund based on medical data was enabled by only 13% of all obligated entities in 2022, according to survey conducted in 2022 as part of the VI Edition of the Survey of the Degree of Computerization in Entities Performing Medical Activities. An inquiry was also made regarding whether paper documentation is still in place, with a negative answer. This implies a complete transition to electronic documentation. The entity holds a sufficient number of computer workstations to implement e-documentation and exchanges electronic medical records with other entities. The entity surveyed also considers the electronic medical records to be secure.

The second part involved questions regarding the e-services. The entity issues e-referrals and e-prescriptions, thus fulfilling its digitalization obligations. It cites paper referrals to health resorts as well as Social Insurance Institution [Zakład Ubezpieczeń Społecznych (ZUS)], Agricultural Social Insurance Fund [PL: Kasa Rolniczego Ubezpieczenia Społecznego (KRUS)] and District Family Assistance Center [Powiatowe Centrum Pomocy Rodzinie (PCPR)] certificates as deviations from electronic form of documentation. The entity surveyed also provides an e-registration system and online prescription ordering as well as electronic sick leave attestation. Teleconsulting services are available, although patients rarely use them. E-services can also be accessed via the entity's website for online medical results and registration. Both the results of the first and second parts indicated that the entity not only meets its digitalization obligations, but also uses voluntary solutions, thus demonstrating a high level of digitalization.

This was confirmed by the entity's response to the question in part three regarding its own assessment of the degree of digitalization at the facility - on a scale of 1 (very low level of digitalization) to 5 (very high level of technological sophistication), the entity set its level at 4. Moreover, the unit surveyed stressed that while it was satisfied with the degree of digitalization at the facility, it planned to further develop the process over the next 12 months.

The subject was also asked to assess the pace of mandatory digitalization in Poland. It was assessed as too slow. It is also worth noting that the entity additionally voluntarily performs analyses of its revenues and costs, as well as calculates and analyzes costs per patient. The entity also keeps an internal IT team to help introduce the digitalization process.

In part three, the entity was also asked to rate the benefits of digitalization on a scale of 0-5, where 0 represents no identified benefit in a given area, and 5 represents a substantial benefit to the facility. In the identification of benefits, the survey drew on the publication of I. Czarska (2020). The results are presented in Table 3.

Table 3.
Digitalization benefits

| Benefit | 0 | 1 | 2 | 3 | 4 | 5 |
|--|----------|----------|----------|----------|----------|----------|
| improved patient service | | | | | | x |
| faster access to patients' medical records sourced from another entity | | | | | x | |
| relieving medical staff from bureaucracy | | | | | x | |
| enhanced data security | | | | | | x |
| increased service quality | | | | | | x |
| reduced treatment costs | | x | | | | |
| reduced administrative costs | | | x | | | |
| unit management streamlining | | | | | x | |
| reduction of patient visits | | | | | x | |
| improved image | | | | | | x |
| increased competitiveness | | | | | | x |
| reduced number of medical errors | | | | | | x |
| Personnel's increased job satisfaction | | | | x | | |

Source: own elaboration.

The entity identifies the greatest benefits the areas of improved patient services, enhanced data security and increased quality of services, improved entity image, increased competitiveness, and reduced medical errors. Faster access to other entities' medical records, relief of bureaucracy for medical staff, management streamlining, and reduced patient visits were also rated highly. Increase in personnel job satisfaction was set at a medium level. The benefit assessed the lowest was reduction in medical costs - digitalization has a marginal impact on reducing these costs. Slightly greater, though still insignificant, is the effect of digitalization on administrative costs.

The entity surveyed was also asked to rate the barriers to the implementation of digitalization on a scale of 0-5, where 0 represented no barriers and 5 represented a substantial barrier difficult to overcome. The results are shown in Table 4.

Table 4.
Barriers to implementation of digitalization

| Barriers | 0 | 1 | 2 | 3 | 4 | 5 |
|---|----------|----------|----------|----------|----------|----------|
| lack of clear standards | | | | x | | |
| reluctance on the part of employees | | | x | | | |
| lack of financial resources | | | x | | | |
| insufficient number of computer workstations | x | | | | | |
| insufficient knowledge on the part of employees | x | | | | | |
| organizational problems | x | | | | | |
| overload of responsibilities | x | | | | | |
| issues of electronic data protection and cyber security | x | | | | | |

Source: own elaboration.

As an entity that is highly advanced in terms of digitalization, it does not identify substantial barriers to the implementation. The biggest such barrier, though rated only at 3, is the lack of clear standards. For its part, the entity does not identify barriers at all in terms of insufficient number of computer workstations, insufficient employee knowledge, organizational problems, overload of responsibilities or cyber security. The subject also stressed that the systems offered

as part of the digitalization of medical entities tend to malfunction and the level of assistance offered is not sufficient.

5.2. Survey with the pharmacy owner - pharmacist

Seeking to obtain answers to questions regarding paper prescriptions and the use thereof against the introduction of mandatory e-prescribing, an interview was conducted with a selected pharmacy owner, a pharmacist. It turned out that despite the mandatory e-prescribing, paper prescriptions are still issued, though in very sporadic cases. In the period from January 02, 2023 to February 02, 2023, paper prescriptions accounted for 1.8% of all full-pay prescriptions, most of which were veterinary prescriptions, which are always issued in paper form. The full-pay prescriptions provided were mainly issued to patients by specialists: dentists, ophthalmologists, gynecologists or dermatologists. According to the pharmacist, this is partly due to the fact that a large number of the medications these specialists prescribe are not refundable, though this should not be taken as a rule. Indeed, occasionally prescriptions for refundable drugs are issued in paper form, but this accounts for less than 1% of all refundable prescriptions. Most commonly, these are "pro auctore" and "pro familiae" prescriptions (issued by doctors for themselves or their families). K. Zon (2022) confirms that paper prescriptions are feasible in such situations. The remaining paper prescriptions were issued in such form because of failures in the electronic prescribing system.

6. Methodology and scope of planned empirical studies

The literature review conducted, as well as the analysis of legal acts and the case study of an outpatient clinic, indicated a great potential for research in the field of digitalization in medical entities. The study will be conducted in three stages divided into a total of 9 phases, as outlined in Table 5.

Table 5.
Research plans

| Research phase | Task | Research sample | Method |
|--|--|-----------------|-------------------------------|
| STAGE 1 – Preliminary study | | | |
| 1) Literature review – preliminary (Scopus, EBSCO) | Digitalization in medical entities | - | Literature analysis |
| 2) Legal regulations | Obligation of digitalization in medical entities | - | Analysis of Polish legal acts |
| 3) Preliminary study | Presentation of digitalization benefits and barriers | Case study | Structured interview |

Cont. table 5.

| STAGE 2 – Main study | | | |
|---|---|---------------------------------------|---|
| 4) Questionnaire 1 | Reasons behind the slow digitalization in medical entities and remedies to improve the situation | Managerial personnel | Structured interview |
| 5) Questionnaire 2 | | Medical entity employees | Questionnaire - MsForms |
| 6) Result analysis | Research findings and conclusions drawn | - | Synthesis, deduction |
| STAGE 3 – Main study | | | |
| 7) Literature review (Scopus, Web of Science) | Comparison of studies on digitalization in Polish medical entities with data from other countries | Medical entities - Polish and foreign | Literature analysis |
| 8) Legal regulations | Digitalization obligation in Polish and foreign medical entities | | Analysis of Polish and foreign legal acts |
| 9) Result analysis | Summary of findings and conclusions drawn | - | Synthesis, deduction |

Source: own elaboration.

This article entails implementation of the first stage of the planned research. The preliminary review of legal regulations indicated numerous digitalization obligations to be met in medical entities. As the results of the survey of the degree of medical entity computerization show, not all entities are fulfilling their obligations (VI Edycja Badania stopnia informatyzacji..., 2022). The entity surveyed as part of the case study, in turn, identified the pace of digitalization in medical entities as too slow in its view. This has given rise to stage two, in which the reasons for the slow development of digitalization in medical entities in Poland and approaches to solving this problem will be sought. This stage will be carried out based on the results of an empirical study conducted among a larger number of medical entities. Two research methods will be used: structured interviews with executives and a survey of medical professionals conducted using MsForms. The third stage, in turn, will involve a comparison of studies on digitalization in Polish and foreign medical entities. For this purpose, in-depth literature and regulatory reviews will be conducted.

7. Conclusion

Digitalization is continuously shaping the healthcare sector (Ylitalo et al., 2023), and the process of digital transformation is an urgent priority for the sector (Binci, Palozzi, Scafarto, 2022). Doctors are adapting to new technologies in different ways, and the best of them will set the pace of change and the effectiveness of the initiatives undertaken (Morland, Pettersen, 2017).

According to K. Kolas (2022), digitalization is the future, not least because, as the WHO warns, a shortage of personnel - even several million people - will emerge by 2035, and the digitalization process is expected to be one of the remedies for this crisis (Dane medyczne to złoto... [ENG: Medical data is gold...], 2022). Digitalization, therefore, is not only expected to support administrative operations and process control, but can also, through the use of remote monitoring, inter alia, improve the delivery of healthcare services, in terms of medical treatment alone (Binci, Palozzi, Scafarto, 2022). The pandemic also showed that e-health is indispensable and served as a reminder that digitization in health care enables continuity of services and coordination of healthcare services (P1 czarno na białym, 2022).

The literature review conducted has revealed a research gap in the area of digitalization in medical entities. There is a scarcity of detailed studies describing the responsibilities, benefits and barriers to the implementation of digitalization. The indicated research gap has been partially filled within the framework of this article.

The main purpose of the article was to identify the digitalization obligations of medical entities, as well as the benefits and barriers associated with it, based on a case study of an outpatient clinic. The study provided answers to the research questions posed. The review of legal regulations enabled outlining the obligations of Polish medical entities in terms of digitalization. The case study carried out as part of the study indicated that the entity surveyed is fulfilling its digitalization obligations. Nevertheless, it believes that the pace of implementation in Poland is too slow, and thus strives to develop in this area, with the help of an internal team of IT specialists. The entity rated the benefits of digitalization very highly. The highest rated benefits include improved patient service, enhanced data security and higher quality of services, improved image of the entity, increased competitiveness, and reduced medical errors. As a highly digitized entity, in turn, it rated the barriers to the digitalization process implementation quite low. The 'lack of clear standards' barrier received the highest score, although it was still rated as moderately hindering to the digitalization implementation process.

The survey interview with the pharmacist, by contrast, indicated that e-prescribing duties are being fulfilled in the vast majority of cases – the mandatory introduction of e-prescribing, however, has been in place for three years, which was sufficient time for its implementation.

The conclusions drawn from the literature review, the analysis of legal acts and the case study provide a rationale for undertaking further in-depth empirical research on digitalization in medical entities, taking the study carried out as a pilot study. Accordingly, the stages of the research to be conducted have been presented.

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AUTOMATION FROM THE PERSPECTIVE OF MODERN SERVICES SECTOR IN POLAND

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Purpose: The aim of the study was to find out how automation is perceived by representatives of the companies from the Modern Business Services Sector (MBSS) in Poland. Research questions were posed, which referred to the assessment of the importance of automation and the readiness of companies to implement it.

Design/methodology/approach: The answers were obtained on the basis of the realisation of 20 individual in-depth interviews - conducted among representatives of various companies from the MBSS.

Findings: Participants in the study positively assessed the importance of automation in the operation of their companies, particularly from the perspective of maintaining competitiveness and keeping up with economic trends. Respondents declared a high level of readiness to implement work automation systems and programmes, although only a small proportion of the companies represented were actually taking any action in this regard. Both organisational culture, company resources and customer demand were identified as key facilitators of automation. In contrast, customer relationships and insufficient company resources were the most important barriers.

Originality/value: There is an insufficient amount of scientific studies on factors supporting and blocking the introduction of automation in MBSS enterprises in Poland. Due to the fact that the conclusions from foreign literature do not allow for generalisation to enterprises in Poland, the overarching aim of the work presented in this article is to fill the gap in the literature concerning factors supporting and blocking the introduction of automation in MBSS enterprises in Poland.

Keywords: intelligent process automation (IPA), robotic process automation (RPA), modern business services sector (MBSS), in-depth interview (IDI).

Category of the paper: Research paper.

1. Introduction

The Modern Business Services Sector¹ is at the forefront of digitalisation, impacting other parts of the economy in both the manufacturing and service sectors (NUB SRK, 2020). For example, in Q4 2021 54 per cent of the transactions that took place in the outsourcing market were related to digitisation-focused processes (digital-focused outsourcing), which can include, but are not limited to: data analytics; cyber security; automation; cloud adoption; mobility (Statista Research Department, 2022). Importantly, the digitisation and automation of the MBSS was already observed before the COVID-19 pandemic (Manning et al., 2018; Ribeiro-Navarrete et al., 2021), the outbreak of which only provided an additional (albeit significant) impetus, resulting in centres introducing intelligent process automation (IPA) solutions or using robotic process automation (RPA) and artificial intelligence (Kholiya et al., 2021; Siderska, 2020; Van Looy, 2021).

Among the goals of introducing IPA in general, the need to optimise costs, improve the quality and speed of services or reduce manual work stands out. In contrast, key barriers to the introduction of process automation include the inadequate quality of the data held, lack of financial, time, as well as competence resources to implement IPA (Suri et al., 2018).

Industry reports suggest that the majority of centres in Poland (which have introduced IPA), implement RPA, and nearly half of centres also use machine learning (ABSL, 2022). However, the actual estimation of the scale of automation in Polish companies is significantly limited for at least two reasons. Firstly, cost- and knowledge-intensive solutions (e.g. AI, RPA) have an impact on building the competitiveness of companies (Nowacki, Wasilik, 2016), making them (e.g. related algorithms) most often subject to corporate secrecy, including under copyright or patent law (Hulicki, 2021; Wyczik, 2021). Secondly, the development of automation solutions is subject to strong dynamics of change (and thus difficult to record), as suggested by both academic studies and industry reports (Chheda et al., 2021; Deloitte, 2021; SSON, 2021).

Nonetheless, it is predicted that RPA backed by modern technology will become even more versatile (Siderska, 2020). Along with artificial intelligence, robots will be able to develop a variety of solutions to facilitate human work organisation (Madakam, Holmukhe, Jaiswal, 2019). Bots combined with smart technologies will accelerate the pace of learning processes, while integrated RPA with technologies such as machine learning, artificial intelligence (cognitive) and data analytics (e.g. Big data) will enable the processing of data (available in real time) as well as even more accurate development of predictions (Ivančić, Suša Vugec, Bosilj Vukšić, 2019). Industries will be supported by RPA to improve business processes and optimise

¹ The modern business services sector includes (Gnusowski, 2018): business process outsourcing (BPO), information technology outsourcing (ITO), services provided by so-called shared service centres (SSC) and research and development services (R&D).

operational efficiency all the time. The implementation of RPA will provide organisations with the opportunity to save money and increase process efficiency by automating some simple and repetitive tasks, thus ensuring better quality and accuracy of work.

Despite the many advantages of RPA, there are many risks and challenges that stem directly from the fact that RPA is not suitable for every type of task. This thus highlights the importance of staff skills in correctly identifying processes that are suitable for automation. In addition, RPA operates between different web-based systems and applications (e.g. ERP), requiring the existing infrastructure to be built on top of highly complex IT solutions, where any, even minor, error made during the coding process can result in disruption to the organisation. In addition, the implementation of RPA comes with challenges regarding data security and privacy. It is important to ensure that sensitive data is not misused. After all, unauthorised access to the RPA system, and including databases, can result in serious consequences that stem directly from the possibility of service manipulation (Fernandez, Aman, 2021; Syed et al., 2020).

From another perspective, as suggested by McKinsey Global Institute studies (2017, 2020), nearly half of occupational activities could be automated to some degree using current technological solutions, while in more than 60% of occupations, at least a third of the tasks performed could be fully automated. Predictions made for 2030 suggest that changes as a result of automation would predominantly affect occupations that are strictly physical in nature, as well as those involved in data processing. From the perspective of the MBSS, this would mean significant changes with back-office processes.

However, there is no doubt that the trend towards IPA/RPA/AI will continue with increased vigour until it eventually begins to affect the workforce, particularly in standard services. As a result, lower-skilled employees will need to be retrained to perform more advanced and complex middle-office and front-office tasks, and a hybrid workforce will become standard. This will translate into an increased demand for professional data analysts, big data analysts and artificial intelligence experts, or RPAs - in the form of experts in user interface enhancement or problem solving (Seibt, Vestergaard, 2018). Without AI solutions, companies will not be able to effectively process and analyse the ever-growing stream of different types of data, collected through all possible channels.

With all this, the prevalence of wage, knowledge and time arbitrage in the offshoring process may be important (Zorska, 2012). Despite the generally positive image of the MBSS in Poland, it is largely based on cost arbitrage (Malik, 2018), which makes the implementation of cost-intensive automation solutions potentially beneficial from the perspective of a foreign operator. On the other hand, the implementation of automation solutions can significantly translate into an increase in the attractiveness of a location in terms of service investments. As suggested by the authors of the A.T. Kearney report (Sethi, Raudabaugh, Suman, 2021), the accelerated pace of technological investments made by corporations from various industries will lead to an increase in the importance of the results obtained by individual countries in the area of the so-called digital resonance (which includes measures concerning, among others:

digital skills; legal and cyber security; corporate operations; productivity) - compared to traditional indicators such as cost attractiveness, among others. While Poland is characterised by a high level of cost attractiveness, its attractiveness resulting from digital resonance is rated low. This implies a need for significant progress, which could include improving the ability of legal systems to adapt to digital models, as well as improving the digital skills of the workforce (Sethi, Raudabaugh, Suman, 2021).

1.1. Objectives of the study

It should be stressed that there is a lack of scientific studies on factors supporting and blocking the introduction of automation in MBSS enterprises in Poland. Despite the conclusions from foreign literature, the possibility of their generalisation to enterprises in Poland is limited, mainly due to the fact that the market of modern business services is developing in different countries of the world at a different pace, and some countries have even specialised in providing this type of services to international business. Therefore, the overarching aim of this thesis is to fill this gap in the literature and, more specifically, to answer the following research questions through an exploratory study:

1. What is the importance of automation (and the associated opportunities and threats) in the functioning of companies as perceived by representatives of MBSS companies in Poland?
2. What is the willingness of companies to automate processes, and in particular what factors are perceived as facilitating or inhibiting organisations from implementing process automation?

2. Method

A series of twenty in-depth individual interviews (IDIs) were conducted with representatives of MBSS companies in Poland. For this purpose, the Google Meet platform was used due to the possibilities of conducting and recording the conversation using audio and video. Respondents were individually invited to participate in the study via email in advance. If the invitation was accepted, each participant was contacted by telephone to arrange an interview date and time. On the appointed date, participants received a link to the Google Meet platform via email. At the beginning of each interview, participants were informed of the voluntariness and anonymity of their participation, while also being informed that the interview would be recorded for the purpose of creating a transcription (for data analysis only). After obtaining consent from the participant for participation and recording, qualified facilitators conducted the interview according to a standardised scenario. The duration of each

meeting did not exceed 30 minutes. Based on the recordings obtained, transcriptions of the interviews were made and analysed.

In order to analyse the data that were obtained through individual in-depth interviews, the Thematic Analysis (TA) method was used. Thematic analysis enables significant patterns or themes of expression to emerge from the raw data through a flexible interpretive approach (Nowell et al., 2017). Thematic analysis is assumed to be appropriate when the purpose of the study is to explore participants' perceptions, insights and experiences (Braun, Clarke, 2009). Taken as a whole, TA represents a multi-step process that includes: organising, identifying, describing and reporting themes from a dataset (Krzystek, 2018). For the purpose of this study, the following steps were adopted in carrying out the thematic analysis of the recordings/transcriptions from the individual in-depth interviews conducted:

1. Familiarisation with the data in the form of repeated listening / reading of the interview transcriptions.
2. Creating codes - extracting distinctive points (so-called thematic areas) from the research material, which enabled the classification of information extracted from the qualitative data.
3. Creation of thematic threads - sorting the coded content to extract thematic threads.
4. Re-reviewing thematic threads - final verification of the extracted threads to check relevance against the entire data set.
5. Compilation of results - bringing together the relevant elements of the analysis with illustrative examples within the thematic area.

Two researchers, independently of each other, analysed the interview transcriptions and created codes from them. In the next step, the same researchers compared their findings to finally develop final versions of the codes and thematic strands by consensus.

2.1. Materials

The individual in-depth interview (IDI) scenario was a set of questions designed to be asked of the interviewee. The thematic areas around which the interview questions were formulated were developed on the basis of the literature review. For each area, a general call-out question and supplementary questions were formulated and presented to the interviewee. The grammatical form of each question was open-ended, which motivated the interviewee to give a broader answer. This way of conducting the IDI gave the respondent the opportunity to speak with a high degree of freedom and to raise the issues they felt were most relevant. Depending on the course of the interview, it was assumed that the order and phrasing of individual questions may have varied slightly. This was a safeguard in case the selected respondent's answer was exhaustive (i.e. to the extent that there was no need to deepen the participant's statement through additional questions). The questions posed addressed the issues outlined in Table 1.

Table 1.*Scenario for in-depth individual interviews*

| Subject area | Trigger question (additional) |
|--|---|
| Verification/ eligibility questions | What position do you hold? |
| | How many employees does your company have? |
| | What industry does your company represent? (Is it a Modern Business Services company?) |
| The importance of process automation | How important is process automation and new technologies such as VR, artificial intelligence, Big Data analytics, Blockchain, etc. to your company? (Which of these technologies are most relevant to your company and why?) |
| Opportunities and challenges from process automation | What opportunities do you see for your company as a result of the progressive automation of processes and the implementation of more and more new technologies? What risks do you see for your company arising from the progressive automation of processes and the implementation of more and more new technologies? |
| Readiness to automate processes: facilitators and barriers | How would you describe your company's readiness to automate processes and implement new technologies in relation to other MBSS companies? (What makes it easier for your organisation to implement process automation and new technologies to match sector trends? What blocks your organisation from implementing process automation and new technologies to match sector trends?) |

Source: Own work.

2.2. Participants

The research sample comprised 20 people. According to the recruitment criterion, people responsible for business development processes in the MBSS companies or board members of the MBSS companies, or senior managers with knowledge of the company's development and/or strategic activities, were eligible to participate. The characteristics of the participants in the study are presented in Table 2.

Table 2.*Characteristics of participants in individual in-depth interviews*

| No. | Position | Type of company | Number of employees |
|-----|---|-------------------------------------|---------------------|
| 1 | Head of the sales department, member of the board | IT services | 560 |
| 2 | Chief Executive Officer | HR services | 25-300 |
| 3 | Senior Consultant, Senior Manager | Advisory and consulting services | >70 |
| 4 | Chief Executive Officer | HR services | roughly 50 |
| 5 | Recruiter | Outsourcing | 170 |
| 6 | HR director | BPO (accounting, HR-payroll, legal) | 150 |
| 7 | Recruitment Coordinator | marketing | 150 |
| 8 | Recruiter | IT services | 1000 |
| 9 | Recruitment Manager | IT services | 550 |
| 10 | Recruiter | IT services | 60 |
| 11 | Senior Recruitment Specialist | HR outsourcing | 400-500 |
| 12 | Recruitment specialist | IT services | >80 |
| 13 | Sourcing Partner | IT services | >2000 |
| 14 | Chief Executive Officer | BPO | roughly 50 |
| 15 | Senior Trainer | call center | roughly 500 |
| 16 | Chief Operation Officer | IT services | >450 |
| 17 | Project Manager | Legal services | 500-1000 |
| 18 | Internal Recruitment Specialist | HR consulting | roughly 60 |
| 19 | Project Manager | Real estate agency | roughly 50 |
| 20 | Member of the Board (R&D) | Software producer | 180 |

Source: Own work.

CEOs (board members), COOs, managers and HR representatives (seconded from the company as competent persons to be interviewed) participated in the study. The respondents represented shared service centres, business process outsourcing and IT services outsourcing companies. Eleven companies represented the HR, sales and marketing and legal services outsourcing industry and the remaining eight companies represented services outsourcing. The companies (or their Polish branches) participating in the study employed, at the time of the research, between 50 and 2,000 employees (including consultants seconded for outsourcing services).

3. Results

The Thematic Analysis conducted allowed for two overarching thematic threads: 1) the importance of process automation; and 2) the readiness to automate processes. In the case of the importance of automation, two categories were identified regarding perceived opportunities and threats from automation. In the case of readiness for automation, two categories were also distinguished, relating to factors supporting and counteracting automation, respectively. For this reason, the remainder of the results will be described according to the extracted thematic threads. On the other hand, as a result of the process related to the highlighting of utterance fragments (texts from the transcriptions) that directly addressed the research questions and thematic threads posed, 129 utterance fragments/text from the in-depth individual interviews were identified.

3.1. Importance of process automation

The vast majority of respondents stated that automation in general is of great, if not enormous, importance to their companies. Only two participants described it as an element of average importance in the functioning of their business (explaining this by the profile of their company and the needs of their customers). The dominant opinion on automation was justified primarily by the need to build competitiveness in the market. Meeting industry trends and keeping up with the needs of external customers were the main motivators for automation, according to participants.

Participant #20: *The more processes are automated, or if we talk about our customers, the more customers want to have automated processes, the better for our company, because we can sell more services to them. The more we have standardised and automated products, the more we reach a larger group of people.*

An equally important factor appeared to be the need to optimise the work of companies. According to the participants, the automation of internal processes makes it possible to standardise/standardise working conditions, including minimising the workload of employees

(as a result of reducing the number of low-complexity tasks assigned to them). Some participants see automation as a kind of safeguard for sustaining business continuity. On the one hand, participants referred to employee turnover or the occurrence of a vacancy in a given position as an example of a situation in which implemented automation would enable specific tasks to be sustained despite such events. On the other hand, participants pointed to the need to process and appropriately secure voluminous amounts of data while possibly minimising errors in both of these processes - precisely through automation.

Participant #7: *For the company, this is certainly very important, for example in terms of the availability of job candidates with the right competences.*

Participant #13: *Certainly automation makes our work easier. We have a lot of databases in our company where a lot of information is stored, for example automatic record searches definitely improve our work.*

The importance of individual new technologies appeared to be more varied in the opinions of participants. This is a direct result of the profile of the business, the competence of the teams, company standards and procedures and customer expectations. Among the technical solutions that participants mentioned as key - now and in the future of companies - were Cloud Services, Python, Java, .Net, OCR, Big Data analytics, AI and technologies supporting data security.

Participant #1: *(...) Java, .Net are the technologies that matter the most to us because the largest number of projects we carry out are in these technologies, and programmers specialising in these two technologies and the largest make up the largest number of people employed by us.*

Only two participants referred to the importance of Blockchain and VR technologies. In both cases, the aforementioned technologies were identified as solutions whose use could potentially be relevant in the further future, although not necessarily in the form of direct application by the company itself.

Participant #17: *It all depends on the context. So far, I haven't seen the use of blockchain technologies in our industry [legal and peri-legal - ed]. I think it's not so much the need to keep up with blockchain technology, in terms of its functionality, but in terms of the potential legal issues that arise from it.*

3.2. Perceived opportunities and threats

Representatives of the MBSS were asked about opportunities and threats strictly related to process automation and the implementation of new technologies in their companies. Among the perceived opportunities, the belief in an increase in company revenues, as well as the overall cost efficiency of companies, dominated. According to the participants, this would be due to the fact that automation directly leads to the modernisation of organisations (as a result of the introduction of innovative solutions), the standardisation of processes (translating into time savings in the execution of tasks) and the expansion of services offered. Participants concluded

that each of these factors is of great importance to external stakeholders - it would therefore translate into an increase in the number of customers and orders.

Participant #8: *Myself, I think it's only better for us, because there will be more projects, more clients, more work, also we should only be happy.*

Some respondents also mentioned opportunities in the form of freeing high-quality human resources from routine and repetitive - and therefore tedious or demotivating in the long term - tasks. In their view, this would result in highly competent people being seconded to other tasks that would make optimal use of their abilities. This opportunity was pointed out as being directly linked to keeping employees motivated on the one hand, and on the other hand to simplifying customer service and thus increasing sales opportunities and reaching a larger audience.

Participant #10: *In terms of opportunities, through automation we enable our employees to deal with new and more interesting areas, because they can automate certain processes for themselves and not deal with them anymore. Our organisation assumes that what can be automated is not interesting enough for a human to do.*

The risks mentioned by participants ranged from the potentially high costs of implementing innovative solutions to increased market competitiveness. The divergence in respondents' opinions is illustrated, among other things, by the issue of job cuts as a result of automation. For example, individuals representing HR companies expressed concerns about their jobs, stating that the work they do will be completely replaced by robots and automation solutions. These opinions, however, were not shared by the other participants, who, on the one hand, denied that their jobs would ever be cut as a result of automation, and, on the other hand, pointed to automation as an opportunity for job redeployment in order to better manage human resources.

Participant #6: *I thought that automation would make the HR department unnecessary too, because after all, we are not going to talk to robots, motivate them to work.*

Participant #17: *(...) technology cannot function without humans. Therefore, a popular myth, a source of fear, is that machines will replace us. (...) in the case of outsourcing, the employees freed from their existing jobs are usually a very valuable resource that can simply be re-located to other work, often more valuable.*

No less, participants almost unanimously referred to the rising financial costs associated with implementing automation solutions as a threat to their companies' operations. In doing so, however, it should be clarified that, in the context of costs, participants pointed to the increasing financial expectations of candidates for automation-related positions (resulting from the need for high and specialised skill levels) as the main threat. At the same time, some participants pointed to the difficulty of attracting highly skilled human resources. The progression of automation throughout the sector would, in the opinion of the participants, reduce the market potential of a company that lacks highly qualified specialists.

Participant #8: *A threat is certainly the problem of acquiring new employees, because the market is demanding. Nowadays, a lot of new foreign companies have appeared on the market, which offer high salaries for employees. We, as a Polish company, often cannot beat that, unfortunately. So the danger is that we simply won't be able to recruit as many people as we need.*

Automation, enables standardisation and optimisation of a company's operations, in the opinion of individual participants may at the same time lead to the emergence of more competitors that provide the same services using similar tools.

Participant #2: *The threat could be theoretically a lot of competition.*

It is noteworthy that out of the entire sample, only two representatives of the sector stated the absence of any threats - resulting from increasing automation and the implementation of more and more new technologies.

Participant #12: *These are not threats, they are opportunities for development and to save time.*

3.3. Readiness to automate processes

According to the majority of respondents (i.e. 15/20), their readiness to implement work/process automation systems and programmes is at a high level. However, it is important to delineate between the declared readiness and the activities actually undertaken in this regard. Only five participants declared that they were implementing (i.e. ongoing at the time of the survey) systems and programmes to reduce the human work required. Ten respondents indicated that despite plans and readiness to implement, automation is still not at the expected level and is being implemented too slowly and therefore inefficiently. In turn, five representatives indicated that the level of automation and plans for its implementation in their companies is very low. At the same time, all participants shared the opinion regarding the generally low level of automation in high-tech companies. For the above reasons, it is important to take a closer look at the participants' responses that referred to potential facilitators and blockers of process automation.

Perceived facilitators and barriers. Of all the factors that respondents cited as key motivators for implementing new technologies, three areas stood out: (1) company culture; (2) company resources; and (3) customer demand.

In the first area, participants unanimously stressed the importance of a pro-development approach by the owners and management to the implementation of the company's strategic goals. Such an approach, according to the participants, includes taking steps and actions to follow sectoral trends, including openness to new technological solutions. Some participants linked this directly to the fact that the company represented has foreign capital, as well as a general organisational culture based on openness and an out-of-the-box approach to the execution of tasks. One person directly referred to the use of agile and scrum practices as key aspects favouring the implementation of automation solutions. In doing so, it should be noted

that the individuals who referred to the importance of organisational culture in their statements represented companies that already had processes that had been automated at the time of the interviews.

Participant #7: *First of all, we are an American company that is always open to new technologies, that is not a conservative, closed company. The company's culture of openness makes us open to new technologies.*

In the case of company resources, participants referred directly to financial aspects (i.e. the available budget, or the ability to finance the implementation process of new technologies) and the facilities of the tools they have, which could be used for implementation work. However, these were not exclusive factors in this area. Equally important in the opinion of the participants was having suitably qualified or experienced specialists who would be directly responsible for the implementation and monitoring of processes. Ultimately, participants representing smaller companies, unanimously stated that it was the scale of their business (relatively small) that enabled them to adapt immediately to external realities or customer requirements - and therefore to automate individual processes.

Participant #10: *Also a high level of experienced professionals, first of all we have people who are very experienced, their competence allows them to act quickly. And the question of scale. We are not a big company, we can modify and implement these processes quickly.*

Finally, participants highlighted the importance of external stakeholders in the form of customers. In this case, it was emphasised that, in the name of maintaining long-term customer relationships and attracting new customers, it is important to streamline processes and introduce new tools - which, according to the participants, is directly related to the progress of automation in companies. Then again, as almost every participant stated, their willingness to automate would transfer into real action, particularly if there was a real need, or external pressure in the form of customer demand.

Participant #1: *I also think that this portfolio of customers is such a trigger for our organisation, because of our cooperation with them we have to improve a lot of processes, get some certifications, introduce a new tool and this also definitely influences the development of automation.*

The factors that participants felt were counteracting the implementation of automation aggregated within the following two areas: 1) financial and human resources; and 2) the needs of external stakeholders. Significantly, six of all participants stated the absence of any barriers. Therefore, the views presented below are based on the responses of fourteen participants.

With regard to the first area, each participant referred to the insufficient financial background a company would have to incur when implementing new technologies. In the opinion of the participants, this would involve not only the purchase of appropriate tools, but also proper budget planning, including the reallocation of financial resources to speed up the implementation process, as well as the development of relevant departments (e.g. IT).

Participant #1: *I think that automation is certainly blocked by a lack of resources. To introduce processes you need resources, you need people involved, and there are so many projects that it is impossible to focus solely on automation.*

Participants went on to highlight the lack of access to skilled staff and resistance from existing employees due to reluctance to learn/use new technological solutions. In doing so, it is important to emphasise that the aforementioned reluctance to learn was not only justified by participants' attitudes, but also by the extensive number of newly emerging technological solutions, the competent acquisition of which is beyond the physical capacity (i.e. in a short time) of even an experienced employee.

Participant #17: *In our industry, there are quite a lot of people with a conservative attitude towards technology, preferring solutions that can be trusted, that are very safe, very analogue. So, it's about the reluctance of users to interact with technology in general. But also, even a technology-friendly person at some point gets tired if they have to learn about the nth solution.*

The second key area of barriers concerned the needs and pressures of external stakeholders - more specifically, the companies' customers. On the one hand, participants pointed to a situation in which a given customer requires the use of older technological solutions, which, in the opinion of the company, will not be as effective as newer solutions. The reason for this situation, in the opinion of the respondents, would be not only the requirements of the clients, but also their infrastructure - preventing the use of new technologies during the execution of the order. On the other hand, participants referred to the opposite situation, in which it is the client who pressures the use of newer and newer technological solutions, so that human resources are strained by the constant learning of a particular, newly chosen solution. Individuals explicitly pointed out that when there is no apparent (financial) benefit from using new and expensive solutions for the benefit of the customer, it is profitable for their company to stay with previously proven and less costly processes.

Participant #7: *Sometimes there is a need to negotiate with clients on the technology used. Sometimes clients necessarily want to work on some specific technology, even though we can see that it will not be successful.*

Participant #8: *As far as our company is concerned, there is nothing blocking us, however we also work with clients (...). So it's kind of a blockade due to the technology the client is using in terms of being able to integrate solutions.*

4. Summary and discussion of results

The aim of the presented study was to find out how automation is perceived by representatives of companies in the Modern Business Services Sector in Poland. Two research questions were formulated relating to the assessment of: 1) the importance of automation

(opportunities and threats); and 2) the readiness of companies to implement it (enabling and counteracting factors). Answers to the questions were obtained through a thematic analysis of data obtained from twenty individual in-depth interviews - conducted among representatives of a variety of the MBSS companies.

Participants in the survey positively assessed the importance of automation in the functioning of their companies, particularly through the prism of maintaining competitiveness and keeping up with the ever-changing trends in the sector. The implementation of new technologies was seen as an opportunity to broaden the offer to customers, modernise and optimise the functioning of enterprises. Automation was associated with an improvement in working conditions, if only as a result of minimising the burden on employees, who (in the absence of implemented automation solutions) are required to perform routine tasks of a lower level of complexity. Among the perceived opportunities, the strongest emphasis was placed on the increase in revenue of companies, as well as the overall cost efficiency of companies. On the other hand, it was possible to deduce from the participants' statements that increasing direct costs (implementation of automation solutions) as well as indirect costs (wages for highly specialised employees) represent the main threat to their companies' operations.

Interestingly, the overwhelming majority of participants unequivocally stated that automation would not replace employees in their case. This thus reflects the observed trends in the MBSS in Poland. In contrast, in the academic literature, estimates of the impact of digital technologies on employment vary widely (Ciarli et al., 2021). Some views are more pessimistic, i.e. digital technologies will mainly lead to the loss of some jobs (Acemoglu, Restrepo, 2019; Frey, Osborne, 2017, Kuzior, 2022); others are more optimistic, i.e. digital technologies will mainly improve existing jobs or create new ones (Arntz, Gregory, Zierahn, 2017; Felten, Raj, Seamans, 2019); and still others take a more neutral position, i.e. the effects will be mixed (Das et al., 2020; Nedelkoska, Quintini, 2018). Nowadays, it is increasingly suggested that, with the development of the fourth industrial revolution, complementarities between automated solutions and workers performing complex cognitive tasks will be highlighted (Ciarli et al., 2021). In addition, it is worth noting the view marking the positive impact of the digitalisation of work on sustainability (Kuzior, Kettler, Rąb, 2022). As also noted by the study participants themselves, process automation can complement humans in performing tasks that require the processing of vast amounts of information and data, thus supporting professionals.

Respondents declared a high level of readiness to implement work automation systems and programmes, although only a small proportion of the companies represented were actually taking any action in this regard. Both organisational culture, company resources and customer demand are key facilitators of automation. On the other hand, however, both customer demand and insufficient company resources can be barriers. The results illustrated a high convergence between the perceived opportunities arising from automation and the facilitators of its implementation. The same applies to the complementarity of perceived threats and barriers.

On the other hand, a certain paradox can be seen, for example in the fact that, while automation is perceived as an opportunity to improve a company's financial performance, it is not implemented - precisely - because of its high financial costs.

The conclusions obtained and their interpretation should be considered with due regard to the limitations that accompany the study carried out. The exploratory nature based on the analysis of qualitative data generally limits the possibility of drawing conclusions about cause-and-effect relationships or relationships. Despite the large sample by the standards of individual in-depth interviews, it cannot be considered representative.

No less, the information obtained can provide an input or basis for designing further hypothesis-testing-oriented research. The opportunities/threats and facilitators/barriers identified in this study can be used to operationalise factors that should be further verified, for example using predictive models. Future research could, on the one hand, focus on the general concept of process automation or, on the other hand, on detailed copies of the technology that fits into this area. Research in this direction should be realised on larger research samples, appropriately estimated for the predicted effect power. It would also be important to select the sample with a view to an equal distribution of representatives of the various industries in the MBSS.

Regardless of the direction taken, it is essential that every effort is made to better understand the factors that could be used to plan measures for the spread of automation in the MBSS companies, including the issue of employee adaptability to new roles and the handling of new processes not yet automated. Quite ironically, it could be argued that automation will not happen until the human responsible for it takes action. As one interview participant (#20) concluded: *It all comes down to people. If we have those who understand what's going on, then implementing any new tool is literally no problem at all.*

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CHANGES IN THE FINANCIAL SITUATION OF CITIES WITH POWIAT RIGHTS IN POLAND IN THE YEARS 2010-2021

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Purpose: The aim of the article is to identify and assess changes in the financial situation of cities with poviats rights in Poland against the background of the entire country in 2010-2021.

Design/methodology/approach: The article identifies and assesses changes in the financial situation of cities with poviats rights in Poland against the background of the entire country in 2010-2021. The empirical material of the article concerns both the entire country and all cities with poviats rights in Poland. The figures come from the Local Data Bank of the Central Statistical Office in Warsaw and concern the years 2010-2021. The collected and ordered empirical material was developed in a descriptive, tabular, and graphical form, using the method of comparative analysis, with comparisons made in time and space. In addition, all diagnostic features illustrating the financial situation of cities with poviats rights in Poland against the background of the entire country for the years 2010-2021 were assessed, which is a new approach to the research problem addressed in the article.

Findings: The analysis of statistical data confirmed the research hypothesis, which assumes that cities with poviats rights in Poland are slightly differentiated in terms of their financial situation and its changes over time, while the very fact of the presence of a city, especially a larger one, is an important factor that positively and permanently affects this situation.

Originality/value: The originality of the work lies in the author's approach to the analysis of the research issues undertaken. The point assessment of the financial situation of the surveyed local government units against the background of the country was carried out. The work is addressed primarily to local government officials responsible for public local government finances, as well as for the conditions, opportunities and directions of local socio-economic development of cities with poviats rights in Poland.

Keywords: cities with county rights in Poland, financial situation, changes in 2010-2021.

Category of the paper: research paper.

1. Introduction

Urban development is a multidimensional process that involves numerous entities located in the city itself and its surroundings. The city is perceived by these entities as a space for action, and it is assessed through the prism of opportunities and facilities supporting the implementation of their aspirations. The process of development of the city is the result of a specific game in which various entities enter into competitive and cooperative relations with each other, each of the entities pursues its autonomous goals using its own strategies, and the sum of the effects obtained by them determines the face and development of the city. At the same time, however, the city should also be perceived as a specific space with exceptional values that influence the behaviour of various entities that will contribute to the achievement of important social goals. Cities are local government units with a unique impact on supra-local and even regional development, because it is in them that potentials, activities, and entities deciding on its course are concentrated. The measure of the city's strength is primarily its ability to shape development in the qualitative aspect, i.e. to generate new solutions and new processes characterised by innovation and creativity. The pace and nature of the development of modern cities are equally determined by the ability to unconventionally use potentials to achieve groundbreaking ideas, as well as the skills and competences of functioning in various cooperation networks. The basic issue relating to the city's development processes is comprehensive economic development, the shaping of which significantly goes beyond the issues of the functioning of the business sector. The process of economic development of the city is the result of the attitudes of the inhabitants, the quality of life, and the related quality of human capital, the policy implemented by local government authorities, the investment image of the city, the functioning of scientific, research, and educational entities, as well as the level of amenities provided by the city to business entities. It should be added that strong cities usually become real centers of economic development, which is manifested in such attributes as:

- high attractiveness of the city for entities looking for conditions for the implementation of unconventional, innovative projects,
- significant share in the city's economic structure of companies creating around local and supra-local cooperation networks, including those with the participation of entities transferring intellectual values to the economy,
- the presence of numerous potential partner entities in the city that enable enterprises to outsource functions, and as a consequence, specialize their own activities and constantly strengthen their leading strategic competences,
- extensive relations between economic entities with local government institutions, scientific, research and development, educational institutions and with entities from the civil sector (Wrana, 2013).

Contemporary cities are as important centers as they are capable of being a space where development takes place by combining various competences, potentials, activities or entities in an original way. At the same time, it is worth postulating greater empowerment of local communities, leading to the city's inhabitants taking over the function of the actual host of space, both in terms of decision-making and implementation, a good example of which may be the participatory budget. Additionally, the ability to compete is to a large extent one of the main criteria for evaluating the effectiveness of actions taken by city governments. The successful competition for a significant investor, the location of an important institution, a prestigious event, or for new residents is a tangible and often spectacular testimony to the success of the policy implemented by local government authorities. Competing is also a process that motivates various entities to increase the effectiveness of their own activities or implement innovations. Competition between cities leads to the strengthening of cities themselves as well as to the strengthening of the regional structure. However, the importance of cooperation as a competence that determines the rank of the city and its development opportunities is becoming increasingly evident. Therefore, today one of the most important factors determining the development of the city is its social potential, which is usually identified by:

- an efficient leader, able to formulate a long-term vision of the development of a given local system, who is able to gather the local elite around him,
- a local elite, bringing together the most active and creative actors,
- functioning of local institutions stabilising the actions of the leader and stimulating local development,
- activity of the local community joining projects initiated by local government authorities or initiating development themselves,
- willingness of local governments to cooperate between municipalities,
- and small and medium-sized enterprises strengthening the local fabric of entrepreneurship.

Assigning a key role in the process of city development to the aforementioned factors results from many reasons, but the most important one lies in the statement that the manner of using the values and resources of the local environment is ultimately always the responsibility of the human factor, which through its actions can either create a development factor out of them, or a limiting barrier (Wrana, 2013; Tuziak, 2014; Kulawiak, 2016).

Local government is a key institution responsible for the implementation of many tasks that serve to meet the needs of primary importance for residents, as well as creating social and economic development in the regional and local system. The effectiveness of the implementation of tasks by local government units is largely dependent on effective financial management, and the guarantee of their implementation is the appropriate economic potential. Therefore, the quality of the local government finance system, considered as a set of institutions, legal norms, and tools defining the principles of local government financial management and used for its management, is of great importance in this regard (Grzebyk, Sołtysiak, Stec, Zajac, 2020; Kata, Czudec, Zajac, Zawora, 2022).

The financial management of local government units is a complex process, conducted in compliance with legislative requirements within the local government budget. Ensuring the efficient and correct operation of this specific economy, which consists primarily of cash and assets, requires strict compliance with many legal acts, standards, as well as budgetary principles. As part of the financial management of local government units, various public tasks and financial operations are carried out, relating to individual public finance departments, and various legal and financial methods and instruments are used (Chojna-Duch, 2003; Kosek-Wojnar, Surówka, 2007; Sołtyk, 2017; Sołtysiak, 2017; Sołtysiak, Suraj, 2018).

Financial management of public sector units, including local government units, should be conducive to rational spending of public funds and making appropriate decisions regarding the management of these funds. The primary objective in the financial management process should be maximizing the benefits from the resources held and minimizing losses and risks associated with the undertaken activity, which is especially true for development projects, where benefits and costs are usually spread over time. Therefore, financial management should focus on:

- shaping the size and structure of budget revenues and determining the ways and sources of their acquisition,
- shaping the capital and property structure guaranteeing economic and financial balance,
- allocation of financial resources - shaping the size and structure of expenditures in connection with the conducted current and investment activities,
- influencing the level of risk accompanying the decisions taken,
- monitoring and forecasting the financial and property situation,
- ongoing assessment of the financial and property situation of the local government enabling the assessment of compliance of current, investment and financial activities with the accepted submissions,
- assessment the impact of external conditions on investment and financial decisions,
- formulating conclusions and recommendations regarding the conduct of business,
- drawing up a financing strategy.

A properly managed unit in the long term should develop the so-called "good indicators", i.e. those that prove its development. Particularly noteworthy is the concept of the financial situation of a local government unit interpreted as the ability of the local government to balance recurring expenditure needs with recurring sources of income, while implementing tasks resulting from the law, which are to serve to further multiply income and maximize public utility for its residents (Mrówczyńska-Kamińska, Kucharczyk, Średzińska, 2011; Adamczyk, Dawidowicz, 2016; Kowalska, Możyłowski, Śmietanka, 2019; Kata, Czudec, Zając, Zawora, 2022; Ociepa-Kicińska, Gorzałczyńska-Koczkodaj, Brzozowska, Pluskota, 2022).

When defining the financial situation of a local government unit, the following are most often emphasised: the possibility of financing services on a continuous basis, the complexity of healthy finances, the ability to repay liabilities, as well as maintaining the current level of

services while maintaining resistance to the risk of changes over time. It seems that the most accurate is the interpretation of the financial situation of a local government unit, referring to its ability to meet its financial obligations on time and to maintain services provided to the local community (Filipiak, 2009, 2011; Dylewski, Filipiak, Gorzałczyńska-Koczkodaj, 2011; Wiśniewski, 2011; Kopyściański, Rólczyński, 2014; Zawora, 2015; Adamczyk, Dawidowicz, 2016; Kotowska, 2016; Natrini, Taufiq Ritonga, 2017; Ociepa-Kicińska, Gorzałczyńska-Koczkodaj, Brzozowska, Pluskota, 2022).

The financial situation of a local government unit is its financial condition in a specific period of time, which is the result of its income and its structure, expenses and their structure, the degree of use of repayable funds, activity, and effectiveness in obtaining extra-budgetary funds, as well as the efficiency of managing financial and material resources. Local authorities should care about the good financial situation of a given territorial unit, as it is a component of its competitiveness. In addition, it is evidenced, among others, the ability to perform tasks, achieve budget balance, increase property and to meet and meet the needs of residents. Among a number of various conditions shaping the financial economy of a local government unit, including its financial situation, exogenous, endogenous, and mixed conditions are generally distinguished. In addition, some common categories can also be distinguished, which include social, economic, environmental, and spatial conditions, as well as institutional, legal, and political conditions. The catalog of such factors is sometimes extended to include events whose effects cannot be predicted and which may fundamentally change the economic situation and the conditions of operation of local government units. This event in 2020 was the emergence of the coronavirus pandemic. It should be added that the analysis of the financial situation of a local government unit provides information about its current and future property and financial situation, and allows one to determine its possibilities and development prospects. (Ossowska, Ziemińska, 2010; Zawora, 2015; Świrska, 2016; Bień, 2017; Standar, 2017; Stanny, Strzelczyk, 2018; Wójtowicz, 2018; Czudec, 2021).

2. Research aim, empirical material, and research methods

The aim of the article is to identify and assess changes in the financial situation of cities with powiat rights in Poland against the background of the entire country in 2010-2021.

The article presents a research hypothesis, assuming that cities with powiat rights in Poland are slightly differentiated in terms of their financial situation and its changes over time, while the mere fact of the presence of a city, especially a larger one, is an important factor that positively and permanently affects this situation.

The empirical material of the article concerns both the entire country and all cities with poviats rights in Poland. The figures come from the Local Data Bank of the Central Statistical Office in Warsaw and concern the years 2010-2021. The collected and ordered empirical material was developed in a descriptive, tabular, and graphical form, using the method of comparative analysis, with comparisons made in time and space.

To identify and assess the financial situation of cities with poviats rights in Poland, the following diagnostic features illustrating it in the years 2010-2021 were analysed:

- total income of communes' budgets per capita (PLN),
- own revenues of communes' budgets per capita (PLN),
- share of own revenues in total revenues of commune budgets (%),
- total expenditure of communes' budgets per capita (PLN),
- capital expenditures of communes' budgets per capita (PLN),
- share of investment expenditures in the total expenditures of communes' budgets (%).

The article evaluates all diagnostic features illustrating the financial situation of cities with poviats rights in Poland against the background of the entire country for the years 2010-2012, 2013-2015, 2016-2018 and 2019-2021. Individual diagnostic features were compared with the national average, which was taken as 100 points, and their advantage or underweight in all cities with poviats rights was assessed accordingly. Then all points were summed and the average was calculated (Figure 1). It should be emphasised that this is a new approach to the research problem addressed in the article.

3. Results

Among the cities with poviats rights in Poland, the smallest percentage, i.e. 18.5%, are units with the largest number of inhabitants, i.e. 200,000. and more. On the other hand, the percentage of cities with the smallest number of inhabitants, i.e. up to 100,000, is the highest, which amounts to 44.6%, while the percentage of cities with the number of inhabitants of 100-200,000 is 44.6%. they constitute 36.9% of all cities with poviats rights in Poland.

The income system of local government units should ensure their fiscal stability, i.e., a relatively permanent state in which local government authorities are able to provide a range of appropriate quality public services, appropriate to the needs of the territorial community, and are able to stimulate socioeconomic development. In turn, long-term fiscal stability creates the basis for the possibility of providing public services in a continuous and effective manner, as well as for settling related financial obligations (Wójtowicz, 2014a, 2014b, 2018; Poniatowicz, 2016).

Table 1.

Total income of budgets of cities with poviata rights in Poland per capita against the background of the entire country in 2010-2021 (PLN)

| Specification | Years | | | |
|---|-----------|-----------|-----------|-----------|
| | 2010-2012 | 2013-2015 | 2016-2018 | 2019-2021 |
| Poland | | | | |
| Mean | 3.448,3 | 3.944,1 | 4.970,2 | 6.576,2 |
| Cities with county rights in total | | | | |
| Mean | 4.184,6 | 4.811,5 | 5.763,2 | 7.712,6 |
| Coefficient of variation V (%) | 17,2 | 16,4 | 13,7 | 15,5 |
| Cities with a population of up to 100,000 | | | | |
| Mean | 4.329,9 | 4.659,9 | 5.687,9 | 7.826,0 |
| Coefficient of variation V (%) | 20,6 | 19,1 | 16,3 | 20,3 |
| Cities with a population of 100-200 thousand. | | | | |
| Mean | 3.952,7 | 4.856,3 | 5.725,5 | 7.571,1 |
| Coefficient of variation V (%) | 12,0 | 15,7 | 13,0 | 11,6 |
| Cities with a population of 200,000 and more | | | | |
| Mean | 4.309,4 | 5.088,3 | 6.020,3 | 7.721,9 |
| Coefficient of variation V (%) | 13,6 | 9,4 | 7,3 | 6,2 |

Source: Central Statistical Office in Warsaw.

As in the whole country, also in cities with poviata rights, the average value of total budgetary income per capita increased in 2010-2021. In the analysed period, the average value of total budgetary income per capita is higher in cities with poviata rights, compared to the national average, and there are no major differences in this respect between the separate groups of these cities, depending on the number of inhabitants. Furthermore, both in the case of all cities with poviata rights in Poland, as well as their separate groups, the differentiation of this feature between individual cities is small in the years analysed, so its variability is low, which proves that these units are relatively homogeneous in terms of this respect (Table 1).

Own income is a strategic element in the finance system of local government units, both from the point of view of the scope of financial independence, as well as in the context of the possibility of applying for funds from the European Union or other complementary sources of financing their activities, functioning, and development. In addition, a greater share of own revenues in total budget revenues allows local governments to manage financial resources more freely and creates the opportunity for them to conduct their own, uninterrupted economy and financial policy, aimed at improving the socio-economic situation and further development (Gołaszewska-Kaczan, 2005; Sobczyk, 2010; Sierak, 2015; Poniatowicz, 2016; Dziemianowicz, Kargol-Wasiluk, Bołtomiuk, 2018; Czudec, 2021; Szofno-Koguc, 2021).

Table 2.

Own revenues of budgets of cities with poviata rights in Poland per capita against the background of the entire country in 2010-2021 (PLN)

| Specification | Years | | | |
|------------------------------------|-----------|-----------|-----------|-----------|
| | 2010-2012 | 2013-2015 | 2016-2018 | 2019-2021 |
| Poland | | | | |
| Mean | 1.824,9 | 2.179,1 | 2.536,3 | 3.208,6 |
| Cities with county rights in total | | | | |
| Mean | 2.276,3 | 2.670,2 | 3.104,0 | 3.843,4 |
| Coefficient of variation V (%) | 29,0 | 25,2 | 26,2 | 23,7 |

Cont. table 2.

| Cities with a population of up to 100,000 | | | | |
|---|---------|---------|---------|---------|
| Mean | 2.418,8 | 2.401,5 | 2.838,1 | 3.586,7 |
| Coefficient of variation V (%) | 33,5 | 30,8 | 32,4 | 28,9 |
| Cities with a population of 100-200 thousand. | | | | |
| Mean | 2.101,3 | 2.712,9 | 3.109,6 | 3.846,8 |
| Coefficient of variation V (%) | 16,4 | 16,8 | 18,7 | 18,4 |
| Cities with a population of 200,000 and more | | | | |
| Mean | 2.294,0 | 3.234,3 | 3.735,6 | 4.456,9 |
| Coefficient of variation V (%) | 31,4 | 15,8 | 16,5 | 15,1 |

Source: Central Statistical Office in Warsaw.

In cities with poviata rights in Poland, the average value of their own budgets per capita increased in 2010-2021, similarly as in the whole country. These cities are also characterised by a higher average value of their own budgets per capita in 2010-2021, compared to the average for the entire country, and this also applies to all their separate groups, depending on the number of inhabitants. The average value of own budgets of cities with poviata rights per capita in Poland in the years 2010-2021, however, varies in their separate groups. Because in the years 2010-2012 it is clearly the highest in the group of cities with the smallest number of inhabitants, i.e. up to 100,000, and in the years 2013-2021 in the group of cities with the largest number of inhabitants, i.e. up to 200,000. and more. In turn, the differentiation of this feature between individual cities is usually small, both in the case of all cities with poviata rights in Poland, as well as their separate groups, that is, these units are relatively homogeneous in this respect (Table 2).

Table 3.

Share of own income in total income of budgets of cities with poviata rights in Poland compared to the whole country in 2010-2021 (%)

| Specification | Years | | | |
|---|-----------|-----------|-----------|-----------|
| | 2010-2012 | 2013-2015 | 2016-2018 | 2019-2021 |
| Poland | | | | |
| Mean | 52,9 | 55,3 | 51,0 | 48,8 |
| Towns with county rights in total | | | | |
| Mean | 54,2 | 55,3 | 53,4 | 49,7 |
| Coefficient of variation V (%) | 18,0 | 15,0 | 15,3 | 14,9 |
| Cities with a population of up to 100,000. | | | | |
| Mean | 55,5 | 51,5 | 49,3 | 45,8 |
| Coefficient of variation V (%) | 18,2 | 17,2 | 16,7 | 15,6 |
| Cities with a population of 100-200 thousand. | | | | |
| Mean | 53,4 | 56,0 | 54,1 | 50,6 |
| Coefficient of variation V (%) | 15,2 | 8,9 | 8,9 | 9,3 |
| Cities with a population of 200,000 and more | | | | |
| Mean | 53,0 | 63,4 | 61,8 | 57,5 |
| Coefficient of variation V (%) | 23,4 | 9,9 | 11,2 | 10,1 |

Source: Central Statistical Office in Warsaw.

In cities with county rights in Poland, the share of own income in the total income of their budgets remains at a similar level in 2010-2021, i.e., the same as in the entire country, except that it was the lowest in 2019-2021. Cities with poviata rights are characterised by a similar share of own income in total income of their budgets, as on average in the country, and there are no

major differences in this respect between the separate groups of these cities, depending on the number of inhabitants, with the exception that in 2013 -2021, it was the highest in the group of cities with the largest number of residents, i.e. 200,000. and more. In addition, both in the case of all cities with poviats rights in Poland, as well as their separate groups, the differentiation of this feature between individual cities is small in the analysed years, so its variability is low, which proves that these units are relatively homogeneous in terms of in this respect (Table 3).

The expenditure of local government units is the transfer of public funds for the implementation of their tasks, i.e., for meeting the collective needs of local and regional communities in the field of public utility. Therefore, the level and structure of these expenses are fully reflected in the directions of their activity. It should be added that the expenditure of the local government sector is constantly growing, and this tendency was observed by Wagner - in the law of constant increase in public expenditure, also called the law of constantly increasing financial needs. On the other hand, among the reasons for the need to increase the expenditure of local government units, the following are distinguished: political, social, sociological and economic, many of which are complex and multifaceted in nature (Kańduła, 2010; Jastrzębska, 2012).

Table 4.

Total budget expenditures of cities with poviats rights in Poland per capita against the background of the entire country in 2010-2021 (PLN)

| Specification | Years | | | |
|---|-----------|-----------|-----------|-----------|
| | 2010-2012 | 2013-2015 | 2016-2018 | 2019-2021 |
| Poland | | | | |
| Mean | 3.652,3 | 3.940,6 | 4.986,5 | 6.465,7 |
| Cities with county rights in total | | | | |
| Mean | 4.428,8 | 4.903,9 | 5.774,6 | 7.717,4 |
| Coefficient of variation V (%) | 19,0 | 16,8 | 12,5 | 18,0 |
| Cities with a population of up to 100,000 | | | | |
| Mean | 4.618,0 | 4.696,7 | 5.671,0 | 7.778,5 |
| Coefficient of variation V (%) | 23,3 | 18,3 | 13,9 | 24,2 |
| Cities with a population of 100-200 thousand. | | | | |
| Mean | 4.157,8 | 5.020,1 | 5.780,3 | 7.572,7 |
| Coefficient of variation V (%) | 13,1 | 17,6 | 13,0 | 12,2 |
| Cities with a population of 200,000 and more | | | | |
| Mean | 4.529,5 | 5.172,0 | 6.013,3 | 7.859,4 |
| Coefficient of variation V (%) | 12,9 | 9,2 | 7,3 | 6,7 |

Source: Central Statistical Office in Warsaw.

As in the whole country, also in cities with poviats rights, the average value of total budget expenditure per capita increased in 2010-2021. In the analyzed period, the average value of total budget expenditure per capita is higher in cities with poviats rights, compared to the national average, and there are no major differences in this respect between the selected groups of these cities, depending on the number of inhabitants. In addition, both in the case of all cities with poviats rights in Poland, as well as their separate groups, the differentiation of this feature between individual cities is small in the analyzed years, so its variability is low, which proves that these units are relatively homogeneous in terms of in this respect (Table 4).

The wealth of local government units clearly affects their investment opportunities, while units with higher budgetary income per capita, including their own income, usually also have a greater investment potential. On the other hand, the implementation of investments by local government units is one of their most important tasks, as it meets the needs of local communities and contributes to their further development. Investment expenditures in the economy and financial policy of local government units, in addition to their own income, are therefore an important factor determining their development prospects (Filipiak, 2011; Błachut, Cierpień-Wolan, Czudec, Kata, 2018).

In cities with poviast rights in Poland, the average value of investment expenditures of their budgets per capita varies in the years 2010-2021, as in the whole country, but it is the highest in the years 2019-2021. Cities with poviast rights, however, are characterised by a higher average value of investment expenditures of their budgets per capita in the years 2010-2021, compared to the average for the entire country, and this also applies to all their separate groups, depending on the number of inhabitants, except for the group of cities with the smallest number of inhabitants, i.e., up to 100,000 in 2016-2018. Moreover, there are no significant differences in this respect between the groups of cities with poviast rights, depending on the number of their inhabitants. On the other hand, the differentiation of this feature between individual cities is, in turn, usually quite large, and in particular it concerns the group of all cities with poviast rights in Poland and the group of cities with the smallest number of inhabitants, i.e. up to 100,000. (Table 5).

Table 5.

Investment expenditures of the budgets of cities with poviast rights in Poland per capita against the background of the entire country in 2010-2021 (PLN)

| Specification | Years | | | |
|---|-----------|-----------|-----------|-----------|
| | 2010-2012 | 2013-2015 | 2016-2018 | 2019-2021 |
| Poland | | | | |
| Mean | 790,0 | 719,0 | 757,3 | 996,7 |
| Cities with county rights in total | | | | |
| Mean | 943,2 | 936,9 | 812,0 | 1.265,4 |
| Coefficient of variation V (%) | 52,8 | 58,1 | 40,5 | 84,4 |
| Cities with a population of up to 100,000 | | | | |
| Mean | 1.065,4 | 743,0 | 708,5 | 1.290,9 |
| Coefficient of variation V (%) | 61,4 | 54,1 | 50,1 | 119,8 |
| Cities with a population of 100-200 thousand. | | | | |
| Mean | 826,8 | 1.092,4 | 885,1 | 1.228,2 |
| Coefficient of variation V (%) | 36,8 | 63,8 | 35,9 | 37,7 |
| Cities with a population of 200,000 and more | | | | |
| Mean | 891,0 | 1.094,4 | 916,1 | 1.278,1 |
| Coefficient of variation V (%) | 36,9 | 31,2 | 23,7 | 25,4 |

Source: Central Statistical Office in Warsaw.

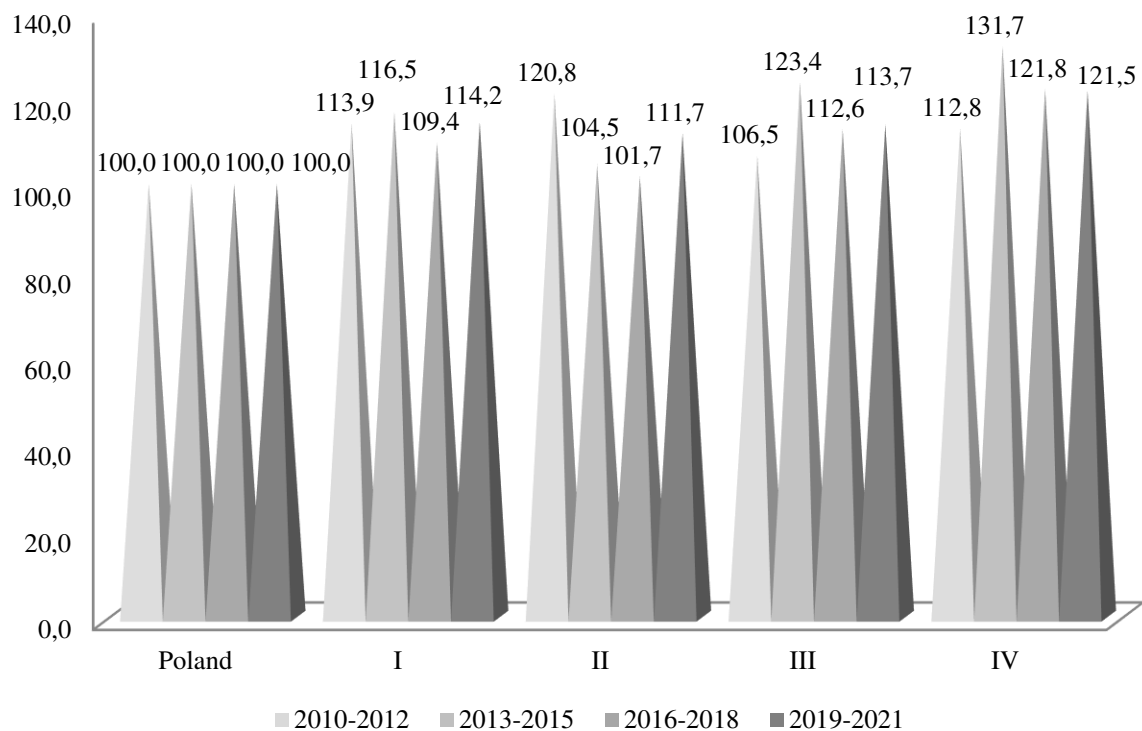
Table 6.

Share of investment expenditures in total expenditures of the budgets of cities with poviats rights in Poland against the background of the entire country in 2010-2021 (%)

| Specification | Years | | | |
|--|-----------|-----------|-----------|-----------|
| | 2010-2012 | 2013-2015 | 2016-2018 | 2019-2021 |
| Poland | | | | |
| Mean | 21,6 | 18,2 | 15,2 | 15,4 |
| Cities with county rights in total | | | | |
| Mean | 20,4 | 18,2 | 13,8 | 15,4 |
| Coefficient of variation V (%) | 33,3 | 42,6 | 31,2 | 43,4 |
| Cities with a population of up to 100,000 | | | | |
| Mean | 21,7 | 15,2 | 12,2 | 14,7 |
| Coefficient of variation V (%) | 36,3 | 38,2 | 37,9 | 60,6 |
| Cities with a population of 100-200 thousand.. | | | | |
| Mean | 19,4 | 20,5 | 15,0 | 15,9 |
| Coefficient of variation V (%) | 29,9 | 47,0 | 26,0 | 28,3 |
| Cities with a population of 200,000 and more | | | | |
| Mean | 19,3 | 20,9 | 15,2 | 16,2 |
| Coefficient of variation V (%) | 30,0 | 24,8 | 19,9 | 22,3 |

Source: Central Statistical Office in Warsaw.

The share of investment expenditure in the total expenditure of the budgets of cities with poviats rights in Poland is at a similar level in 2010-2021 and is very similar to the average for the entire country, although it decreased in 2016-2021. There are also no major differences in this respect between the selected groups of cities with poviats rights, depending on the number of their inhabitants, with the exception that the lowest share of investment expenditures in total budget expenditures in 2013-2021 is in the group of cities with the smallest number of inhabitants, i.e. up to 100,000. Moreover, the differentiation of this feature between individual cities is, in turn, usually quite large, and in particular it concerns the group of all cities with poviats rights in Poland and the group of cities with the smallest number of inhabitants, i.e. up to 100,000 (Table 6).



Explanations: I – cities with poviats rights in general; II – cities with a population of up to 100,000; III – cities with 100-200 thousand inhabitants; IV – cities with a population of 200,000 and more.

Figure 1. Score assessment of the financial situation of cities with poviats rights in Poland against the background of the country for the years 2010-2021 (Poland = 100.0 points).

Source: Own study.

Figure 1 presents the results of the score assessment concerning the financial situation of cities with poviats rights in Poland against the background of the entire country for the years 2010-2021. It should be noted that there are no major changes in this respect in the analysed years. Namely, cities with poviats rights in Poland in the entire period covered by the research are characterized by an average better financial situation, compared to the average for the entire country, especially in the years 2013-2015. In addition, there are no significant differences in terms of the financial situation between the groups of cities with poviats rights, depending on the number of their inhabitants. Nevertheless, it can be noticed that in the years 2010-2012, the best financial situation is in the cities with the smallest number of inhabitants, i.e. up to 100,000. However, in the remaining years studied, i.e. 2013-2021, this applies to cities with the largest number of inhabitants, i.e., 200,000. and more. All this therefore confirms the research hypothesis put forward in the article, which assumes that cities with poviats rights in Poland are slightly differentiated in terms of their financial situation and its changes over time, while the mere fact of the presence of a city, especially a larger one, is an important factor that positively and permanently affects this situation.

4. Summary and conclusions

Local governments, including those from cities with poviata rights, perform very important functions, both from the point of view of society and the economy, primarily by conducting an effective and efficient development policy based on responsible and rational financial management.

The analysis of the statistical data showed that cities with poviata rights in Poland are characterized by a better financial situation on average, compared to the average for the whole country in 2010-2021, and there are also no major changes in this regard throughout the period covered by the research. In addition, there are also no very significant differences in terms of a number of diagnostic features illustrating the financial situation of cities with county rights between the groups of cities separated in the article, with the exception that when making comparisons, the group of cities with the largest number of residents is quite often the most favourable.

Therefore, it allows us to confirm the research hypothesis, assuming that cities with poviata rights in Poland are slightly differentiated in terms of their financial situation and its changes over time, while the very fact of the presence of a city, especially a larger one, is an important factor that positively and permanently affects this situation.

It should be added that the presented results of the analysis of statistical data provide relevant and up-to-date knowledge that may be useful primarily to local government officials responsible for public local government finances, as well as for the conditions, opportunities, and directions of local socioeconomic development of cities with poviata rights in Poland. At the same time, it justifies the need to continue similar research and analyses.

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ENDOGENIC CONDITIONS FOR THE DEVELOPMENT OF NON-AGRICULTURAL ECONOMIC ACTIVITIES IN RURAL COMMUNITIES OF EASTERN AND WESTERN REGIONS OF POLAND

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Purpose: The aim of the article is to identify and evaluate endogenous conditions for the development of non-agricultural economic activity in rural communes of eastern and western regions of Poland

Design/methodology/approach: The article identifies and evaluates endogenous conditions for the development of non-agricultural economic activity in rural communes of eastern and western regions of Poland. The empirical material of the article concerns both all rural communes in the country and all rural communes in the eastern and western regions of Poland. The figures come from the Local Data Bank of the Central Statistical Office in Warsaw and concern the years 2020-2021. The empirical material collected and ordered was developed in descriptive, tabular, and graphical form, using comparative analysis. In addition, a score assessment was made of all diagnostic features illustrating the endogenous determinants of the development of non-agricultural economic activity in rural communes of eastern and western regions of Poland against the background of the entire country for 2021.

Findings: The analysis of statistical data confirmed the research hypothesis, which assumes that the activity of inhabitants of rural communes in eastern and western regions of Poland in the development of non-agricultural economic activity is diverse and shows a relationship with the quality of its endogenous conditions, with these conditions being clearly the best in units with high activity of inhabitants in this regard.

Originality/value: The originality of the work lies in the approach to the analysis of the research issues undertaken. For the purposes of research, the author's indicator of activity of residents in the development of non-agricultural economic activity in a given local government unit (commune) against the background of the country and other local government units (communes) was compiled and used. In addition, a point assessment of endogenous conditions for the development of non-agricultural economic activity in the surveyed local government units against the background of the country was made. The work is directed primarily to local government officials responsible for the conditions, opportunities, and directions of local socioeconomic development of rural communes in Poland.

Keywords: rural communes in Poland, economic activity of inhabitants, non-agricultural economic activity, endogenous conditions of development

Category of the paper: research paper.

1. Introduction

Conditions of endogenous development are divided into two groups, i.e., traditional and modern. Traditional conditions are closely related to production resources, i.e. land, natural environment, as well as human and material capital. On the other hand, modern ones include: the ability to improve the quality of owned resources, social capital, development of cooperation and network organizational forms based on local resources, the structure of the economy and its ability to adapt to changing external conditions, including innovation, as well as environmental conditions and efficiency activities of local institutions. It should be added that endogenous development occurs only when development factors pass from the state of typical resources to a situation of recognizing and assessing the use value and proper use. Only launched and used resources become active development factors. In addition, endogenous development often also requires the impact of exogenous factors, among which the following should be mentioned: the emergence of external demand for resources or for finished products or services and obtaining external support. Therefore, the concepts of endogenous development recognise that one should count on one's own strengths and capabilities and base development on one's own endogenous potential, as well as develop cooperation with other regions (Szymła, 1997; Głąbicka, Grewiński, 2005; Pietrzyk, 2005; Falkowski, 2006; Heffner, 2007; Kosiedowski, 2008; Ślusarz, 2008; Czudec, 2011; Gałązka, 2011; Korenik, 2011; Olejniczak, 2016).

Each commune is characterized by a separate specificity, which is determined primarily by such features as: type of commune (urban, urban-rural, rural), location in space and accessibility (suburban areas, border areas, valuable natural areas, etc.), population and demographic (number and structure of population, quality of human and social capital, socio-cultural characteristics, changes in the number of inhabitants, i.e. growth, stagnation, decline), level of development and structure of the economy, labor market and unemployment, tangible and intangible resources, infrastructure (social, technical, institutional), natural environment (quality, values), local initiatives (establishing and developing cooperation, entrepreneurship, innovation, openness to new solutions). On the other hand, the conditions in which the local government functions, i.e. the characteristics of the local environment (commune), largely determine its financial situation (level and structure of income and budget expenditures, debt) and determine the possibilities and directions of its activities. in terms of further socio-economic development.

Particularly important determinants of development, including nonagricultural economic activity and the functioning of the local government, are therefore in the endogenous (often specific and unique) features of the local environment (commune). These features have a significant impact on the scale, directions, and dynamics of socio-economic development and are also the original (sort of natural) conditions in which local government functions and conducts its own development policy, including nonagricultural economic activity.

As a result, nonagricultural economic activity develops well in rural areas around larger urban centres and located along main communication routes, where there is a significant degree of population concentration, a significant labor market, appropriate infrastructure, greater wealth of the population, high demand, high own incomes of communes, convenient location in relation to the sales market. Non-agricultural economic activity also develops well where there are traditions of running a business, where there are better educated, entrepreneurial people and leaders, as well as in communes with high activity of local governments and other institutions, and in rural areas where there are special natural and cultural values predisposing to the development of tourism. Therefore, the most important factors stimulating the development of non-agricultural economic activity in rural areas are: location, human, social and financial capital as well as activities of local governments, while the most important barriers to its development are: demand barrier and unfavorable demographic structures, especially in peripheral rural areas (Duczkowska-Piasecka, 1997; Wilkin, 1997; Kłodziński, Rosner, 2000; Kamińska, 2011; Duczkowska-Małysz, Duczkowska-Piasecka, 2014; Zarębski, 2015; Brodziński, Brodzińska, 2016; Kulawiak, 2022).

The eastern regions of Poland are voivodeships with a low level of socioeconomic development, characterized by low population density, low quality of human, social and intellectual capital, low level of development of technical, social and institutional infrastructure, limited territorial accessibility and low level of income of the population and local government units. Therefore, these are voivodeships that meet the definition criteria used for peripheral areas. On the other hand, the western regions of Poland in the geographical and natural sense are the Oder basin stretching between the Sudetes and the Baltic Sea, and in the economic sense they are a more developed and prosperous part of the country, especially in comparison to the eastern regions. The location of the western regions of Poland in the vicinity of Germany and the Czech Republic, as well as in the vicinity of the Scandinavian countries, creates an opportunity for their further socio-economic development, which can be accelerated primarily by establishing and using mutual relations and economic relations (cross-border cooperation) (Mogła, Zaleski, Zathej, 2011; Kudełko, 2013; Balińska, 2015; Czudec, Majka, Zając, 2018; Grzebyk, Miś, Stec, Zając, 2019; Miś, Zając, 2020).

2. Research aim, empirical material, and research methods

The aim of the article is to identify and evaluate endogenous conditions for the development of nonagricultural economic activity in rural communes of eastern and western regions of Poland.

The article presents a research hypothesis, which assumes that the activity of inhabitants of rural communes in eastern and western regions of Poland in the development of non-agricultural economic activity is diverse and shows a relationship with the quality of its endogenous conditions, with these conditions clearly the best in units with high activity of residents in this range.

The empirical material of the article concerns both all rural communes throughout the country and all rural communes in the eastern and western regions of Poland, this is in six voivodeships, this is Lubelskie, Podkarpackie, and Podlaskie as well as Dolnośląskie, Lubuskie and Zachodniopomorskie¹. The figures come from the Local Data Bank of the Central Statistical Office in Warsaw and concern the years 2020-2021. The collected and ordered empirical material was developed in a descriptive, tabular, and graphical form, using the comparative analysis.

Data on the dynamics of establishing new and closing existing business entities are often considered the main source of information about the activity of residents in the development of nonagricultural business activities, as well as about the condition of the economy in a given area, for example, in a commune. These indicators take into account not only hard factors of economic growth, but also those immeasurable, related to investors' moods and their expectations as to the possibility of undertaking and conducting nonagricultural economic activity. The rate of growth in the number of registered business entities proves the high activity of the inhabitants in the development of nonagricultural economic activity, as well as the improvement of the economic situation in a given area, e.g., in a commune, and implies many positive phenomena in the form of multiplier effects in the economy. On the other hand, the decrease in the number of registered business entities indicates a deterioration of the general climate for entrepreneurship and may even mean closing a given area, e.g. a commune, for investments and development of non-agricultural business activity (Zarębski, 2015; Brodziński, Brodzińska, 2016). For the purposes of research, the author's indicator of activity of residents in the development of non-agricultural economic activity in a given local government unit (commune) against the background of the country and other local government units (communes) was compiled and used. The construction of this indicator consists in the fact that the number of economic entities per 1000 working-age population in the previous year (i.e., 2020) in the country was added to the number of newly registered economic entities per 1000 working-age population in the surveyed year (i.e., 2021) in the country. Then, their sum was adopted as a value of 1.0 for the country, and the advantage or underweight of this sum in all rural communes in Poland compared to the country was assessed accordingly. Subsequently, from the number calculated in this way, both for the country (i.e. 1.0) and for all rural communes in Poland, the % of economic entities deregistered in the surveyed year (i.e. 2021) was subtracted. It should be added that for the index value of up to 0.50,

¹ One of the administrative borders of these provinces is the state border.

it was assumed that the activity of the inhabitants in the development of nonagricultural economic activity is weak, for the value of 0.51-0.75, this activity is moderate, and for the value of 0.76 and more, that she is tall. Taking into account the above assumptions, all rural communes in the country and all rural communes in the eastern and western regions of Poland were divided into three groups, depending on the activity of their inhabitants in the development of non-agricultural economic activity. It should be emphasised that this is a new approach to the research problem addressed in the article.

In turn, for the identification and assessment of endogenous conditions for the development of nonagricultural economic activity in rural communes covered by the research, the following diagnostic features illustrating them in 2021 were analysed: population density (population per 1 km²), percentage of working age population, nonworking age population per 100 working-age population, birth rate per 1000 population, migration balance for permanent residence per 1000 population, employed persons per 1000 working-age population, registered unemployment rate (%), percentage of population using water, sewage and gas networks, total income of commune budgets per capita (PLN), own revenues of communes' budgets per capita (PLN), share of own revenues in total revenues of communes' budgets (%), total expenditures of communes' budgets per capita (PLN), investment expenditures of communes' budgets per capita (PLN) and share of investments in the total expenditure of communes' budgets (%).

In addition, the article evaluates all diagnostic features illustrating the endogenous determinants of the development of nonagricultural economic activity in rural communes covered by the research against the background of the entire country for 2021. Individual diagnostic characteristics were compared with the national average, assumed as 100 points, and their advantage or underweight was assessed accordingly in all rural communes covered by the research. Then all points were summed and the average was calculated (graphs 1-4).

3. Results

Analysing the economic activity of inhabitants of rural communes in Poland in terms of taking up and developing non-agricultural economic activity, it should be noted that the percentage of communes characterised by moderate activity in this respect is clearly the largest (55.4%). On the other hand, a smaller percentage is represented by rural communes, where the activity of inhabitants in the field of taking up and developing nonagricultural economic activity is high (23.4%) and those where this activity is weak (21.2%). The situation in this respect is completely different in the eastern and western regions of Poland. For in the case of rural communes of eastern regions, the percentage of units characterised by high activity of inhabitants in the field of taking up and developing non-agricultural economic activity is clearly the smallest (5.1%), while the percentage of communes with moderate and low activity of

inhabitants in this respect is 51.6, respectively. % and 43.3%. On the other hand, in the case of rural communes in the western regions, the percentage of units with low activity of inhabitants in the field of taking up and developing non-agricultural economic activity is clearly the smallest (6.7%), while the percentage of communes with moderate and high activity in this respect is similar, i.e. 47, 9% and 45.4%. All this partly confirms the research hypothesis put forward in the article (Table 1).

An important factor determining the possibilities and needs of economic development in a given area (e.g., in a commune) is the demographic situation, understood as the shape of natural and migration processes of the population and its structures by sex and age. In addition, it is of fundamental importance for the development of rural areas, which is confirmed by the results of the research and analyses (Frenkel, 1999; Pięcek, 2007, Zegar, 2011; Grzebyk, Miś, Stec, Zając, 2019).

Rural communes in Poland are characterized by worse demographic conditions and a worse situation on the labor market, compared to the averages for the whole country, and this applies to such features as: population density, natural increase per 1000 population, number of employees per 1000 population in working age and the registered unemployment rate and concerns mainly communes in the eastern regions. On the other hand, in the case of characteristics such as: the percentage of working-age population, the number of nonworking-age population per 100 working-age people, and the net migration for permanent residence per 1000 population, the situation is better in rural communes than in the whole country, especially municipalities in the western regions. However, rural communes in Poland are differentiated in this respect, depending on the activity of their inhabitants in the development of nonagricultural economic activity, and in the case of most of the analysed features characterising demographic conditions and the situation on the labor market, they are best presented in the group of communes with high activity of inhabitants in the development of nonagricultural economic activity, and the worst in the group of communes with low activity of inhabitants in this respect, and this applies both to rural communes throughout Poland and to rural communes in its eastern and western regions, which partially confirms the research hypothesis presented in the article (tab. 1).

Infrastructure is, in a way, the backbone of the economy and the basis for all economic activity, conditioning its scope, structure, and spatial distribution. The level of its development largely determines the attractiveness of both the entire region (voivodship) and the local environment (county, commune) and determines its development potential. Among the elements of infrastructure that play an important role in the economic activation of a given area (e.g. communes), as well as in shaping the living conditions of the inhabitants, there are primarily roads, communications, electricity and gas networks, water supply, and sewage systems, which has been confirmed in many studies and analyses. It should be added that the use of infrastructure as an important factor in the development of rural areas is related to the implementation of an appropriate investment policy in this respect. Investment policy is the

domain of activity of local authorities, and its aim is to increase the attractiveness and credibility of the countryside as a place to live and create jobs through the development of non-agricultural economic activity. However, a serious obstacle in the development of infrastructure in rural areas is the high cost of most such projects, which mainly results from the dispersion of the settlement network. In general, it can be stated that the infrastructure in rural areas in Poland is still relatively underdeveloped, although there are very large regional and local differences in this respect (Gałązka, 1999; Pięcek, 1999; Czudec, 2003; Kołodziejczyk, 2009; Jarosiński, 2011; Kołodziejczyk, 2013; Grzebyk, Miś, Stec, Zając, 2019).

Table 1.

Selected characteristics characterising the demographic conditions and the situation on the labor market in rural communes covered by the research in 2021

| Specification | Rural communes | | | |
|---|----------------|--|-----------|---------------|
| | Total | According to the value of the inhabitants' activity indicator in the development of non-agricultural economic activity | | |
| | | Do 0,50 | 0,51-0,75 | 0,76 i więcej |
| Poland | | | | |
| Number of communes | 1523 | 323 | 844 | 356 |
| Population density - population per 1 km ² | 72,8 | 44,2 | 67,4 | 111,6 |
| Percentage of the working age population | 59,6 | 59,4 | 59,5 | 60,0 |
| Population at non-working age per 100 people at working age | 67,8 | 68,5 | 68,1 | 66,6 |
| Natural increase per 1000 population | -5,4 | -8,5 | -5,5 | -2,3 |
| Migration balance for permanent residence per 1000 population | 0,6 | -3,8 | -0,4 | 7,1 |
| Working people per 1000 people of working age | 192,6 | 136,2 | 184,5 | 263,0 |
| Registered unemployment rate | 4,9 | 6,0 | 5,0 | 3,6 |
| Eastern regions of Poland | | | | |
| Number of communes | 349 | 151 | 180 | 18 |
| Population density - population per 1 km ² | 58,3 | 44,7 | 65,7 | 97,9 |
| Percentage of the working age population | 59,4 | 59,1 | 59,5 | 60,9 |
| Population at non-working age per 100 people at working age | 68,6 | 69,4 | 68,3 | 64,4 |
| Natural increase per 1000 population | -7,7 | -9,9 | -6,4 | -2,8 |
| Migration balance for permanent residence per 1000 population | -1,9 | -3,9 | -1,1 | 6,7 |
| Working people per 1000 people of working age | 150,4 | 126,1 | 161,9 | 239,0 |
| Registered unemployment rate | 6,1 | 6,5 | 5,7 | 5,6 |
| Western regions of Poland | | | | |
| Number of communes | 163 | 11 | 78 | 74 |
| Population density - population per 1 km ² | 49,2 | 32,2 | 39,6 | 61,8 |
| Percentage of the working age population | 60,2 | 59,9 | 60,1 | 60,3 |
| Population at non-working age per 100 people at working age | 66,2 | 67,1 | 66,5 | 65,8 |
| Natural increase per 1000 population | -5,3 | -7,3 | -6,5 | -3,6 |
| Migration balance for permanent residence per 1000 population | 3,1 | -2,1 | -0,5 | 7,6 |
| Working people per 1000 people of working age | 204,4 | 182,9 | 181,6 | 231,6 |
| Registered unemployment rate | 4,5 | 5,0 | 5,1 | 3,8 |

Source: Central Statistical Office in Warsaw.

Table 2.

Selected characteristics characterising infrastructural conditions in rural communes covered by the research in 2021

| Specification | Rural communes | | | |
|--|----------------|--|-----------|---------------|
| | Total | According to the value of the inhabitants' activity indicator in the development of non-agricultural economic activity | | |
| | | Do 0,50 | 0,51-0,75 | 0,76 i więcej |
| Poland | | | | |
| Percentage of population using the water supply system | 85,8 | 84,0 | 85,3 | 88,9 |
| Percentage of the population using the sewage system | 40,3 | 29,8 | 38,7 | 53,8 |
| Percentage of population using the gas network | 19,7 | 11,8 | 17,1 | 33,0 |
| Eastern regions of Poland | | | | |
| Percentage of population using the water supply system | 78,2 | 79,9 | 76,4 | 81,3 |
| Percentage of the population using the sewage system | 34,5 | 30,5 | 36,7 | 46,9 |
| Percentage of population using the gas network | 24,2 | 16,2 | 29,6 | 37,0 |
| Western regions of Poland | | | | |
| Percentage of population using the water supply system | 93,0 | 96,3 | 94,3 | 91,1 |
| Percentage of the population using the sewage system | 53,0 | 51,5 | 50,0 | 56,3 |
| Percentage of population using the gas network | 21,5 | 12,1 | 12,1 | 32,7 |

Source: Central Statistical Office in Warsaw.

In rural communes in Poland, as in the whole country, the most developed infrastructure element is the water supply network, followed by the sewage network, and the least developed is the gas network, especially in communes in the western regions. However, there is a variation in this respect between rural communes, depending on the activity of their inhabitants in the development of nonagricultural economic activity, especially in the case of sewage and gas networks. Well, they are best developed in the group of rural communes with high activity of residents in the development of nonagricultural economic activity, and this applies both to rural communes throughout Poland, as well as in its eastern and western regions, which partially confirms the research hypothesis presented in the article. On the other hand, in rural communes throughout Poland and in its eastern regions, the worst developed sewerage and gas network can be found in a group of communes with low activity of inhabitants in the development of nonagricultural economic activities. However, in the case of the western regions of Poland, groups of rural communes with weak and moderate activity of inhabitants in the development of non-agricultural economic activity are characterised by similar accessibility of the population to these elements of the infrastructure (Table 2).

The basic condition for effective and efficient implementation of statutory tasks by communes is to ensure stable budgetary revenues, not only allowing for financing current expenses, but also enabling undertaking new investment tasks, including those conducive to the development of non-agricultural economic activity (Czudec, 2021).

Table 3.

Selected characteristics characterising the economic and financial conditions in rural communes covered by the research in 2021

| Specification | Rural communes | | | |
|--|----------------|--|-----------|---------------|
| | Total | According to the value of the inhabitants' activity indicator in the development of non-agricultural economic activity | | |
| | | Do 0,50 | 0,51-0,75 | 0,76 i więcej |
| Poland | | | | |
| Total revenues of communes' budgets per capita in PLN | 6.621,0 | 6.402,9 | 6.528,8 | 7.037,4 |
| Own revenues of communes' budgets per capita in PLN | 2.284,6 | 1.797,0 | 2.141,7 | 3.065,6 |
| Share of own revenues in total revenues of commune budgets in % | 33,6 | 27,6 | 32,2 | 42,5 |
| Total budget expenditures of communes per capita in PLN | 6.044,7 | 5.796,3 | 5.958,0 | 6.475,6 |
| Investment expenditures of communes' budgets per capita in PLN | 975,5 | 949,9 | 933,7 | 1.098,1 |
| Share of investment expenditures in total expenditures of commune budgets in % | 15,4 | 15,5 | 15,0 | 16,2 |
| Eastern regions of Poland | | | | |
| Total revenues of communes' budgets per capita in PLN | 6.372,4 | 6.311,3 | 6.338,7 | 7.222,8 |
| Own revenues of communes' budgets per capita in PLN | 1.786,6 | 1.658,2 | 1.758,5 | 3.144,9 |
| Share of own revenues in total revenues of commune budgets in % | 27,7 | 26,0 | 27,7 | 42,9 |
| Total budget expenditures of communes per capita in PLN | 5.768,3 | 5.703,4 | 5.776,4 | 6.231,5 |
| Investment expenditures of communes' budgets per capita in PLN | 976,0 | 991,1 | 952,3 | 1.085,4 |
| Share of investment expenditures in total expenditures of commune budgets in % | 16,2 | 16,5 | 15,8 | 16,6 |
| Western regions of Poland | | | | |
| Total revenues of communes' budgets per capita in PLN | 6.880,6 | 7.406,1 | 6.570,7 | 7.129,2 |
| Own revenues of communes' budgets per capita in PLN | 3.054,7 | 3.329,1 | 2.579,3 | 3.514,9 |
| Share of own revenues in total revenues of commune budgets in % | 42,9 | 42,0 | 38,7 | 47,5 |
| Total budget expenditures of communes per capita in PLN | 6.271,5 | 6.706,3 | 6.044,7 | 6.446,0 |
| Investment expenditures of communes' budgets per capita in PLN | 1.021,0 | 1.089,5 | 939,5 | 1.096,8 |
| Share of investment expenditures in total expenditures of commune budgets in % | 15,3 | 13,2 | 14,7 | 16,3 |

Source: Central Statistical Office in Warsaw.

In rural communes in Poland, the average value of total budgetary income per capita is lower than the national average, where it amounts to PLN 7,226.5, and this applies in particular to communes in eastern regions. However, rural communes are differentiated in this respect, depending on the activity of their inhabitants in the development of nonagricultural economic activity. The average value of total budgetary income per capita of rural communes is clearly the highest in the group of communes with high activity of inhabitants in this respect, but this applies only to rural communes throughout Poland and in its eastern regions. For in the case of the western regions of Poland, the average value of total budgetary income per capita of rural communes is clearly the highest in the group of communes with low activity of inhabitants in

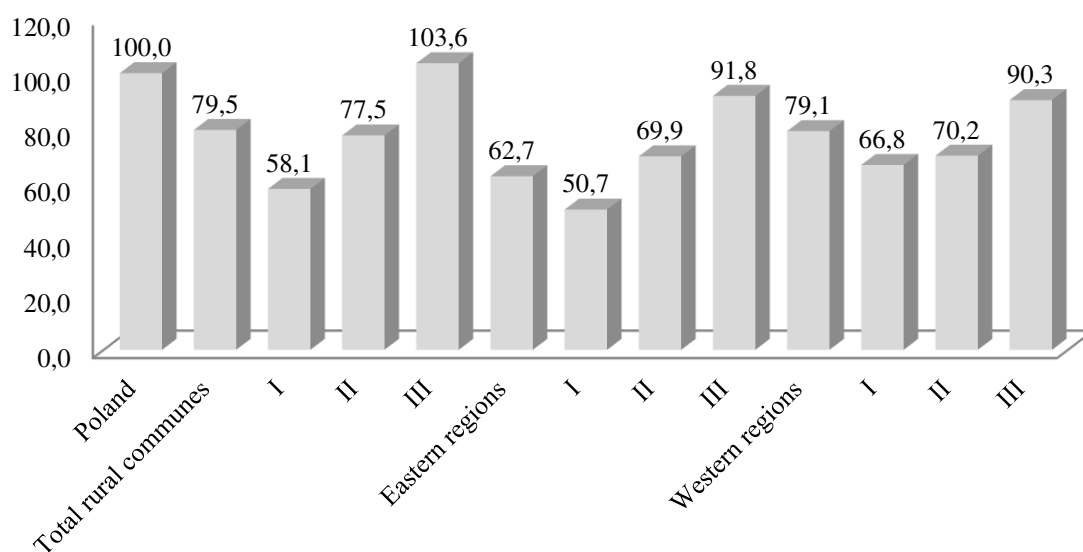
the development of nonagricultural economic activities. On the other hand, the lowest average value of total budgetary income per capita of rural communes throughout Poland and in its eastern regions is characterised by a group of communes with low activity of inhabitants in the development of non-agricultural economic activities, and in the case of western regions of Poland, a group of communes with moderate activity of inhabitants in this respect (Table 3).

Rural communes in Poland are characterised by a lower average value of their own budgetary revenues per capita and a lower share of these revenues in the total revenues of commune budgets, compared to the averages for the entire country, which amount to PLN 3,479.2 and 48.1%, respectively, are municipalities in the eastern regions. However, there is variation in this respect between rural communes, depending on the activity of their inhabitants in the development of nonagricultural economic activity. The average value of own revenues per capita of rural communes' budgets and the share of these revenues in the total revenues of communes' budgets are by far the highest in the group of communes with high activity of inhabitants in the development of non-agricultural economic activity, and this applies both to rural communes throughout Poland and to rural communes in eastern and its western regions, which partially confirms the research hypothesis presented in the article. On the other hand, they are the lowest in the group of rural communes with low activity of residents in this respect, but this applies only to rural communes throughout Poland and in its eastern regions, because in the case of western regions of Poland, the lowest average value of own budgets of rural communes per capita and the lowest share of this income in the total income of commune budgets is in the group of communes with moderate activity of inhabitants in the development of non-agricultural economic activity (Table 3).

In rural communes in Poland, the average value of total budget expenditure per capita is lower than the national average, which is PLN 6,870.1, and this applies especially to communes in eastern regions. However, rural communes are differentiated in this respect, depending on the activity of their inhabitants in the development of nonagricultural economic activity. The average value of total budget expenditure per capita of rural communes is clearly the highest in the group of communes with high activity of inhabitants in this respect, but this applies only to rural communes throughout Poland and in its eastern regions. On the other hand, in the case of the western regions of Poland, the average value of total budget expenditure per capita of rural communes is clearly the highest in the group of communes with low activity of inhabitants in the development of non-agricultural economic activities. On the other hand, the lowest average value of total budget expenditures per capita of rural communes throughout Poland and in its eastern regions is characterised by a group of communes with low activity of residents in the development of non-agricultural economic activities, and in the case of western regions of Poland, a group of communes with moderate activity of residents in this respect (Table 3).

Rural communes in Poland are characterised by a similar average value of investment expenditure per capita similar to that in the whole country (PLN 1,024.0), especially in western regions. However, there is variation in this respect between rural communes, depending on the activity of their inhabitants in the development of nonagricultural economic activity. The average value of investment expenditures per capita in the budgets of rural communes is by far the highest in the group of communes with high activity of inhabitants in the development of non-agricultural economic activity, and the lowest in the group of rural communes with moderate activity of inhabitants in this respect, and this applies both to rural communes throughout Poland, as well as rural communes in its eastern and western regions, which partially confirms the research hypothesis presented in the article (Table 3).

On average, the share of investment expenditure in the total budget expenditure of rural communes in Poland is similar to the average for the whole country, where it amounts to 14.9%, and this applies especially to communes in western regions. There are also no major differences in this regard between the selected groups of rural communes, with a slightly higher share of investment expenditure in the total expenditure of commune budgets in the group of communes with high activity of residents in the development of non-agricultural economic activity, and this applies in particular to rural communes throughout Poland and in its western regions (Table 3).

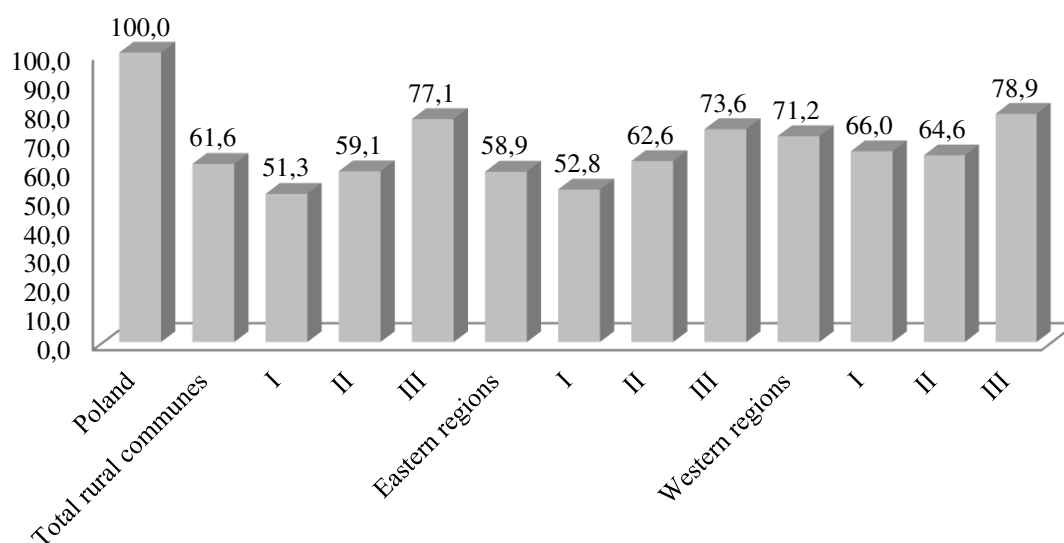


Explanations: I - rural communes, in which the value of the residents' activity indicator in the development of non-agricultural economic activity is below 0.51; II - rural communes, in which the value of the residents' activity indicator in the development of non-agricultural economic activity is from 0.51 to 0.75; III - rural municipalities, in which the value of residents' activity indicator in the development of non-agricultural economic activity is 0.76 and more.

Figure 1. Score assessment of demographic conditions and the situation on the labor market in rural communes covered by the research against the background of the country for 2021 (Poland = 100.0 points).

Source: Own study.

Figure 1 shows the results of the scoring concerning demographic conditions and the situation on the labor market in rural communes covered by the research against the whole country for 2021. It should be noted that rural communes in Poland are characterised by, on average, worse demographic conditions and a worse situation on the labor market, compared to the average for the whole country, and this is especially true for rural communes in the eastern regions. However, there is a clear differentiation in this respect between selected groups of rural communes, depending on the activity of their inhabitants in the development of nonagricultural economic activity. By far the best situation in this regard and the closest to the average for the entire country is in the group of communes with high activity of inhabitants in the development of non-agricultural economic activity, and this applies to both rural communes throughout Poland and rural communes in eastern and western regions, which partially confirms the research hypothesis put forward in the article. On the other hand, it is the worst in the group of rural communes with low activity of the inhabitants in the development of non-agricultural economic activities, especially in rural communes in the eastern regions. On the other hand, in the group of rural communes with moderate activity of inhabitants in the development of nonagricultural economic activity, demographic conditions and the situation on the labor market are at an average level and are very similar in rural communes of the eastern and western regions, with the exception that they are slightly worse compared to those that characterize this group of communes throughout Poland.



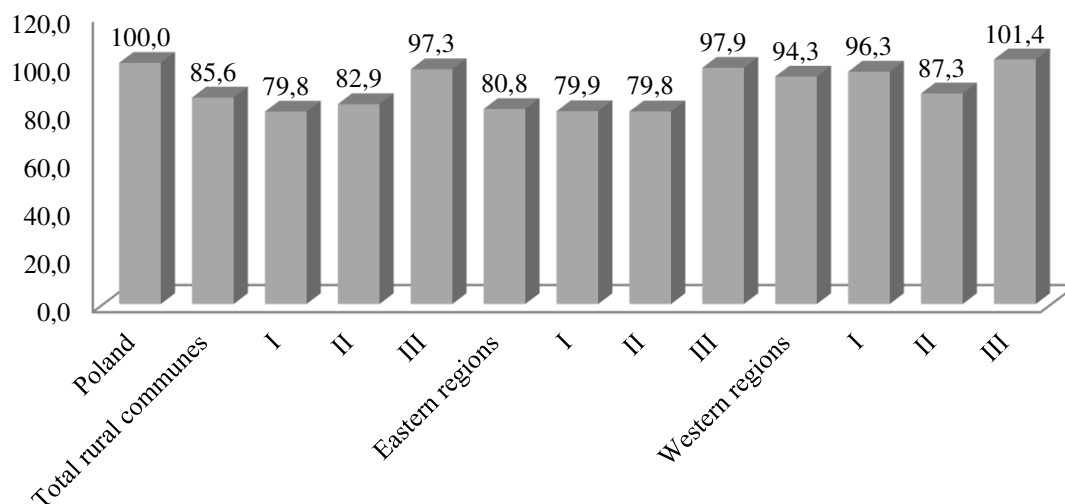
Explanations: as in diagram 1.

Figure 2. Score assessment of infrastructural conditions in rural communes covered by the research against the background of the country for 2021 (Poland = 100.0 points).

Source: Own study.

Figure 2 presents the results of the score assessment with respect to infrastructural conditions in rural communes covered by the research against the whole country for 2021. On its basis, it should be noted that rural communes in Poland are characterised by, on average, worse infrastructural conditions, compared to the averages for the whole country, and this is

especially true for rural communes in the eastern regions. However, there is a clear differentiation in this respect between selected groups of rural communes, depending on the activity of their inhabitants in the development of nonagricultural economic activity. Well, by far the best infrastructure conditions are characterized by a group of communes with high activity of residents in this respect, and this applies to both rural communes throughout Poland and rural communes in its eastern and western regions, and this partially confirms the research hypothesis put forward in the article. On the other hand, the worst situation in this respect is in the group of rural communes with low activity of inhabitants in the development of nonagricultural economic activity, but this applies only to rural communes throughout Poland and in its eastern regions. However, in the case of rural communes in the western regions of Poland, the infrastructural conditions are similar in the group of communes with low and moderate activity of their inhabitants in the development of nonagricultural economic activity, and at the same time, similar to those characterizing the group of rural communes with moderate activity of inhabitants in the development of non-agricultural economic activity throughout Poland and in its eastern regions.



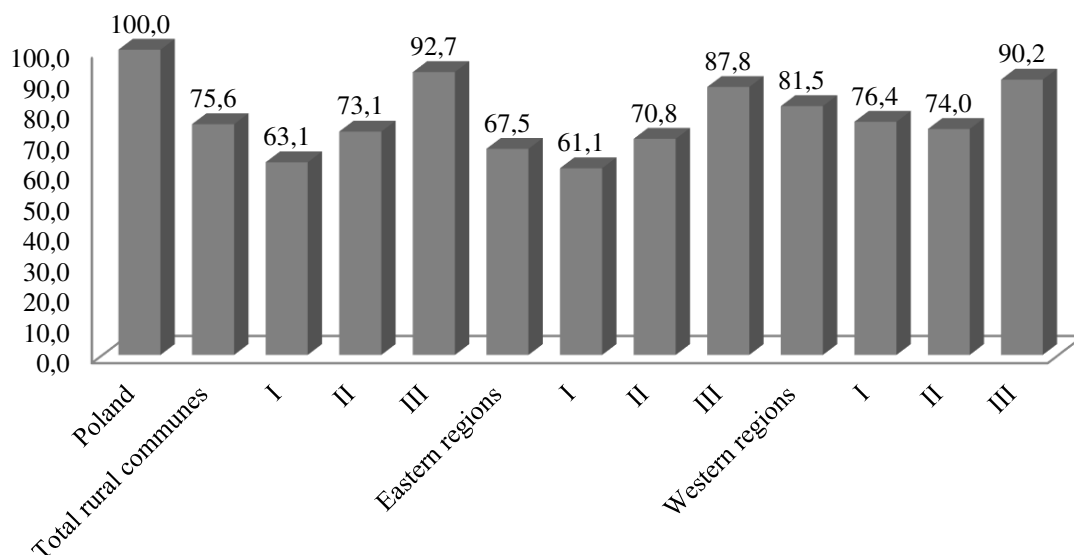
Explanations: as in diagram 1.

Figure 3. Score assessment of economic and financial conditions in rural communes covered by the research against the background of the country for 2021 (Poland = 100.0 points).

Source: Own study.

Figure 3 presents the results of the score assessment regarding economic and financial conditions in rural communes covered by the research against the whole country for 2021. It should be noted that rural communes in Poland are characterised by, on average, slightly worse economic and financial conditions, compared to the average for the whole country, and this is especially true for rural communes in eastern regions. However, there is a differentiation in this respect between selected groups of rural communes, depending on the activity of their inhabitants in the development of nonagricultural economic activities. The best economic and financial conditions are characterised by a group of communes with

high activity of residents in this respect, and this applies both to rural communes throughout Poland and to rural communes in its eastern and western regions, which partially confirms the research hypothesis presented in the article. On the other hand, in the group of rural communes with weak and moderate activity of inhabitants in the development of nonagricultural economic activity, the economic and financial conditions are slightly worse and similar, especially in rural communes throughout Poland and in its eastern regions.



Explanations: as in diagram 1.

Figure 4. Score assessment of endogenous conditions for the development of non-agricultural economic activity (i.e. demographic conditions and the situation on the labor market, as well as infrastructural, economic and financial conditions) in rural communes covered by the research against the country in 2021 (Poland = 100.0 points).

Source: Own study.

Figure 4 presents the results of the scoring on endogenous conditions for the development of nonagricultural economic activity (i.e. demographic conditions and the situation on the labor market, as well as infrastructural, economic and financial conditions analyzed together) in rural communes covered by the research against the background of the entire country for 2021. On its basis, it should be noted that rural communes in Poland are characterized by, on average, worse endogenous conditions for the development of non-agricultural economic activity, compared to the average for the entire country, and this is especially true for rural communes in the eastern regions. However, there is a clear differentiation in this respect between selected groups of rural communes, depending on the activity of their inhabitants in the development of nonagricultural economic activity. By far the best endogenous conditions for the development of nonagricultural economic activity are characterized by a group of communes with high activity of inhabitants in this respect, and this applies both to rural communes throughout Poland and to rural communes in its eastern and western regions, and this partially confirms the research hypothesis presented in the article. On the other hand, the worst situation in this respect is in the group of rural communes with low activity of inhabitants in the development of non-

agricultural economic activity, but this applies only to communes throughout Poland and in its eastern regions. Because in the case of rural communes in the western regions of Poland, endogenous conditions for the development of nonagricultural economic activity are similar in the group of communes with weak and moderate activity of their inhabitants in this respect and at the same time similar to those characterising the group of rural communes with moderate activity in the development of non-agricultural economic activity. business activity throughout Poland and in its eastern regions.

4. Summary and conclusions

Non-agricultural economic activity is the domain of responsible, creative, and courageous people, focused on achieving the assumed goals, including the desire to make a profit. It is also a real manifestation of an entrepreneurial attitude toward the environment and the ability to take advantage of emerging opportunities and market opportunities.

The development of nonagricultural economic activities is particularly important in rural areas, thanks to which they become more attractive, richer, and diversified, and also perform many important functions, both from the point of view of the economy and society.

The economic activity of the inhabitants of rural communes in Poland in the development of nonagricultural economic activity is, however, diversified and this applies both to communes throughout Poland, as well as in its eastern and western regions. In the case of rural communes throughout the country, the largest percentage are units with moderate activity of residents in this respect, in the case of rural communes in the eastern regions the percentage of units characterised by high activity of residents in this respect is the smallest, and in the case of rural communes in the western regions the lowest percentage are units with poor activity of the inhabitants in the development of nonagricultural economic activity.

Analysis of statistical data showed that rural communes in Poland are characterised by, on average, worse endogenous conditions for the development of nonagricultural economic activity, compared to the average for the whole country, and this applies in particular to communes in eastern regions.

However, rural communes throughout Poland and in its eastern and western regions are differentiated in terms of many diagnostic features illustrating their endogenous conditions for the development of nonagricultural economic activity, depending on the activity of the inhabitants in this respect. In the case of most comparisons, the group of rural communes with high activity of inhabitants in the development of nonagricultural economic activity is the most favourable. In addition, it was also confirmed by the point evaluation of endogenous conditions for the development of nonagricultural economic activity in the surveyed local government units against the background of the country, carried out in the article.

All this, therefore, allows us to confirm the research hypothesis put forward in the article, which assumes that the activity of the inhabitants of rural communes in eastern and western regions of Poland in the development of nonagricultural economic activity is diversified and is related to the quality of its endogenous conditions, with these conditions being clearly the best in units about the high activity of the inhabitants in this area.

It should be added that the presented results of the analysis of statistical data provide relevant and up-to-date knowledge that may be useful primarily for local government officials responsible for the conditions, opportunities and directions of local socioeconomic development of rural communes in Poland. At the same time, it justifies the need to continue similar research and analyses.

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INVESTMENT ACTIVITIES OF INSURANCE COMPANIES OPERATING IN VISEGRAD GROUP COUNTRIES – THEORETICAL AND EMPIRICAL APPROACH

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Purpose: The objective of this article is to assess the relationship between the investment activities of insurance companies and the gross premium written as well as the selected profitability and liquidity indicators. The research hypothesis assumes that such a relationship can be identified, and it depends on the type of activity and varies for each country.

Design/methodology/approach: The study period covers 2013-2020 in a panel approach. Insurance companies operating in the Visegrad countries were subjected to the study. Econometric panel data models were estimated and verified.

Findings: The study covering life and non-life insurance companies, indicated confirmation of the assumed research hypothesis. In the case of life insurance companies, considering all companies of the Visegrad Group countries together, the following factors have a statistically significant impact on the level of investments: gross premium written, profit after tax. However, this conclusion cannot be generalised by treating individual countries separately. In comparison, when analysing the performance of non-life insurers, only gross premiums written have a statistically significant impact on the level of investments.

Research limitations/implications: The analysis covers only the companies of the insurance sector of the Visegrad countries. In the next step, similar research should be carried out for companies from other groups of countries.

Practical implications: The considerations and research results contained in the article can serve insurance company managers in making investment-related decisions based on the technical results obtained. They can also be used by state governments and regulators to predict the future investment behaviour of insurance companies.

Originality/value: The uniqueness of the proposed article is demonstrated by the use of panel data and panel estimation used to describe the above-mentioned relationships as well as a comparison of results by type of activity and country.

Keywords: insurance company, investments, Visegrad Group, investments, panel data estimation.

Category of the paper: research paper.

1. Introduction

From the point of view of the Solvency II Directive, the superior principle for the investment of assets held is a prudent investor principle, whereby insurance companies only invest in assets and instruments for which the risks can be properly identified, measured, and monitored by insurers. At the same time, entities must manage and report on these assets correctly.

The Directive establishes that all assets, including in particular those covering the minimum capital requirement and the solvency capital requirement, must be invested to guarantee the safety, quality, liquidity, and profitability of the entire portfolio. On the other hand, assets to cover technical provisions must be invested to match the nature and duration of insurance and reinsurance liabilities. In doing so, the interests of all policyholders and beneficiaries must also be taken into account, considering the disclosed objectives of the investment policy in place.

According to the European Insurance and Occupational Pensions Authority (EIOPA), when managing investment risk, an insurance company should individually develop sets of key risk indicators that are consistent with its investment risk management principles and its business strategy. When managing investment risk, an insurance company cannot limit itself to information obtained from other financial institutions, asset managers or rating agencies. First of all, the insurer is obliged to review and monitor the safety, quality, liquidity and profitability of entire investment portfolios regularly.

In conducting its investment policy, the insurance company should pay particular attention to limits of liability, including policyholder guarantees, any disclosed policy on future discretionary benefits and the reasonable expectations of policyholders, as well as the acceptable level and nature of risk;

The location and availability of assets and the regulation of the investment economy in other countries are also extremely important.

According to the current legal regulations, when investing assets covering technical provisions, an insurance entity obliged to take into account the type of business it conducts, paying particular attention to the nature and duration of its obligations under insurance or reinsurance contracts. At the same time, assets covering technical provisions for solvency purposes must be invested in accordance with the interests of policyholders, insured persons and beneficiaries of insurance contracts, while taking into account the objectives of the investment policy pursued.

The insurance company is obliged to diversify its assets in order not to lead to excessive dependence on one specific asset, issuer or group of issuers related to each other or a specific geographical area and excessive accumulation of risk in the entire portfolio. On the other hand, investments in assets issued by the same issuer or a group of related issuers must not expose a given insurance company to excessive risk concentration.

The purpose of this article is to assess the relationship between the investment activities of insurance companies and the gross premium written as well as the selected profitability and liquidity indicators. This relationship will be presented for life and non-life insurance companies separately. The research hypothesis, tested in the paper, assumes that such a relationship can be identified and that it varies according to the type of activity and depends on the country. The sample covers the financial results of insurance companies of the Visegrad Group countries from 2013 to 2020. The calculations were made in the Gretl program. The structure of the article includes a description of the idea and principles of investment, a review of previous research in this area, a description of the proposed research methodology as well as the results and conclusions obtained.

2. Literature review

In the literature, you can find many articles on dependencies in insurance companies. The more important of them are presented below.

According to D. Wieczorek-Bartczak (2017, p. 51), investment activity is such an area of the insurer's business that should be analysed in terms of the risks arising from it. According to the prudent investor principle, if an insurance company is unable to identify the risks associated with an investment, or is unable to measure or monitor those risks, it should not make such an investment.

According to Jędrzychowska and Poprawska (2008), the investment policy of insurance companies is mainly influenced by two factors: the individual investment decisions of the company, which shows itself in the appearance of the portfolio and changes in its structure as well as the market situation. M. Lament (2013) is of the opinion that the investment policy of insurance companies is to allocate assets in order to guarantee a certain rate of return on investment at an assumed level of risk that preserves the financial security of the insurance company, as well as enabling its ongoing ability to settle its liabilities. On the other hand, the objectives of an insurance company's investment policy are a consequence of the strategic objectives it pursues, the scope of its business, and the applicable legislation.

Gründl, Dong and Gal (2016) highlighted the different investment strategies of insurance companies. According to them, these strategies are primarily impacted by regulatory requirements, which can both encourage and discourage long-term investment. Another factor that influences the investment policy of insurance companies is the type of insurance offered (life, non-life). Non-life insurers prefer to maintain a high degree of liquidity in the investments they hold, as claims can occur within a short period of time (from the conclusion of the contract). Life insurance, on the other hand, is dominated by long-term, less liquid assets, where a 'buy and hold' strategy is most often applied.

The question of the substance of investment activities was also addressed by Hao, Li and Yang (2022). They stated that insurance companies are an important institutional investor playing a vital role in the sustainable development of the capital market, and national policies should properly guide their investment structure. At the same time, the supervision of insurance companies should be strengthened in order to prevent the risks associated with speculative trading.

A key tool in analysing the profitability of insurance companies' investment activities is indicator analysis. Kopczyńska (2000) believes that indicator analysis makes it possible to systematically assess the financial situation in terms of the current and forecast financial performance. On the other hand, based on her research, Mioduchowska-Jaroszewicz (2012), concluded that the financial indicators used to assess the situation of insurance companies must take into account the specifics of the insurance business. This is due to the fact that sectoral indicators used in general for all sectors can be easily manipulated, falsified or errors can be committed in relation to insurance, since the insurer's report does not include many of the items that make up the formula of the indicators (for example, sales revenues, short-term liabilities, long-term liabilities, trade receivables or trade payables). A proposal for indicators to assess the financial situation was proposed by, among others: Monkiewicz, Gąsioriewicz, Hadyniak (2000). On the other hand, recommendations in this regard are provided on an ongoing basis by the Financial Supervisory Commission. According to Janowicz-Lomott, Spigarska et al. (2020), an insurance company uses the following groups of indicators to assess its activities:

- Profitability indicators.
- Performance indicators.
- Correlation indicators.

Research that indicates the relationship between individual financial indicators has been carried out by a number of foreign researchers. For example, Aktas and Ünal (2015) studying the Turkish market found that there is a statistically significant relationship between insurance companies' performance indicators and share price. Their study covered the period from 2005Q1 to 2012Q4 and involved seven insurance companies whose shares were traded on Borsa Istanbul during the sample period.

On the other hand, Abidin and Cabanda (2011) studying non-life insurance companies in Indonesia between 2005 and 2007 found that, based on the use of DEA (Data Envelopment Analysis), large insurance companies are more efficient when compared to small ones. They also stated that there were significant relationships between net premiums (NPM) and performance, while there was no significant relationship between premiums and ROA and ROE indicators.

In the case of Bangladesh, Siddik, Hosen et al. (2022), using panel data from 2011-2019, studied the relationship between non-life insurance company insolvency and profitability. Based on the results, the insolvency of insurance companies has a noticeable negative impact on their profitability. It was also stated that there were relationships between leverage and

profitability as well as between profitability and the age of the insurance company. It was noted that insurance companies are less sensitive to market changes as they age and that inflation negatively affects profitability (a significant negative impact was found).

Panel data models were also used by Morara and Sibind (2021) when analysing insurance companies in Kenya. 37 non-life and 16 life insurance companies were analysed between 2009 and 2018 to determine what factors impact their financial performance. Based on the research carried out, it was concluded that there was a positive relationship between the size of the insurance company and the profits made. On the other hand, as in the case of Bangladesh, financial performance is negatively correlated with the age of the insurance company. It was also noted that insurance companies with a high leverage indicator perform better than those with a low indicator. Panel data and the pooled ordinary least squares, fixed effects and random effects models were used for estimation.

On the other hand, the US and UK markets were analysed by Batool and Suhi (2019). For the study, they used quarterly data from 24 insurance companies between 2007 and 2016 and panel data models. The size of the insurance firm, liquidity, leverage and asset turnover as well as factors such as GDP (Gross Domestic Product), CPI (Cost per Impression), interest rate and WTI (West Texas Intermediate) were used as explanatory variables. The selected dependent variables were ROA (Return on Assets) and ROE (Return on Equity). The authors stated that in the US, significant factors were the size of the insurance firm, liquidity, leverage, asset turnover, GDP and WTI (positive impact) and CPI and interest rate (negative impact). On the UK market statistically significant were size of the insurance firm, liquidity, GDP, CPI and WTI (positive impact) and leverage, asset turnover and interest rate (negative impact).

The literature cited above points to a research gap in the analysis of combined results for more than one country. Hence, the proposed analysis of insurance companies of the Visegrad Group countries partially fills the gap.

3. Data and methodology

The empirical analysis covers annual data on the activities of insurance companies operating in the countries of the Visegrad Group in 2013-2020. They were obtained from the Orbis database. The Gretl program was used to estimate the proposed models and calculations. The research sample covered life insurance companies and non-life insurance companies separately. The number of insurance companies in the analysed countries is shown in Table 1.

Table 1.
Number of analysed insurance companies

| Country | Life insurance | Non-life insurance |
|----------|----------------|--------------------|
| Czechia | 3 | 13 |
| Hungary | 5 | 8 |
| Poland | 11 | 9 |
| Slovakia | 2 | 1 |
| Total | 21 | 31 |

Source: own presentation based on the data from Orbis database.

The proposed panel data model, describing the level of investment in individual insurance companies, takes the form of:

$$TI_{it} = \alpha_0 + \alpha_1 GPW_{it} + \alpha_2 PAT_{it} + \alpha_3 ROE_{it} + \alpha_4 ROA_{it} + \alpha_5 SR_{it} + \xi_{it} \quad (1)$$

where the endogenous variable is the total investment TI_{it} in the insurance company i -th in the year t . All regressors were selected on the basis of the literature. In this case, they are: gross premium written (GPW), profit/loss after tax (PAT), return on equity (ROE), return on assets (ROA) and solvency ratio (SR). The variables TI , GPW and PAT used for modelling were given in Euro, while the ratios ROE , ROA and SR were expressed as percentages. Structural parameters are denoted by $\alpha_0, \alpha_1, \dots, \alpha_5$ and ξ_{it} is the error term. The proposed model has been assessed separately for life insurance companies and non-life ones. The data for each group formed an unbalanced panel. Then, applying the diagnostic tests the type of the model that the type of model that best describes the investment level of the analyzed insurance companies was selected.

4. Empirical results

In the first step of the empirical analysis, the correlations between the selected factors describing the level of investment and that level were examined. The results for life insurance companies and non-life insurance company are presented in Table 2.

Table 2.
Correlations between selected factors for analysed insurance companies

| Life insurance companies | | | | | | |
|--------------------------|----|---------|---------|---------|---------|----------|
| Variable | TI | GPW | PAT | ROE | ROA | SR |
| TI | 1 | 0.9628* | 0.9505* | 0.3342* | 0.0581 | -0.2554* |
| GPW | | 1 | 0.9557* | 0.2461* | 0.5591* | -0.0872 |
| PAT | | | 1 | 0.3064* | 0.1871* | -0.0858 |
| ROE | | | | 1 | 0.2162* | -0.1920* |
| ROA | | | | | 1 | 0.5658* |
| SR | | | | | | 1 |

Cont. table 2.

| Non-life insurance companies | | | | | | |
|------------------------------|----|---------|---------|---------|---------|----------|
| Variable | TI | GPW | PAT | ROE | ROA | SR |
| TI | 1 | 0.9057* | 0.3353* | -0.0256 | -0.1029 | -0.2550* |
| GPW | | 1 | 0.6178* | 0.0477 | 0.0587 | -0.2440* |
| PAT | | | 1 | 0.3339* | 0.4136* | -0.0412 |
| ROE | | | | 1 | 0.5093* | -0.1813* |
| ROA | | | | | 1 | 0.0449 |
| SR | | | | | | 1 |

*) statistically significant at 5% significance level.

Source: own calculation based on the data from Orbis database in Gretl program.

We can notice significant relationships between the investment level and almost all selected factors (except ROA) and between pairs of selected factors for life insurance companies. In the case of non-life insurance companies the investment level is correlated with the gross premium written, profit after tax and solvency ratio. Also, some of the pairs of variables are significantly correlated.

Then the proposed model 1 was estimated, for all companies from all selected countries of the Visegrad Group that constituted one panel. Results, presented in the Table 3, show that the fixed effects model is the one that best describes the level of investment for both, life and non-life insurance companies. The positive, significant influence for life companies have gross premium written and profit after tax. In the case of the non-life insurance only the gross premium written significantly influences the level of investment.

Table 3.

Estimates of the total investment model as well as statistics of the tests for all the companies in all countries in 2013-2020

| Variable | Life companies model | | Non-life companies model | |
|-------------------------|----------------------|---------------|--------------------------|---------------|
| | pooled model | fixed effects | pooled model | fixed effects |
| constant | 369624*** | 655554*** | -10897.5 | 51703.2*** |
| GPW | 1.7191*** | 1.2023*** | 2.2440*** | 1.4958*** |
| PAT | 8.0874*** | 3.3818*** | -5.3072*** | |
| ROE | 3282.06** | | 932.4760** | |
| ROA | 7072.64 | | -4023.87** | |
| SR | -7336.07*** | | 438.108 | |
| Joint significance test | 99.8664# | | 70.4032# | |
| Breusch-Pagan test | 112.2570# | | 138.0150# | |
| Hausman test | 41.7116# | | 177.9650# | |

*) **) (***) statistically significant at the level of 0.1, 0.05 and 0.01 respectively.

#) the null hypothesis is rejected at 0.05 significance level.

Source: own estimation using the Gretl package.

In the next step, the country effects were analysed. First, omitting the effect in Slovak companies, as they constitute the smallest number of companies in the samples, and then omitting the constant in the model. Results are given in Table 4. As we can see the life companies show the country effects, while non-life ones not. In such cases the fixed effects models showed to be more appropriate for modelling the investment level.

Table 4.

Estimates of the total investment model as well as statistics of the tests for all the companies in all countries, including country effects in 2013-2020

| Variable | Life companies model | | Non-life companies model | |
|-------------------------|----------------------|--------------|--------------------------|--------------|
| | pooled model | pooled model | pooled model | pooled model |
| constant | 405032*** | | -16448.4 | |
| GPW | 1.6871*** | 1.6871*** | 2.2629*** | 2.2629*** |
| PAT | 8.2520*** | 8.2520*** | -5.1629*** | -5.1629*** |
| ROE | 2292.80 | 2292.80 | 790.3150** | 790.3150** |
| ROA | 7078.67 | 7078.67 | -3203.34 | -3203.34 |
| SR | -7014.49** | -7014.49** | 177.635 | 177.637 |
| Czechia | 94857.4 | 499889** | 38534.5 | 22086.1 |
| Hungary | -69536.7 | 335495*** | 228.260 | -16220.1 |
| Poland | 817.127 | 405849*** | -18438.0 | -34886.4 |
| Slovakia | | 405032*** | | -16448.4 |
| Joint significance test | 119.851# | | 76.0285# | |
| Breusch-Pagan test | 117.195# | | 146.813# | |
| Hausman test | 45.7606# | | 152.816# | |

*) **) (***) statistically significant at the level of 0.1, 0.05 and 0.01 respectively.

#) the null hypothesis is rejected at 0.05 significance level.

Source: own estimation using the Gretl package.

Finally, the model was estimated for each country companies separately. Results of estimations for life companies are given in the Table 5 and for non-life insurance companies in the Table 6.

Table 5.

Estimates of the total investment model as well as statistics of the tests for life insurance companies from countries separately in 2013-2020

| Variable | Czechia | Hungary | Poland | Slovakia |
|-------------------------|--------------|--------------|---------------|---------------|
| | pooled model | pooled model | fixed effects | fixed effects |
| constant | -43563.9 | 33936.4 | 1279630*** | 450610*** |
| GPW | 5.2250*** | 3.2255*** | 0.8187*** | 1.7087** |
| PAT | | 45.7089*** | 3.0172*** | 32.0585* |
| ROE | | -8941.70** | 15500.7* | |
| ROA | 1714.18*** | | -102239* | -175997** |
| SR | 27314.4** | | -16095.9* | |
| Joint significance test | | | 84.8216# | |
| Breusch-Pagan test | | | 28.3159# | |
| Hausman test | | | 74.4752# | |

*) **) (***) statistically significant at the level of 0.1, 0.05 and 0.01 respectively.

#) the null hypothesis is rejected at 0.05 significance level.

Source: own estimation using the Gretl package.

Table 6.

Estimates of the total investment model as well as statistics of the tests for non-life insurance companies from countries separately in 2013-2020

| Variable | Czechia | Hungary | Poland | Slovakia ¹ |
|-------------------------|---------------|---------------|---------------|-----------------------|
| | fixed effects | fixed effects | fixed effects | fixed effects |
| constant | 88163.9*** | -5002.95 | 135593*** | |
| GPW | 0.9858*** | 1.2263*** | 0.9027*** | |
| PAT | -0.2342*** | | 5.2151*** | |
| ROE | | | | |
| ROA | | -578.744*** | | |
| SR | | 193.812** | | |
| Joint significance test | 634.007# | 9.9315# | 4.7962# | |
| Breusch-Pagan test | | 24.6010# | 1.4708 | |
| Hausman test | 9094.88# | 9.5789# | 28.4601# | |

*) **) (***) statistically significant at the level of 0.1, 0.05 and 0.01 respectively.

#) the null hypothesis is rejected at 0.05 significance level.

¹) for Slovakia only one company was analysed that caused not enough degree of freedom to estimate the model.

Source: own estimation using the Gretl package.

As we can see for companies of all countries the gross premium written is the significant factor that influence the investment. Such relationship is positive. You can also see the influence of different factors in different countries. Diagnostic tests allowed for the selection of appropriate models. Usually, as the most relevant one, turned out to be the fixed effect model.

5. Conclusions

The analysis carried out has shown that it is possible to identify factors influencing the level of investment by insurance companies. They are different for life insurance companies and non-life insurance companies. Taking the performance of insurance companies together, it can be seen that the investment level of life insurance companies is mainly influenced by the gross premium written and profit/loss after tax, while non-life insurance companies are only influenced by gross premium written. Fixed effects models proved to be the best. The obtained results fit into the identified research gap, i.e. they were allowed to draw conclusions regarding insurance companies of the Visegrad group.

Taking into account country specificities and selecting the best of the estimated models, country effects were also noted. The common factor having a significant impact on the level of investment was again found to be the gross premiums written. This means that the higher the premium, the higher the level of investment for each type of insurance and in each of the countries analysed. Profit/loss after tax significantly affects the investment levels of life insurance companies in Hungary, Poland and Slovakia. On the other hand property insurance: for companies in Czechia and Poland. ROE proved to be significant only for life insurance companies in Hungary and Poland. On the other hand, ROA significantly influences the investment level of life insurance companies in Czechia, Poland and Slovakia, while for non-

life insurance companies only for Hungarian companies. When it comes to the last factor, namely the solvency indicator, it was noted to be significant for Czech and Polish insurers, while for non-life insurers only for Hungary. It can therefore be concluded that the research hypothesis established in the introduction has been confirmed. Furthermore, the results obtained confirm the conclusions of other authors of research carried out in other markets, cited earlier in this article. The article's contribution to the development of science also results from the use of panel data and panel estimations used to describe the financial dependencies of insurance companies, as well as the comparison of results by type of activity of these companies and the country of operation.

The conclusions from the audit may be used to make economic decisions for the stakeholders of insurance companies and supervisory authorities in order to assess the activities of the audited entities.

The analyses carried out can contribute to improving the efficiency of insurance companies and provide managers with useful information for making investment-related decisions.

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SUPPORT SYSTEM OF MOUNTAIN TRAVELS FOR PEOPLE WITH DISABILITIES

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Purpose: The aim of the study is to increase the availability of the tourist offer in non-urbanized areas, including mountain tourist trails, for people with special needs resulting from the lack of full fitness.

Design/methodology/approach: Creating an integrated platform for planning, organization, supervision and support for the availability of the mountain travel offer for people with difficulties in physical functioning and a specialized off-road wheelchair for the implementation of the tourist offer

Findings: The development of a specialized off-road wheelchair for people with disabilities together with an IT support system for planning, navigation, and communication with the system operator and emergency services will increase the accessibility of non-urbanized areas, including tourist trails, for people with special needs.

Social implications: For people with disabilities, the proposed solution is to improve the quality of life, enable rehabilitation in a natural environment in a non-urbanized conditions, and the possibility of mountain tourism, and travel in green areas. A sense of contentment and satisfaction in active rehabilitation and integration in society.

Originality/value: The proposed solution for an integrated support system for people with disabilities based on the development of a specialized off-road wheelchair equipped with on-board computer with the functions of planning and navigating on routes, communication and calling for help in unplanned emergency situations. The paper is addressed to people with disabilities, organizations dealing with such people, decision makers in the field of investment planning and financing of such projects, research and development centers in construction of vehicles and IT systems.

Keywords: transport accessibility, disabled people, all-terrain wheelchair, non-urbanized areas, tourist routes.

Category of the paper: Research paper.

1. Introduction

Transport accessibility is one of the key aspects of human perception of the environment (Freiria et al., 2022) or (Ravensbergen et al., 2022). Nowadays, transport accessibility is the main product of the transport system, which determines the advantage of the location of a given area (region, city, or route) in relation to other areas. Transport accessibility affects the influx of both people and capital. The greater the availability, the better the potential conditions for demographic and economic development. It is one of the main factors in transport planning. It is directly related to the ease of reaching a specific goal (Kokhan et al., 2022).

Social exclusion in transport is the second most important mobility problem, along with accessibility to transport. Mobility is one of the main dimensions of social exclusion. Cox and Bartle (2020) as well as Priestley et al. (2016) show that insufficient access to transport prevents the society from fully meeting its social needs. Ensuring accessibility requires taking into account the needs of people with disabilities at the stage of planning and designing infrastructure or organizing other spheres of human activity, such as culture or travel. Making life easier for all members of society, including people with disabilities, avoids exclusion and gives equal opportunities to take advantage of these spheres.

The European Union estimates that people with disabilities may constitute more than 80 million inhabitants of the EU, of which 46 million are women. Every fourth European has a family member with a disability. The population of the European Union is aging, and as a result, there will be more people with disabilities. According to the World Health Organization, disability affects more women, who are particularly vulnerable to it due to their longer life expectancy. According to the European Health Survey, Poland may be inhabited by 4.9 million to even 7.7 million people with disabilities depending on the adopted criterion, which is the so-called biological disability, i.e., a declaration of a given person regarding the limited ability to perform activities due to health problems (European Disability Strategy 2010-2020).

It is estimated that up to 30% of the society may have permanent or temporary limitations in mobility or perception, with manual and cognitive difficulties, the elderly, physically weaker, and having difficulty moving. Polish society is changing - it is getting older. Currently, almost 9 million people over 60 live in Poland. According to forecasts, in 2030 there will be 10.7 million of them and they will constitute nearly 30% of the population (Accessibility Plus call, 2022).

Jaroš (2022), Kenyon et al. (2002), Mackett and Thoreau (2015) analyzed the aspect of social exclusion is extremely important within the framework of sustainable development policy. People with motor disabilities are now largely socially excluded from communicating with nature on tourist routes. With regard to the project in question, it should be noted that there are shortcomings in the adaptation of tourist routes and the insufficient accessibility to properly

prepared prams, which, in a safe and easy-to-use manner, could level the chances of travel for people with mobility disabilities (Mattioli, 2014). At the same time, the carts available on the market are not available to everyone due to their high price. Therefore, the idea of the project is not only to prepare the right application and improvements to trolleys, but also to launch the entire logistics base, including trolley rentals. In this way, the financial barrier to using travel will also be removed (Preston, Rajé, 2007).

Rational improvements, including compensation and assistive technologies, will be the main task of the project. This is a direct removal of barriers and, most importantly, facilitating independent living and participation in social life. Due to the universal and modular design, which enables the replacement of the electrically assisted manual drive part with an electric one controlled by a manipulator, the target group can be defined as broadly as possible. People with difficulties in moving in flat terrain will be able to use hiking trails with inclinations, uneven surfaces, insufficiently legible markings, etc. It can therefore be indicated that the beneficiaries of such a solution will be people moving with the help of assistive equipment, such as crutches, canes, walkers, prostheses, wheelchairs, but also people with hearing impairment, manual and cognitive difficulties (e.g. after a stroke, suffering from Alzheimer's disease), pregnant women, and physically weaker, e.g. the elderly and experiencing difficulties in moving (e.g. as a result of an injury or illness). Therefore, the solutions proposed in the project will be addressed not only to people with the status of a disabled person, but also to people for whom it is very difficult to move around or orient themselves in the field. Both the infrastructure and the means of transport should take into account the social needs and the amateur nature of people who will design and built vehicles. It should be remembered that people with disabilities and seniors constitute a significant part of society (Siebert, 2012; Hill et al., 2014; Cavallone et al., 2022; Goodlin et al., 2022).

The paper presents the objectives and the results planned to be achieved from the project “Integrated platform for planning, organization, supervision and support for the availability of the mountain travel offer for people with difficulties in physical functioning and a specialized off-road vehicle for the implementation of the tourist offer – Mountains Without Barriers”. The idea of project in schematic form is presented in the figure 1.

2. Project assumptions

The main assumption of the project is to develop an integrated IT system, mobile solutions, and wheelchair construction elements that meet the expectations and requirements of people with functional physical and cognitive difficulties, for whom the implementation of mountain travel is currently significantly difficult or even impossible. The experiences of people with disabilities and their assistants to people who support them (guardians) create assumptions and

guidelines that should be met by the solutions being developed. In addition, the beneficiaries of the project results will be directly people with special needs resulting from a lack of full fitness. Thus, the creation of construction and technological solutions increasing the accessibility of the tourist and cultural offer (including access to national parks, nature reserves, nature monuments or historic buildings) in public space in a non-urbanized environment resulted in the involvement of an entity associating people with special needs, the Borderland without barriers foundation. It is to constitute a consultative body in the field of construction and technological solutions implemented and to engage in work in the field of acquiring knowledge and exchanging experiences about the area of mountain travel for the disabled. In addition, it will allow for the implementation of functional tests of the developed solutions from the perspective of people with special needs resulting from the lack of full efficiency.

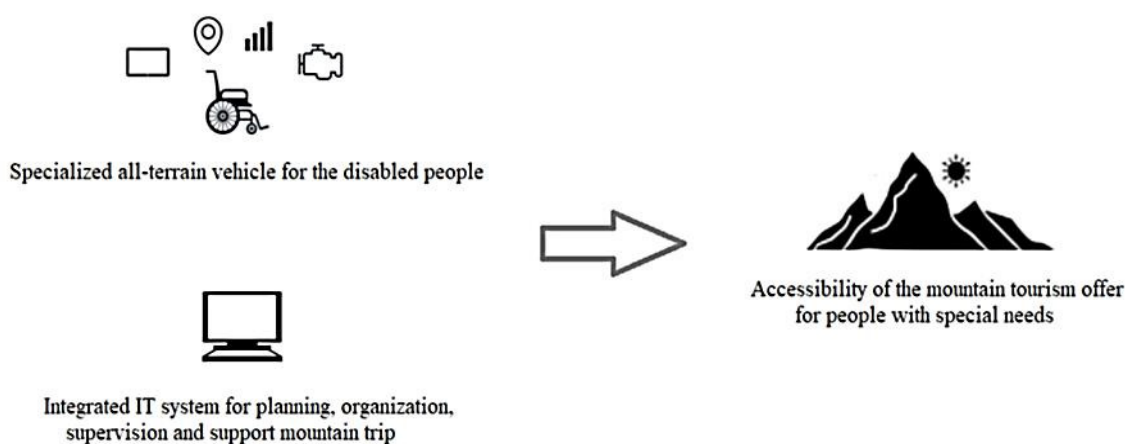


Figure 1. Idea of the implemented Mountains without barriers project.

Source: Own work.

Another assumption of the project is to ensure the safety of mountain travel for people, including people with disabilities, with the use of solutions developed in the construction of wheelchairs and designated routes on hiking trails or forest roads. As part of the wheelchair modification of the structure for mountain travel, it is required to implement technical solutions that facilitate the control of the wheelchair, such as the uphill start assistant and the downhill assistant preventing the vehicle from accelerating above the set descent speed. In addition, the applied additional electronic modules allow the assessment of the position of the trolley and information for the driver or the reaction of the drive unit to a possible loss of stability in terms of movement on / from the hill. The aspect of maintaining the safety of mountain travel also applies to the stage of determining routes for the implementation of the trip, as well as the stage of navigation on it. Thus, parameterization of the course of tourist routes and forest roads is required to determine the route sections in the routing algorithm that meet, among others, conditions of permissible inclinations for journeys with the developed specialist wheelchair. The assumptions of the project assumed the necessity to parameterize selected popular tourist routes and forest roads in order to determine the parameters of the route's inclination, its gauge, evenness and type of surface, as well as possible restrictions on the accessibility of the route.

In order to increase the accessibility of mountain travel and to support people with reduced physical fitness, rehabilitation in a non-urbanized environment surrounded by nature, the assumption was made to support the traveler through the use of a pro-ecological drive unit powered by electricity. However, it is to be a kind of boost in propelling the wheelchair in terms of the route, forcing the disabled person to perform rehabilitation exercises through the work of the upper or lower extremities. In other words, it is the possibility of active rehabilitation in fresh air, surrounded by nature.

Another assumption of the project is the creation of the idea of creating mobile rental of specialized wheelchairs that allow the implementation of mountain travel on the basis of rental with support for the implementation of the route without incurring the costs of purchasing a specialized wheelchair. The possibility of using the developed solutions of a specialized wheelchair and IT systems of travel support in the field of mountain travel will allow for a significant increase in the accessibility of the tourist offer, and thus the accessibility of disabled people to areas of the non-urbanized environment, the natural environment. An example of the concept of mobile rental companies according to the Borderland Without Barriers Foundation is presented in Figure 2.



Figure 2. An example of the concept of mobile rentals.

Source: Adopted from the Borderland Without Barriers Foundation.

In addition, it was assumed that in the implementation of the integrated IT system for planning, organization, supervision, and support of mountain trips carried out by people with functional, physical, and cognitive difficulties, open data sources such as Open Street Map, State Forest Data Bank and algorithms based on Open Trip Planner will be used. The mobile tool will run on the open Android operating system. The developed results of assisting solutions and modern methods of user interaction with the device and interface will refer to the Guidelines for the accessibility of websites, in terms of equal opportunities and nondiscrimination, including accessibility for people with disabilities.

3. Expected results

The expected result of the project is the development of an integrated system of planning, organization, supervision, and support for the implementation of the mountain travel offer by people with special needs resulting from the lack of full fitness. The integrated support system uses electronic and information technologies, mobile tools, and design solutions to modify existing wheelchairs, including adapting the drive system to conditions in non-urbanized areas.

The expected result of the project in the form of a full support system for mountain travel for people with functional, physical, and cognitive difficulties includes the following functionalities:

- Planning routes on hiking trails and forest roads.
- Online visualization of realized displacements.
- Navigation on the route being carried out.
- Generating voice messages.
- Monitoring the parameters of the wheelchair's operation.
- Tracking the position, speed, and location of the wheelchair.
- SOS Help calls for people with disabilities.
- Adaptation of the wheelchair structure for the disabled.
- Equipping the wheelchair with replacement power sources.
- Steering a wheelchair with a joystick.

Planning of mountain routes requires the development of a multimedia travel planner tool in the project that allows for the designation of a route along the existing tourist routes, forest roads, and public roads by indicating the starting point (the starting point for the implementation of the mountain travel offer), the destination point (the end of the trip), and intermediate points. Their indication by the user of the planner or the operator of the mobile system of specialized wheelchair rentals will allow one to define the location of service points for the disabled in order to support the basic life functions and to replace or recharge the power source of the wheelchair drive unit. A key element in planning a mountain trip is the necessity to designate a route taking into account the possibility of traveling along forest roads (due to forestry works, some sections may be closed), the altitude profiles of hiking trails or forest roads. Thus, as part of the development and implementation of route search criteria, in addition to the common search criteria, the fastest route or the shortest route, a route planning criterion will be introduced to minimize changes in the altitude profile and the possibility of taking into account the need to recharge or replace the power source of the drive unit at defined service points in mountain areas.

An example of planning routes on tourist routes in the mapa-turystyczna.pl planner is shown in Figure 3. The place where the trip starts – PTTK shelter in the Hala Lipowska, the place where the trip ends – PTTK shelter in the Hala Miziowa, the route through Hala Rysianka, Trzy Kopce, Hala Cebulowa.

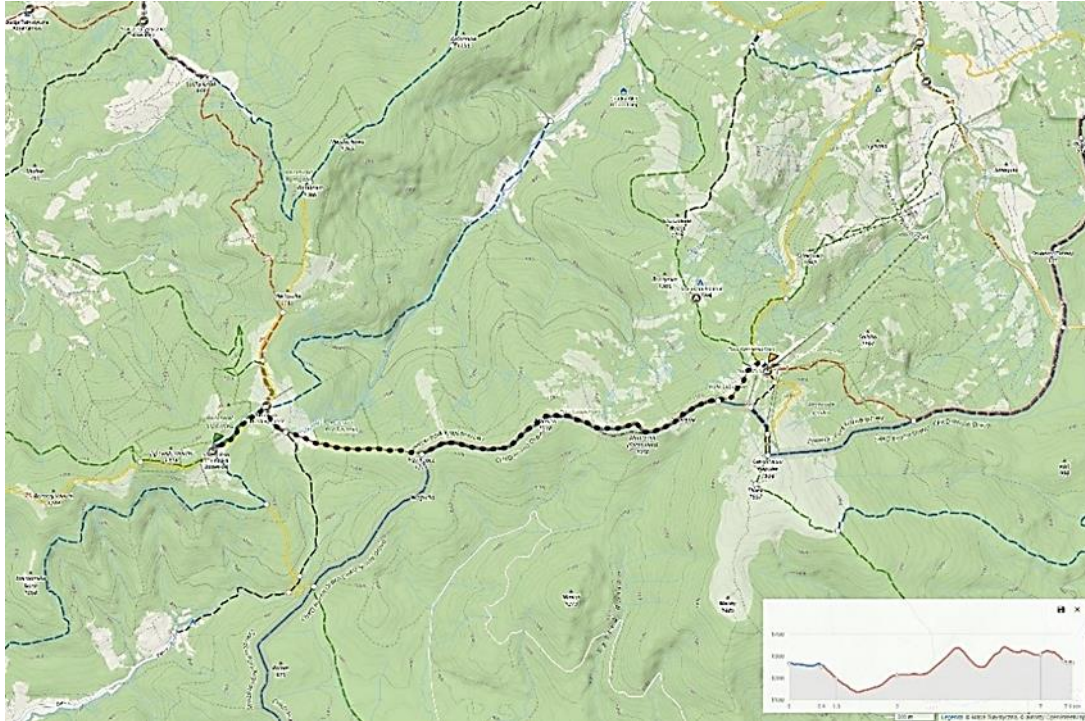


Figure 3. An example of route planning using the mapa-turystyczna.pl planner.

Source: Own work.

Online visualization of realized movements requires the development of a graphic visualization tool for the location of people implementing mountain travel offers, indicating the parameters of the trip, its duration, energy consumption (battery charge status), the envisaged further route, its course and duration. The visualization tool will allow economic entities providing mountain travel offers to monitor the location of rented wheelchairs and, moreover, to provide information about the routes to be provided to emergency services, including the Tatra Volunteer Rescue Service and the Volunteer Mountain Rescue Service. The archiving of the routes implemented and then the analysis in terms of the use of the mobile system of specialized wheelchair mileage rentals, will allow further increasing the availability of tourist offers in individual mountain areas, where the conditions will allow for travel by people with special needs resulting from the lack of full fitness.

Navigating the route in mountainous areas requires the development of a mobile device that allows people to navigate using specialized wheelchairs. The developed solution mounted on the trolley structure will be based on the Raspberry Pi platform and will ensure communication using cellular data transmission (modem). In addition, the developed mobile device will be equipped with a GPS receiver to determine the location, and the control and control of the device will be carried out by handling the graphic interface of the touch display and voice

messages sent by people using the device. The functionality of navigating due to people with functional physical and cognitive difficulties requires the design and implementation of an application interface, related to WCAG 2.1 according to the principles of perceivability, functionality, comprehensibility, and compatibility.

The delivery of messages for disabled vehicle users requires the development of additional mobile device functionality in the project, allowing for the sending of additional information on the implementation of routes in the form of messages, e.g., about the closure of hiking trails or forest roads, the current weather situation, the possibility of sudden weather phenomena or rules of behavior in certain situations. In addition, it can provide wheelchair users with information about current places where they are located, among others. entrances to national parks, nature reserves in the vicinity of natural monuments, historic buildings, or viewpoints. The presentation of the message will take place on the display of the mobile device and through voice information. The possibility of transmitting messages to pram users in mountain areas will be available to the economic entity responsible for the organization of the mountain travel offer, as well as the TOPR and GOPR rescue services.

Monitoring the operating parameters of a wheelchair (a vehicle for the disabled) in terms of the drive system will allow planning or identification of the need to replace the power source (battery) or recharge it during the trip. The electronic system performing the monitoring functions will be a mobile device mounted on the trolley structure and equipped with an additional module for estimating the energy consumption (mobile electricity meter). Information on the available energy for the propulsion unit allows for securing the route implementation, thus reaching the destination of the journey, or the need to provide recharging on the route by replacing the power source (battery). Providing the required level of electricity for the wheelchair drive unit is crucial for the safety of people with limited physical and cognitive functionality, especially in non-urbanized areas, including hiking trails and forest roads.

Tracking the location, speed, and location of the wheelchair will ensure the safety of disabled people using the mountain travel offer. The additional MEMS modules implemented in the trolley structure allow for the assessment of the trolley's position (possibility of overturning), and with the use of a mobile device, they will transmit a message to the driver or force the drive unit to react (emergency stop) to a possible loss of stability in terms of moving uphill and in the opposite direction. In addition, the use of electronic control of the trolley's braking system will allow you to perform the functions of hill start assistant and hill descent assistant. Also, it will prevent acceleration of the trolley above the set descent speed. For people with limited physical and cognitive functionality, it is crucial to develop solutions that allow them to ensure travel comfort and safety while implementing the mountain travel offer.

SOS help calls for people with disabilities required to develop a mobile device in the design that allows for an independent (voice) call for help from a person with functional physical and cognitive difficulties implementing the mountain travel offer and an automatic call for help through the mobile application due to the lack of contact with a disabled person (no response to voice or graphic messages) or overturning the wheelchair based on the signals sent from the MEMS modules installed in the wheelchair structure. The automatic SOS emergency message will provide information on the type of event, time of its occurrence, and location in the form of geographic coordinates. Information will be provided directly to the economic entity responsible for organizing the mountain travel offer, as to well as the TOPR and GOPR emergency services.

Adaptation of the wheelchair structure for people with disabilities (with varying degrees of limitation in physical and cognitive functioning) requires the development of a modular structure in the project that allows for a simple and quick change of modules that perform driving functions, control the direction of movement, type of seat, and secure a person traveling in a wheelchair. For people with special needs, including individual needs, resulting from a lack of full fitness, the key is to adapt the construction of specialized wheel-chairs, allowing them to ensure the safety and comfort of travel during the implementation of the mountain travel offer. Adapting the vehicle to people who are just starting their adventure with mountain travel. The current constructions are dedicated to people who lead a sports lifestyle.

As part of the implementation of the first research task in the Mountains Without Barriers project, incl. specifying the requirements for the solutions created together with the "Borderland without barriers" foundation and in the presence of GOPR assistance, tests of the existing vehicle for disabled people owned by the above mentioned foundation were carried out by Hala Lipowska, Hala Rysianka, Trzy Kopce, Hala Cebulowa, Hala Miziowa are shown in Figure 4.

Controlling the wheelchair with the use of a joystick requires the development of a manipulator module in the design that allows to control the movement of the wheelchair by the movement of the hand of the person on the wheelchair. However, this requires the introduction of an additional system for independent control of the drive wheels. However, this solution prevents the interaction of the electric drive unit and drive modules using human muscle force.



Figure 4. Tests of a three-wheeled vehicle for disabled people on the route at 23-24 July 2022.

Source: Own photo.

Equipping a wheelchair with replacement power sources requires the development of an intuitive and easy-to-use system for replacing the power source of the drive unit (battery) and the possibility of connecting a charger powered from the power grid as well as charging with the use of alternative energy sources, photovoltaic panels. An intuitive and easy-to-use system for people with limited physical and cognitive functionality is crucial when implementing the mountain travel offer.

Additional system functionalities required to be developed in the project include: support in the organization of the mountain travel offer for specialist wheelchair rentals and the possibility of specifying requirements for the designation of hiking trails and forest roads as well as the construction of specialized wheelchairs for travel in non-urbanized areas.

4. Conclusions

The expected result of the project will be to increase the accessibility of the tourist offer in non-urbanized areas for people with special needs, including individual ones, resulting from the lack of full fitness. The results will be achieved through the development, implementation, and verification of solutions aimed at changing the approach to mountain travel as a field of travel intended only for people with full fitness towards people who require additional support in its implementation. Using innovative technical solutions, including route planning systems, its visualization, navigation, communication, and monitoring that support mountain travel, it is possible to improve the comfort of movement of people with special needs.

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HOW THE TYPE OF PUBLIC BENEFIT WORK IN NONPROFIT ORGANIZATIONS INFLUENCES SOCIAL MEDIA PRESENCE: AN EXAMPLE FROM FACEBOOK

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Purpose: The main objective of the study was to identify those nonprofit organizations that were characterized by the highest Facebook publication frequency, the highest number of Facebook followers and the highest average public reaction to the Facebook content.

Design/methodology/approach: Content analysis was used to accomplish the research objectives.

Findings: The results of the study clearly indicated that the nonprofit organizations with the most effective use of Facebook are those operating in the areas related to ecology, animal protection and protection of natural heritage.

Research limitations/implications: There is a need for research on the basis of which it will be possible to find out whether, in fact, the high interest in organizations related to ecology, animal protection and protection of natural heritage and their Facebook profile has a psychological basis.

Practical implications: The results of the research can be an important source of information for executives of nonprofit organizations in the utilization of social media in their day-to-day operations.

Originality/value: This paper expands the knowledge of Facebook utilization in a specific group of Polish nonprofit organizations, i.e. those with the status of public benefit organizations.

Keywords: social media, Facebook, nonprofit organizations, ecology and animal protection organizations.

Category of the paper: Research paper.

1. Introduction

Social media has become an indispensable part of our lives, shaping our communication, information sharing, and social interactions. It provides organizations with an opportunity to reach and engage with their target public in ways that were once unimaginable. Nonprofits, in particular, have found social media to be a powerful tool in disseminating their message,

building brand awareness, and encouraging donations. One of the key benefits of social media for nonprofits is that it allows organizations to reach a wider public at a lower cost. Traditional advertising and marketing tools can be expensive, limiting the ability of nonprofits to maximize their outreach efforts. Social media, on the other hand, provides a platform for organizations to share their message with thousands or even millions of people with a single post. Nonprofits also leverage social media to build engagement with their public. By creating and sharing content that resonates with their audience, nonprofits create a sense of community and connect with potential donors at an emotional level. By fostering dialogues and discussions around the issues that they support, nonprofits can initiate conversations that can inspire social change. Moreover, social media provides an avenue for fundraising. Using crowdfunding platforms and accepting donations online, nonprofits can collect small donations, which can add up to substantial amounts. Social media also provides a medium for direct communication between nonprofits and donors, increasing transparency and accountability. However, social media does pose some challenges for nonprofits. The rapidly changing nature of social media and the need to constantly generate content can be time-consuming and demanding. With the diversity of social media platforms and their differing public audiences, nonprofits also face the challenge of creating content that resonates across several platforms. The need to measure the effectiveness of social media strategies can also be a challenge for nonprofits that work with limited resources. Considering the role that social media sites can potentially play in the activities of nonprofit organizations, undertaking research in this area becomes particularly relevant. This paper is an attempt to expand the knowledge of their utilization in a specific group of Polish nonprofit organizations, i.e. those with the status of public benefit organizations. This status gives these organizations the opportunity to receive 1.5% of income tax from individuals who in their annual tax return indicate to which specific public benefit organization they wish to donate their share of tax. Due to the dispersed nature of potential contributors covering basically the entire country, organizations of this type should employ all available communication channels in their activities to promote their ideas and values. Social media sites, especially Facebook, by far the most popular in Poland, seem with their features to be particularly well predisposed to do so (As of December 2022, there were 24,201,800 active Facebook users in Poland, which translates into 64.1% of the country's total population, data source <https://napoleoncat.com/stats/>).

2. Literature review

Even a quick glance at the public relations literature makes it easy to identify two dominant themes in the organizational utilization of social media, these are presence and engagement (cf. Campbell, Lambright, 2019). This paper focuses on both of them, attempting to answer the

question of whether the type of public benefit work can affect more effective utilization of a Facebook social media site. Presence is related to publication activity, which means that the public, through content, can interact with a specific organization on an ongoing basis. Engagement, on the other hand, functions as both a state and a process. Engagement as a state refers to an individual's psychological and emotional connection to an object or activity, such as a product, brand, or organization. In this sense, engagement is a subjective experience that reflects the degree to which an individual is invested in or committed to the object or activity. Engagement as a process refers to the ongoing and dynamic interactions between an individual and an object or activity. In this sense, engagement is not just a static state but a continuous process of interaction, feedback, and adaptation (Johnston, Taylor, 2018).

This research is built upon the theoretical foundation provided by Lovejoy and Saxton's (2012) hierarchy of engagement. Hierarchy of engagement is a framework that outlines the various levels of engagement that individuals can have with a brand or organization. The hierarchy is comprised of three levels, each representing a different degree of engagement. The first one is providing information, followed by building community, with requesting specific action as the highest level of engagement. It was based on research conducted in a group of major U.S. nonprofit organizations. At the lowest level, the process of "engaging" the public takes place through the dissemination of posts, which primarily perform an informative function. A number of research results conducted especially in English-speaking countries has indicated that social media content performs just such a function (cf. Guo, Saxton, 2014; Huang et al., 2016; Van Wissen, Wonneberger, 2017; Bellucci, Manetti, 2017; Hellsten et al., 2019, Tao et al., 2021). The lowest level in the hierarchy of engagement means, from the organizational point of view, primarily placing emphasis on a sufficiently high publishing frequency rate, which will be the initial stage in the process of "engaging" the recipient of the message. In addition, it provides an opportunity to create a correspondingly large base of so-called "followers," i.e. people or entities that observe a particular Facebook profile. At the second level, nonprofit organizations harness the interactivity feature of social media, and by encouraging a two-way communication, they create the foundations of a "community" gathered around its mission. In this case, the social media content is intended to encourage their members of the public to react, which, in the case of Facebook, may include liking a post, sharing it, or commenting on it. The third, and highest level in the hierarchy of engagement, involves making efforts through social media sites that will result in the recipient of the content taking specific actions in favor of the organization, such as attending events or making a donation. Overall, the Lovejoy and Saxton hierarchy of engagement provides a useful framework for understanding the different levels of engagement that individuals can have with a brand or organization. By understanding these levels, organizations can better tailor their public relations strategies to build strong, long-lasting relationships with their public audience. In this study, relying on these premises made it possible to place organizations at a specific level in the hierarchy of engagement, taking as an assessment parameter the type of public benefit work.

In the scholarly literature, the impact of the type of nonprofit organization activity on its social media utilization has been studied only to a limited extent. In general, the research focused on three dimensions of social media presence: adoption, activity and visibility. In the case of the adoption dimension, those features of the organization were scrutinized that may have been firstly relevant in the very selection process of a particular social media site for building interactions with the public, and secondly, the impact of those features on publication frequency rate in the already selected channel were also scrutinized. A wide variety of features were being selected, but were only occasionally related to the type of public benefit work. Thus, the type of features analyzed included the size of staff resources, the nature of employment (full-time vs. part-time job), the geographic location of the organization, the age of the organization's top executives, expenditures on lobbying and fundraising activities, revenues from ongoing programs, the size of the organization measured by the size of its assets, the length of time the website had been used in its activities, the reach of the website, the nature of the organization (e.g., membership, board size, organizational effectiveness); as well as dependence on donors and government authorities (cf. Nah, Saxton, 2013; Lee, 2018). The subjects of the study were primarily nonprofit organizations operating in English-speaking countries, and the main focus was on the largest ones. The scale of social media adoption in Polish nonprofit organizations depending on various organizational features was analyzed by Olinski and Szamrowski (2018). Again, these features were not related to the type of activity work. They took into account such organizational features as the level of total revenue, the revenue level from the 1% of personal income tax, the employment size, the use of volunteers and the geographic scope of activities. An examination of the sheer impact of the type of public benefit work activity on social media adoption is found in only a few studies. For example, such research was conducted by Guo and Saxton (2017). However, they focused on the organizational use of Twitter, not Facebook, and included organizations with revenue greater than \$1 million. Thus, these were primarily medium-sized and large entities. Besides, Guo and Saxton (2017) did not make comparisons across the different types of activities carried out by nonprofit organizations, and focused on just one of them, related to "Civil Rights and Advocacy." A similar situation was evident in studies conducted by Campbell and Lambright (2020), Campbell et al. (2014) and Huang et al. (2016). The former two examined the use of all social media sites in public and nonprofit human services, with the latter focused on HIV/AIDS nonprofit organizations (only the Facebook site was analyzed). Therefore, no comparisons were made between different types of public benefit work, and attention was focused on only one specific type. In addition, studies by Campbell and Lambright (2020) and Campbell et al. (2014) focused on organizations operating in a limited area of South Central New York. It is worth emphasizing, however, that in the case of these three studies, attention was also focused on smaller entities. In the case of HIV/AIDS nonprofit organizations, these were entities whose revenue exceeded only \$25,000. This is especially important because the three dimensions of social media presence: adoption, activity, and visibility have rarely been examined in the case

of such small entities. Most often, larger entities, especially those in the top 100 nonprofit organizations, have been examined (cf. Lovejoy et al., 2012; Nah, Saxton, 2013; Saxton, Waters, 2014; Maxwell, Carboni, 2016). To summarize, the scholarly literature, especially the domestic research, lacks studies that address the issue of determining the impact of the type of public benefit work on the process of "engaging" the audience through the content of the social media sites. This article aims to at least partially fill this gap.

3. Methods

Purpose of the study

The main objective of the study was to identify those nonprofit organizations that were characterized by:

- The highest Facebook publication frequency.
- The highest number of Facebook followers.
- The highest average public reaction to the Facebook content.

The research sample included a specific group of nonprofit organizations, i.e. only those that had the status of public benefit organizations, primarily due to the fact of their key importance within Polish nonprofit organizations, as well as for reasons related to their open reporting, which allowed access to research-relevant data.

Research sample selection process

The research sample selection process was a multi-stage process. The first stage identified those nonprofit organizations that were eligible to receive 1% personal income tax in 2020. The database from the National Freedom Institute's website was used for this purpose. As of December 8, 2021, it consisted of 8833 nonprofit organizations with Public Benefit Organization (PBO) status. In the case of organizations whose annual revenue did not exceed PLN 100,000, the range of data available in the database was somewhat more modest than those with revenue above that amount. Already at the outset, it was necessary to exclude 241 organizations from the analysis, as they had not included their annual financial and substantive report in the database or had begun the process of closing down their operations. Thus, further research covered 8592 organizations. The following data were extracted from the database, among others: total revenue, revenue from unpaid and paid public benefit activities, revenue from business activities, revenue received from the 1.5% personal income tax, and sources of revenue broken down into those of a private and those of a public nature.

The second stage of the research process analyzed the extent to which Polish Public Benefit Organizations utilize social media. First, it was verified whether each organization had its own website. In most cases, organizations included a link to their own website in the annual report. When absent, a Google search engine was used to find the website. Next, each organization's website was examined to see if it had a forward button to social media sites (the button was clicked, checking if it actually redirected to a specific site). It also took into account the fact that some organizations did not have their own website and instead used only social network sites. Facebook was the most popular social network site used by Polish Public Benefit Organizations. More than 60% of Polish public benefit organizations had their own Facebook profile (N = 5184). The second most frequently used site was YouTube, although by only 8% of organizations. Such a large disproportion meant that further research focused solely on the organizational use of Facebook.

In the next stage, public benefit organizations were divided into four clusters, taking the value of total annual revenue as the criterion for division. Thus, 136 organizations with revenue greater than PLN 10 million (group 1), 1047 organizations with revenue between PLN 1 million and PLN 10 million (group 2), 2073 organizations with revenue between PLN 100 thousand and PLN 1 million (group 3) and 1927 organizations with revenue less than PLN 100 thousand (group 4) were categorized. The minimum sample size for a finite population totaled 1025 entities (100 from the first cluster, 281 from the second, 324 from the third and 320 from the fourth, confidence level = 0.95, maximum error of 0.05). The selection of public benefit organizations from each stratum was conducted with the use of the Research Randomizer algorithm.

In the fourth stage of the research, a post database was compiled, consisting of all organizational content published on Facebook in the months of February 2020 and 2021. It should be noted that February 2020 is the time before the outbreak of the COVID-19 pandemic in Poland, during which the activities of Polish public benefit organizations were not yet restricted to any extent. February 2021, on the other hand, was the time of lockdown, which involved significant restrictions on their day-to-day operations. The restrictions, however, applied only to the offline environment, so their impact on the organizational activities of the Facebook profile was not considerable. Both in 2020 and 2021 posts from the same organizations were examined. The analysis included the basic features of the organization's Facebook profile, i.e. the number of followers, the publication frequency, and also the audience reaction to a single post (audience response was measured by the number of likes, shares and comments). Due to the inability to compare organizational utilization of Facebook in 2020 and 2021, 52 organizations (5.07%) were excluded from further study. The reason for this varied and was related to the organization losing its PBO status, deleting its organizational Facebook profile, setting up a new Facebook profile between 2020 and 2021, or beginning the process of winding down its business.

Analysis of the Facebook profile allowed the identification of organizations that were particularly active in terms of the content publishing frequency with simultaneously high public engagement and a significant number of Facebook followers. They represented a group of entities whose statutory activities were related to ecology, animal protection and the protection of natural heritage (Article 4, item 18 of the Act of April 24, 2003 on public benefit activity and volunteerism). In the final stage of the study, organizations within this group were submitted for further analysis. The data from a Microsoft Excel spreadsheet was transferred to Statistical Package for the Social Sciences (SPSS), where it was checked for accuracy and completeness. Then, the SPSS program was used to carry out a statistical analysis. The following statistical procedures were used: analysis based on standard parameters and the study of the dependence of selected variables (Kruskal-Wallis tests). The classic p value <0.05 was adopted as the significance level in the analyses. A total of 52 organizations were included in the research sample, 7 large entities (annual revenue greater than PLN 10 million, e.g., *Międzynarodowy Ruch Na Rzecz Zwierząt – Viva*), 11 medium ones (revenue between PLN 1 million and PLN 10 million, e.g., *Ogólnopolskie Towarzystwo Ochrony Ptaków*), 16 small ones (revenue between PLN 100 thousand and PLN 1 million, e.g., "Aurea" Golden Retriever Foundation) and 18 smallest ones (annual revenue less than PLN 100 thousand, e.g., *Ratujemy Dogi*).

4. Results

Type of public benefit work and Facebook frequency publication rate

The results indicate that the most active organizations in terms of publication frequency were not those whose primary activities were related to ecology, animal protection and the protection of natural heritage, but those whose main area of activity was intertwined with providing aid dedicated to Poles and the Polish community abroad (table 1). Despite this fact, they were not included in further in-depth analysis. This was due to the following two factors. First, the research sample included a total of only two entities in this category (the entire database of the National Liberty Institute included only 16 organizations engaged in this type of activity). Second, the category of average publication frequency equaling 168 posts in February 2020 and 261 posts in February 2021 was heavily skewed by just one organization, the Association *Wspólnota Polska*, which during the studied periods published 332 and 519 posts, respectively (these were record-breaking numbers among all organizations, which gives an average of 11.44 posts per day in February 2020 and 18.53 in February 2021).

In regard to publication frequency, organizations whose activities were related to the broadly understood ecology category clearly outdistanced organizations operating in the other public benefit spheres. In 2021, organizations operating in the area of preserving national traditions, sustaining Polish identity and developing national, civic, and cultural awareness

published on average 12.5% fewer posts (on average 33.23 posts per month, category size - 15 organizations), organizations operating in the area of supporting national and ethnic minorities and regional languages 39.8% less posts (category size - 8 organizations), organizations operating in the area of promoting and protecting human and civil rights and freedoms, work to support the development of democracy as much as 42.4% less (the category size also included 8 entities). The organizations most heavily represented in the study, i.e. from domains 1,6,7,14,15,17 in terms of publication frequency, at most reached 39% of the publication frequency of organizations from the domain of ecology and animal protection. Their publication activity most often oscillated around an average of 10 posts per month, almost four times less than the publication frequency of organizations operating in the field of ecology and animal protection (both in 2020 and 2021).

Table 1.

Facebook frequency publication rate and public engagement reaction rate corresponding to the type of public benefit work (February 2020 and 2021)

| Type of public benefit work* | Total number of organizations | Average frequency publication rate (posts per month) | | Average public engagement reaction rate to single post | | Average number of likes -single post | | Average number of shares - single post | | Average number of comments - single post | |
|------------------------------|-------------------------------|--|------|--|------|--------------------------------------|------|--|------|--|------|
| | | 2020 | 2021 | 2020 | 2021 | 2020 | 2021 | 2020 | 2021 | 2020 | 2021 |
| 18 | 52 | 35 | 38 | 388 | 465 | 263 | 355 | 97 | 74 | 27 | 36 |
| 1 | 102 | 11 | 10 | 58 | 66 | 43 | 45 | 12 | 17 | 3 | 4 |
| 2 | 12 | 6 | 6 | 13 | 10 | 10 | 7 | 2 | 2 | 1 | 1 |
| 3 | 61 | 11 | 11 | 65 | 62 | 42 | 38 | 20 | 18 | 3 | 6 |
| 4 | 15 | 28 | 33 | 136 | 123 | 92 | 95 | 30 | 11 | 14 | 17 |
| 5 | 8 | 14 | 23 | 31 | 27 | 20 | 22 | 5 | 4 | 6 | 1 |
| 6 | 95 | 10 | 10 | 182 | 342 | 121 | 266 | 51 | 56 | 10 | 20 |
| 7 | 147 | 9 | 10 | 36 | 40 | 27 | 26 | 7 | 11 | 1 | 3 |
| 10 | 14 | 8 | 5 | 49 | 26 | 40 | 21 | 8 | 4 | 2 | 1 |
| 11 | 1 | 3 | 0 | 20 | 0 | 16 | 0 | 4 | 0 | 0 | 0 |
| 12 | 4 | 0 | 1 | 0 | 28 | 0 | 25 | 0 | 3 | 0 | 0 |
| 13 | 15 | 9 | 7 | 17 | 12 | 13 | 8 | 4 | 3 | 1 | 1 |
| 14 | 85 | 16 | 15 | 21 | 19 | 17 | 14 | 4 | 3 | 1 | 1 |
| 15 | 76 | 8 | 9 | 27 | 26 | 23 | 23 | 3 | 2 | 1 | 2 |
| 16 | 71 | 8 | 7 | 53 | 54 | 35 | 34 | 15 | 18 | 2 | 2 |
| 17 | 123 | 14 | 12 | 38 | 36 | 33 | 31 | 2 | 2 | 2 | 3 |
| 19 | 6 | 4 | 4 | 13 | 11 | 8 | 8 | 1 | 1 | 4 | 2 |
| 20 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 8 | 22 | 22 | 286 | 216 | 242 | 186 | 28 | 15 | 15 | 16 |
| 23 | 21 | 7 | 6 | 25 | 19 | 18 | 16 | 7 | 2 | 1 | 1 |
| 24 | 2 | 7 | 5 | 144 | 90 | 87 | 70 | 55 | 16 | 2 | 4 |
| 26 | 9 | 26 | 19 | 133 | 83 | 115 | 74 | 11 | 4 | 8 | 6 |
| 27 | 5 | 12 | 8 | 12 | 10 | 9 | 7 | 2 | 2 | 1 | 1 |
| 28 | 2 | 168 | 261 | 17 | 10 | 13 | 8 | 3 | 2 | 1 | 0 |
| 31 | 12 | 5 | 14 | 18 | 27 | 13 | 16 | 4 | 5 | 1 | 6 |
| 32 | 9 | 8 | 6 | 66 | 53 | 57 | 47 | 7 | 4 | 2 | 1 |
| 33 | 15 | 13 | 12 | 23 | 44 | 18 | 27 | 3 | 10 | 2 | 7 |

*1 - social assistance, including aid offered to disadvantaged families and individuals, and ensuring equal opportunities to such families and individuals; 2 - professional and social integration and reintegration of persons threatened with social exclusion; 3 - charity work; 4 - preserving national traditions; sustaining Polish identity and developing national, civic, and cultural awareness; 5 - work to support national and ethnic minorities and regional languages; 6 - protection and promotion of health; 7 - work to support the disabled; 10 - work to support the elderly; 11 - promotion of economic growth and entrepreneurship; 12 - promotion of development of new technologies, inventions and innovation, transfer and implementation of new technologies for companies; 13 - work to support the development of local communities; 14 - science, education, coaching, and upbringing; 15 - recreation of children and youth; 16 - culture, art, protection of culture and national heritage; 17 - promoting physical culture and sports; **18 - ecology, animal protection, protection of natural heritage**; 19 - tourism and knowledge touring; 20 - public order and security; 22 - promoting and protection of human and civil rights and freedoms, work to support the development of democracy; 23 - rescue systems and protection of residents; 24 - aid to victims of calamities, natural disasters, armed conflicts and warfare – in Poland and abroad; 26 - work to support European integration, and the development of contacts and co-operation between societies; 27 - promoting and organizing volunteerism; 28 - aid extended to Poles and Polish community abroad; 31 - work to support families, promote motherhood and parenthood; promote and protect the rights of children; 32 - prevention of addictions and social pathology; 33 - work to support non-governmental organizations and entities listed in article 3, para 3 active in the areas listed in subpara 1-32.

Source: Own study.

The frequency publication rate of organizations operating in the field related to ecology, animal protection and protection of natural heritage increased by 8.8% compared to February 2020. The most significant increase was recorded for small entities (19%), with a slightly smaller increase within medium-sized entities (13%). For large entities it amounted to 7%, while in the cluster of the smallest entities, the publishing frequency activity in February 2021 was almost 21% lower compared to February 2020.

Overall, the size of the organization, measured by the level of annual revenue, only marginally affected its publication frequency rate. In February 2021, large entities published an average of 58 posts (more than two posts per day, standard deviation value – SD = 12.02), medium entities 60 posts (more than two posts per day, standard deviation value – SD = 65.12), small entities 42 posts (1.5 posts per day - less than in the case of medium and large organizations, but they were still characterized by a high publication frequency rate, standard deviation value- SD = 59.71), only the smallest entities explicitly showed less, with an average of 15 posts per month (however, compared to organizations from other public benefit work, this is still a value ranking them high in publication activity, standard deviation value – SD = 20.91). In the case of medium, small and smallest entities, the value of the standard deviation differed noticeably from the "Mean" value, taking values clearly higher than in each of these groups. This demonstrates the wide diversity in publication frequency rate within the entities in these clusters. For example, this can be seen in the group of medium-sized entities, organizations such as the *ADA Foundation*, *Krakowskie Towarzystwo Opieki nad Zwierzętami* and *Radomskie Towarzystwo Opieki nad Zwierzętami* which published 214, 119 and 82 posts in February 2021, respectively. In the case of the *ADA Foundation*, this gives an average of as many as 7.64 posts per day (the organization published a single post on average every 3 hours and 8 minutes). On the other hand, the cluster of medium-sized entities included organizations that published 6 and 9 posts in the entire month of February 2021 (*Towarzystwo Opieki Nad Zwierzętami w Polsce - Zabrze Branch* and *Tilia Association*). Their publication frequency rate

was thus noticeably lower, although it did not differ from the average values for organizations from other areas of public benefit work. A similar situation was also observed for small entities, where the publication activity of organizations such as the *Azylu Koci Świat* Foundation, surpassed even that observed for the *ADA* Foundation (228 posts in February 2021, the organization published a single post on average every 2 hours 56 minutes). A high publication frequency rate was also observed for the *Kotkowo* Foundation and the *Kocia Mama* Foundation (113 and 103 posts in February 2021, respectively). On the other hand, 4 organizations were identified whose publication activity was limited to at most 4 posts per month (1 post every 7 days). These disparities were even greater for the smallest entities, with 5 entities publishing between 26 and 59 posts in the month, 6 organizations between 4 and 8 posts, one organization 2 posts and as many as 6 organizations that did not publish any posts in February 2021. Only in the case of the largest nonprofit organizations, the value of the standard deviation (21% of the "Mean" value) proved the relatively homogeneous publication frequency rate of the organizations making up this cluster. In the month of February 2021, publication activity in this cluster ranged from 41 posts for the "WWF Poland" Foundation to 77 for the *Ogólnopolskie Towarzystwo Ochrony Zwierząt OTOZ Animals* Foundation.

Type of public benefit work and Facebook number of followers

Organizations operating in the area of ecology, animal protection and protection of natural heritage were characterized not only by a high publication frequency rate but also by a large number of followers of the Facebook profile. In this regard, these organizations ranked second among all 33 legally sanctioned spheres of public benefit work in February 2020, and third in 2021. In general, for 2020, organizations in the sphere of number 18 should rank first, as those ahead of them operating in the area were related to offering aid to victims of calamities, natural disasters, armed conflicts and warfare, in Poland and abroad (24), were very modestly represented in the research sample (only two entities, one of which, i.e., *Polska Akcja Humanitarna*, greatly skewed the average, with their number of Facebook profile followers totaling 101,274). The average number of Facebook profile followers were higher in these organizations by more than 24% compared to those in the environmental field, which may therefore be misleading. In February 2021, the exact same situation was identified, with the difference, however, that organizations from the sphere of number 18, were further overtaken by those operating in the area of promoting and protecting human and civil rights and freedoms (the Facebook number of followers were almost 5% higher, and this category includes such organizations as the *Kampania Przeciw Homofobii*, or the *Amnesty Polska* Association with more than 100 thousand Facebook followers, the *Rodzić po ludzku* Foundation with 78 thousand followers, or an organization supporting the LGBT community - *Lambda Association* - Warsaw with almost 19 thousand followers).

Both in the first and second year of the analysis, the number of followers of the Facebook profile in the group of organizations most numerous represented in the research was clearly smaller than the pro-ecological and pro-animal organizations. For instance, for organizations operating in the field of social assistance (1), the number was more than 7 times lower in both 2020 and 2021, for organizations related to supporting the disabled (7) it was 18 times lower for 2020 and as high as 19 times for 2021. Similarly large differences were observed in the case of organizations engaged in promoting physical culture and sports (more than 20 times in 2020 and 18 times in 2021). Only in the case of organizations related to the protection and promotion of health, this difference was smaller and in February 2021 it amounted to only 18.5% (the impact of such a small difference was particularly due to one organization, i.e., the *Wielka Orkiestra Świątecznej Pomocy*, with an impressive 1.5 million so-called "followers" in February 2021).

Compared to 2020, the number of Facebook followers increased in all statutorily distinguished 33 areas of public benefit work or, as in the case of organizations engaged in the promotion of developing new technologies, inventions and innovation, transfer and implementation of new technologies for companies, remained at the exact same level. The scope of this increase varied, and reached a maximum of 37% for organizations operating in sphere number 22 (promoting and protecting human and civil rights and freedoms). For organizations operating in the area of ecology, animal protection and the protection of natural heritage, it amounted to 14.5%.

Table 2.

The type of public benefit work and average number of Facebook followers (February 2020 and February 2021)

| Type of public benefit work* | Total number of organizations | Average number of Facebook followers | | % change in the number of Facebook followers |
|------------------------------|-------------------------------|--------------------------------------|-------|--|
| | | 2020 | 2021 | |
| 18 | 52 | 41082 | 47047 | 114,5% |
| 1 | 102 | 5139 | 6465 | 125,8% |
| 2 | 12 | 1107 | 1322 | 119,4% |
| 3 | 61 | 9384 | 10969 | 116,9% |
| 4 | 15 | 12402 | 14646 | 118,1% |
| 5 | 8 | 3985 | 4688 | 117,6% |
| 6 | 95 | 36474 | 39678 | 108,8% |
| 7 | 147 | 2127 | 2602 | 122,3% |
| 10 | 14 | 3007 | 3677 | 122,3% |
| 11 | 1 | 734 | 849 | 115,7% |
| 12 | 4 | 2206 | 2206 | 100,0% |
| 13 | 15 | 3208 | 3688 | 115,0% |
| 14 | 85 | 2661 | 3249 | 122,1% |
| 15 | 76 | 1401 | 1737 | 124,0% |
| 16 | 71 | 2566 | 3078 | 120,9% |
| 17 | 123 | 1976 | 2533 | 128,2% |
| 19 | 6 | 2609 | 2848 | 109,2% |
| 20 | 1 | 431 | 679 | 157,5% |
| 22 | 8 | 35864 | 49339 | 137,6% |

Cont. table 2.

| | | | | |
|----|----|-------|-------|--------|
| 23 | 21 | 2067 | 2698 | 130,5% |
| 24 | 2 | 51077 | 60115 | 117,7% |
| 26 | 9 | 4125 | 5376 | 130,3% |
| 27 | 5 | 1348 | 1667 | 123,7% |
| 28 | 2 | 9936 | 11940 | 120,2% |
| 31 | 12 | 2227 | 2922 | 131,2% |
| 32 | 9 | 3577 | 3998 | 111,8% |
| 33 | 15 | 4624 | 6037 | 130,6% |

* Types of public benefit work exactly the same as in Table 1.

Source: Own study.

The size of the organization, measured by the level of annual total revenue, significantly influenced the number of Facebook followers in the category of organizations engaged in activities related to ecology and animal protection. This was confirmed by both "Mean" values and the Kruskal-Wallis test (performed for 2020 and 2021, $p < 0.001$). The average number of Facebook followers in the group of large entities in February 2021 amounted to a value of 251,959 (an increase of 5.7% compared to February 2020), in the group of medium-sized entities 60,138 (an increase of 35.3% compared to February 2020), in the group of small entities 12,928 (an increase of 27.1% compared to February 2020), and in the group of the smallest entities 5,006 (an increase of 18.5% compared to February 2020). For all four clusters, the standard deviation rates clearly deviated from the "Mean" value, assuming in the cluster of large entities a value equal to 53% of the "Mean", in the cluster of medium-sized entities 137% of this value, in the cluster of small entities 59.5%, and in the cluster of the smallest organizations 97% of this value (data from 2021, in February 2020 a similar situation was observed). Such results testify to the wide variation in the number of Facebook followers within entities of different size clusters. On the one hand, we are dealing with organizations with an extensive base of "followers", for example, the *WWF Poland* Foundation (a large organization, number of followers = 438,536), *ADA* Foundation (a medium size organization, number of followers = 223,586), *Azylu Koci Świat* Foundation (a small organization, number of followers = 28801), *Ratujemy Dogi* Foundation (a micro organization, number of followers = 16658), and, on the other hand, organizations that, despite having a Facebook profile for a long time, still have a very modest database. In the group of large entities, the *Towarzystwo Opieki nad Zwierzętami w Polsce* with a number of followers slightly over 22,000 may be pointed out (compared to other organizations in this size group, it is more than 10 times lower), in the group of medium-sized entities, the *Tilia* Association and the *Towarzystwo Opieki Nad Zwierzętami w Polsce* - Branch in Zabrze with the number of "followers" barely exceeding a thousand. Likewise in the cluster of small entities, three organizations were identified with a number of followers hovering around 1,000, and in the cluster of the smallest organizations, four were identified.

Type of public benefit work and Facebook public engagement rate

The data presented in Table 1 clearly show that the scale of the public reaction to Facebook in the case of organizations operating in the area related to ecology, animal protection and protection of natural heritage was clearly greater compared to organizations operating in other areas of public benefit work. In February 2021, a single post published by an organization of this kind was, on average, liked 354 times, shared 74 times and commented on 36 times. The total public engagement measured as the sum of these three reactions, was therefore slightly above the 464 value. Compared to February 2020, an increase of almost 20% was recorded in this regard (in terms of the number of likes an increase of 35%, in the number of comments an increase of 33%, only in the case of the number of shares a clear decrease was observed). Organizations related to protection and promotion of health ranked second in terms of the total level of feedback to Facebook content. The total level of viewer engagement of the content published by these organizations, measured as the sum of these three responses, averaged just under 342 in February 2021, and was down nearly 36% compared to organizations with a broader environmental focus. The average public reaction for the third ranked group of organizations engaged in activities related to promoting and protecting human and civil rights and freedoms (Sphere 22 of public benefit work) was over twice lower (this category included such organizations as the *Amnesty International Association*, *Kampania Przeciw Homofobii or Lambda – Warszawa Association*). The decline in public reaction to the Facebook content was even greater for the next-ranked categories of organizations. The reaction to a single post for organizations operating in the field of preserving national traditions and sustaining Polish identity and developing national, civic, and cultural awareness (sphere number 4) was almost four times lower, for organizations related to aid to victims of calamities, natural disasters, armed conflicts and warfare (in Poland and abroad (24)), and work to support European integration, and the development of contacts and co-operation between societies (26) more than five times lower (the number of organizations operating in areas 24 and 26 of public benefit work was low, but they were characterized by high activity on Facebook, e.g. *Polska Akcja Humanitarna* and *Bieg Piastów*). Reactions to a single post in the group of the organizations most numerous represented in the study were even smaller, for organizations operating in the area of social assistance (sphere number 1) by more than 7 times, for organizations associated with work to support the disabled (7) by more than 11 times and as much as 13 times smaller for organizations involved in promoting physical culture and sports (17).

The prevalence of public reaction to Facebook content in organizations operating in the field of ecology and animal protection over the rest was similarly substantial a year earlier, that is, for the February 2020 data. Thus, the 2021 figures are not incidental, they are specific for organizations operating in this domain. Also in 2020, the same organizations were ranked second and third. The only difference was the reverse order, as the second place was occupied by organizations related to promoting and protecting human and civil rights and freedoms (22). In 2020 the magnitude of the advantage that organizations from domain number 18 of public

benefit work gained over the second and third in the ranking was at a comparable level. The response to a single post in organizations operating in the twenty-second domain of public benefit work measured by the average number of likes, shares and comments was 35.5% lower and more than twice for organizations operating in the protection and promotion of health domain (6). Equally as large as in 2021 were the differences in reactions to content for the organizations most represented in the study, i.e. those related to social assistance (average reaction 6 times lower), activities to support the disabled (7) and promoting physical culture and sports (average reaction more than 10 times lower).

The size of the organization, measured by the level of annual total revenue, significantly influenced the average public reaction to a single post in the organizations operating in the field related to ecology and animal protection. This was confirmed by the Kruskal-Wallis tests (performed for 2020 and 2021), which are robust to extreme observations and which allow to answer the question of whether the “Mean” values in Figure 1 for the average public reaction to Facebook content actually decrease with the diminishing organization's total revenue. The test value for February 2020 was $\chi^2(3) = 167.462$, $p < 0.001$; (mean rank for cluster 628.59; mean rank for cluster 2 = 485.53; mean rank for cluster 3 = 254.76; mean rank for cluster 4 = 101.21). A pairwise comparison indicated that the posts of the largest organizations in terms of annual total revenue had a higher level of average public response compared to organizations in all other clusters ($p < 0.001$ for groups 2, 3 and 4, significance level corrected using the Bonferroni method). The pairwise comparison also indicates that the posts of the smallest entities have the lowest reaction from their public. It is lower compared not only to entities in cluster one, but also to those in clusters two and three ($p < 0.001$ in each case). Kruskal-Wallis tests also confirmed that the level of reaction to posts by entities in cluster two was higher compared to organizations in clusters 3 and 4 ($p < 0.001$ in both cases). Only seemingly different results were obtained for February 2021. At first glance, one can observe a significant increase in response to posts published by medium-sized entities (more than 86%) and a 70% decrease in the group of the largest entities. This first change was decided by only one organization, i.e., the *ADA* Foundation, whose single post elicited an average reaction of more than 2000 likes, shares and comments. Compared to the previous year, the value had doubled (in February 2020 the average reaction amounted to 1039 figures for each single post). If we add to this the exceptional publishing frequency rate (136 and 214 posts in February 2020 and 2021, respectively), this one entity alone can significantly affect the performance of this entire size cluster. Such a scenario would mean that medium and large entities from the sphere number 18 of public benefit work would clearly deviate in their favor from small and smallest entities in terms of public reaction to Facebook content, while medium entities would outperform large ones in this regard. However, in the 2021 financial report, the *ADA* Foundation minimally exceeded 10 million zlotys in total revenue (10,096,556 zlotys), marking its shift from the category of medium-sized entities to the largest ones, and ultimately shifting the public's reaction to Facebook posts to this category as

well. That would make the results of the public's average response to a single post for February 2021 exactly the same as for February of the previous year, which was also confirmed by the Kruskal-Wallis tests.

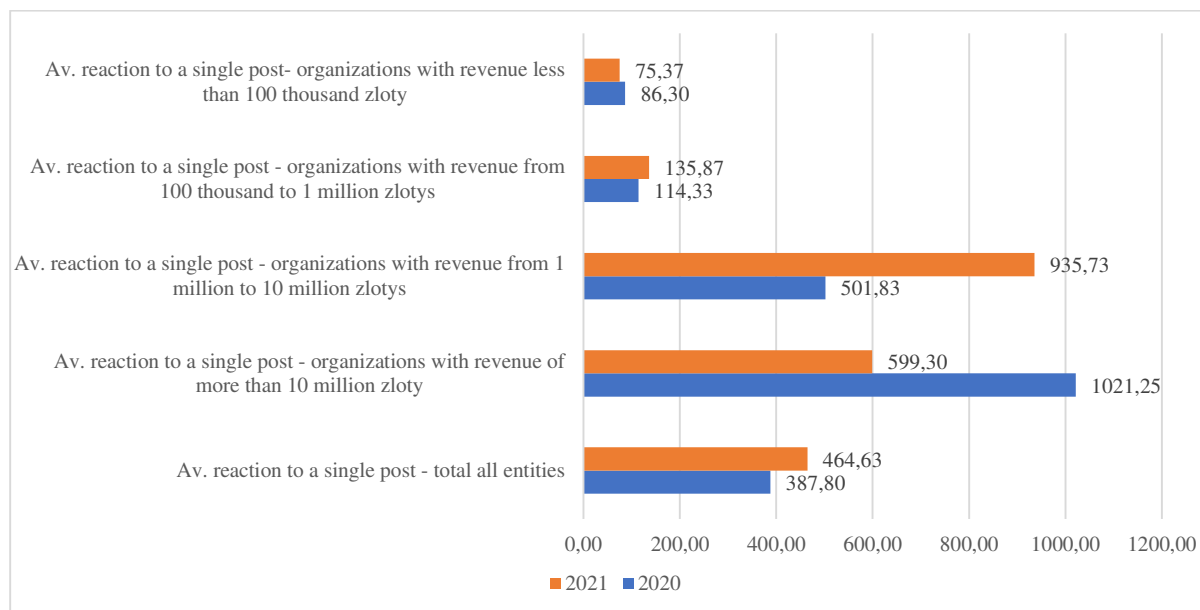


Figure 1. Average public reaction to a single post in organizations operating in the area of ecology, animal protection and protection of natural heritage according to the size of annual total revenue-February 2020 and 2021.

Source: own study.

Average public reaction to a single Facebook post varied widely within the four identified clusters. Among the largest entities, they ranged from 65 likes, shares and comments for the *Towarzystwo Opieki Nad Zwierzętami w Polsce* in February 2021, to nearly 1300 reactions for the *Ogólnopolskie Towarzystwo Ochrony Zwierząt OTOZ Animals*. Compared to the February 2020 metrics, the average reaction to a single post within the cluster of the largest entities dropped by 70% from 1021 to 599. Again, posts by the *Towarzystwo Opieki Nad Zwierzętami w Polsce* were the least responsive (an average of 198 likes, shares and comments per post). In contrast, posts by the *Międzynarodowy Ruch Na Rzecz Zwierząt – VIVA* were the most responded to ($M = 1891$). The diversity of public reaction to a single post was even greater among medium, small and especially the smallest entities. In the first one, in February 2021, two organizations were identified whose posts practically went unnoticed (on average no more than 7 reactions to a single post), another four organizations in which reactions to Facebook content were low (22 and 57, respectively), or at most moderate (124 and 128). The remaining organizations were characterized by a high level of public reaction to the Facebook posts, and in the case of one organization, i.e. the *ADA Foundation*, it was even exceptionally high ($M = 2004$). Notably, as a result of the organization's posts, the average response to a single post in February 2021, among medium-sized entities, almost doubled compared to the same month last year. In the cluster of small entities, 7 organizations were identified where a single post elicited an average reaction of less than 100 likes, shares and comments (data for February 2021). For the remaining 9 organizations in this category, it oscillated between 108 and 554 for

the Veterinary Society Foundation (two organizations were identified with an average public reaction of more than 500 for a single post). The average response to a single post, both in the first measurement year and the year after, remained at a similar level and amounted to 114 for 2020 and 135 for February 2021, respectively. Among the smallest entities, the average public reaction to a single Facebook post varied the most. Firstly, as many as 6 organizations in February 2021 did not publish any post, so automatically there could be no reaction from the public (in February 2020, there were 4 such organizations in this group, three organizations did not publish any post in both February 2020 and 2021). For 7 organizations, the reaction to Facebook posts in February 2021 did not exceed 100 likes, shares and comments (ranging on average from 7 to 67 reactions to a single post). In the other 5 organizations, the average number of reactions ranged from 105 for the posts of the *Nadzieja - Ochrona Zwierząt* Association to 171 for the *Ratujemy Dogi* Foundation. In both February 2020 and 2021, posts from exactly the same 5 organizations elicited the greatest public reaction. As in the case of small organizations, the averaged reaction to a single post, both in February 2020 and a year later, remained at a similar level and amounted to 86 for the former period and 75 for the latter, respectively.

The structure of the reaction to a single post was overwhelmingly dominated by "likes" in both the first and second years of analysis. In February 2020, they accounted for nearly 68% of all reactions. Their share in February 2021 was even higher, exceeding 76%. "Comments" accounted for the smallest share of reaction to a single post. In both February 2020 and 2021 it was barely around 7%. Moreover, a relatively large decrease in the proportion of "shares" in the structure of responses to a single post was also observed. Their share in February 2020 was 25%, and in February 2021 less than 16%. The structure of reaction to a single post in the group of large, medium and small entities was about the same. In each of them, both in 2020 and 2021, "likes" dominated. This prevalence was particularly evident in the group of medium-sized entities, where "likes" accounted for as much as 84.5% of all responses to Facebook content published in February 2021 (in February 2020 it was 76%). This result was most influenced by the *ADA* Foundation, where this reaction was particularly popular. In the cluster of the largest entities, the share of this reaction was slightly lower, at 64% in both February 2020 and 2021. For small entities, the share of this reaction totaled 59% in February 2020 and 58% in February 2021, respectively. In these three groups, "comments" accounted for the lowest share in the structure of reaction to a single post in both studied periods (their share ranged from 4.5 to 8.7%). Slightly different results were observed among the smallest nonprofit organizations. In February 2021, the proportion of "shares" in the structure of reaction to Facebook content was greater than the proportion of "likes" (50.9% to 42.8%, while in February 2020 it was 48.8% to 44.5% in favor of "likes"). The reason for this is the nature of these organizations themselves. Since these are organizations whose activities are often based on running animal shelters and finding "homes" for animals, it is common to find requests for their further "sharing" in the post itself. This was the exact situation in the case of the smallest entities. Similar to the large, medium and small organizations, the lowest share in the structure of reaction to the Facebook content were "comments" (about 6% in both analysed periods).

5. Discussion

The results of the study clearly indicated that the nonprofit organizations with the most effective use of Facebook are those operating in the areas related to ecology, animal protection and protection of natural heritage. The word "most effective" in this case means a high frequency publication rate, in conjunction with a correspondingly high public reaction to the published content (reaction in this case is measured by the number of likes, shares and comments of each single post) and an equally high number of followers of a particular organizational Facebook site. Thus, the goal of the research was fulfilled, it was possible to identify one clearly dominant type of public benefit style work, which more effectively than others, uses the potential of Facebook. The reason for this is complex and boils down to the organization triggering a sequence of the following events, gaining as many followers of the Facebook profile as possible in the initial stage, using not only the content, but also actively using other online communication channels, such as its own website, other social media sites or the offline environment in general. With the satisfactory growth in the number of profile followers, the next step for those responsible for controlling these channels is to elicit the greatest possible public reaction to the content published on the site. In doing so, we will get the classic "loop" effect, as content that provokes a large reaction attracts more people, who can potentially be an additional source of so-called "followers", which again can increase the response to the Facebook content. It seems that organizations operating in the field related to ecology, animal protection and the protection of natural heritage have an essential advantage over other organizations in this regard, an advantage whose basis is primarily psychological. It is what enables them to gain a large enough base of Facebook followers at the very outset of their social media presence (so the content itself is not crucial here). First, as Amiot and Bastian (2015) suggest, the human-animal relationship affects virtually all of us, stimulating us to create an individualized image of how we perceive the animal world and the world of nature in general. Second, also Amiot and Bastian (2015) identify six psychological rules affecting our perception of the animal world namely: evolutionary factors; developmental and learning processes; factors associated with work, religion, and culture; factors associated with individual differences; ideological beliefs; gender; factors related to the impact of animals on our health and vice versa and an intergroup relations perspective that also affects human-animal relations. Some of them have the potential to clearly influence the high interest in the Facebook profile of organizations operating in the field related to ecology, animal protection and the protection of natural heritage, hence they are particularly relevant to this research.

Evolutionary factors are primarily related to the concept of biophilia and the ensuing perception of the world. Biophilia is the concept that humans have an innate, instinctive affinity for the natural world and its living systems. The term was first coined by biologist and naturalist Wilson (1984). According to the biophilia hypothesis, humans have evolved to be deeply

connected to nature over the course of our evolutionary history. This connection has been hard-wired into our biology and psychology, and we have an innate desire to be surrounded by natural environments and living things. The result of such behavior can be a whole spectrum of feelings, from attraction to aversion, from admiration to indifference, and from calmness to anxiety. Feelings are scalable, and their extreme form often involves the need to share it, if only on Facebook.

Rules related to the effects of interactions with animals and our attitude towards them might also be an indirect factor in the interest in animal welfare. Particularly important here is the period of childhood, where our character is formed to the greatest extent. Studies conducted by Paul (2000) indicate that contact with animals during this period may predispose people to develop positive attitudes toward animals in later adult life and a greater interest in their welfare, manifested, for example, in observing actions carried out by organizations related to the field of ecology, animal protection and the protection of natural heritage.

Our attitude towards animals, whether negative, indifferent, positive or even extremely positive, can be influenced by factors such as religion, culture and related values, individual differences, ideological beliefs and gender. The latter three, in particular, can indirectly explain such a high attention to public benefit organizations connected with ecology and animal protection and their Facebook profile. In the case of individual traits, this will primarily be the ability to be empathetic towards animals, the appearance of which is often determined by at least having a pet. Strongly developed empathy is, as numerous studies have shown, a factor that enables people to feel the suffering of animals more strongly (cf. Ellingsen et al., 2010; Erlager, Tsytsarev, 2012) and the resulting feelings, to actively oppose the acts of violence against them (the organization's Facebook posts often used acts of violence against animals to provoke a fierce public reaction). Ideological beliefs, on the other hand, can clearly draw a line of conflict, in which on the one side we have people with strongly right-wing beliefs adhering to principles in which humans are seen as different from animals, standing higher in the hierarchy than them, and on the other side we have people with more left-wing beliefs who treat the world of humans and the world of animals equally (Motyl et al., 2010). Such a well-defined distinction line is particularly welcome on social media sites, often provoking public to violent reactions to the Facebook content, especially when it comes to post comments. Also, gender significantly determines perceptions of animals and nature in general, influencing involvement in the field of pro-environmental activism. This is because women are much more likely than men to boycott events that expose animals to suffering, e.g., boycotting circuses, experimenting on animals, giving up eating meat, or joining animal protection organizations to a much greater extent (Galvin, Herzog, 1998). From the point of view of a social media entity, the latter feature is particularly desirable, as it makes it possible to gain an active user of this communication channel.

The way in which humans interact with animals can also result from their membership in diverse social groups. This draws further important dividing lines within the human-animal relationship that can be used in management of social media sites. First, they may be related to so-called speciesism (Singer, 2009). Singer argues that the traditional view of human beings as the only beings with moral value is a form of speciesism that is morally unjustifiable. He contends that there is no inherent moral difference between humans and animals that justifies the differential treatment of these beings. Rather, the capacity to experience pleasure and pain is what matters morally, and animals are capable of experiencing these sensations just as humans are. Singer further argues that the exploitation of animals for human purposes, such as for food, clothing, experimentation, and entertainment, is morally indefensible. He maintains that such practices result in immense suffering for animals and are therefore inexcusable. Second, the division along the lines of "environmentalists" versus "non-environmentalists" resulting from the Realistic Conflict Theory (RCT). Realistic Conflict Theory (RCT) is a social psychological theory that explains the way in which intergroup conflict arises from competition over limited resources, including money, power, and territory. The theory posits that intergroup hostility is often driven by the perception of competition for scarce resources between different groups (Sherif, 1966). In the case of environmentalists and non-environmentalists, this will be a conflict over the protection of certain plant and animal species, at the expense of human welfare. Third, a division arising from the way in which the commonalities of humans and animals are perceived. A group that emphasizes primarily similarities will actively respond to animal suffering resulting from human mistreatment (Allen et al., 2002). The perception of the animal world through the prism of anthropomorphism, also significantly conditions greater interest in the activities of animal protection organizations. These clearly drawn boundaries give those responsible for handling social media sites considerable room for maneuver, as the potential members of the public are often extremely active with regards to the content and committed to their pro-animal and pro-environmental values. In conclusion, the success of organizations related to ecology and animal protection is not necessarily only the result of efficient Facebook content management, but may have a completely different background, often independent of the actions of those responsible for this part of the organization's activities. Undoubtedly, further research in this area is required.

6. Conclusions

This article develops the concept of Internet presence in relation to the type of public benefit work. The results have clearly indicated that some of them are clearly better predisposed to utilize social media sites in their day-to-day operations. The reasons behind this are complex, and the cause is not necessarily related to the managerial skills of those responsible for their management.

Although this study makes several contributions, it also includes a number of limitations. First, there is a need for research on the basis of which it will be possible to find out whether, in fact, the high interest in organizations related to ecology, animal protection and protection of natural heritage and their Facebook profile has a psychological basis. This is especially important because this sphere has the potential to significantly affect the way content on social media sites is handled. Facebook itself makes it easy to conduct such studies, as those who most actively follow a particular organization's profile, next to their nickname, receive a "leader among fans" badge visible to all. "Most active" in this case means a high reaction frequency measured by the number of likes, shares and comments. Reaching out to these people will make it easier to comprehend the motives behind their impressive activity on the Facebook profile of pro-environmental and pro-animal organizations. Second, the study also did not examine the content of the posts themselves, their function and the emotional charge it contained. After all, perhaps it is in the content of the posts themselves that lies an additional reason why organizations of this type are so popular on Facebook.

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OUTSOURCE MANUFACTURING IN ACCOUNTING RECORDS

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Purpose: Outsourcing is becoming an increasingly common source of utilizing the resources available in the economy, while improving their quality and reducing the necessary costs. The paper aims is to indicate the contemporary role of production outsourcing based on an attempt to define it and to present the accounting records of the obtained work results.

Methodology/Approach: The basic research methods used to verify the problem and the answers to the questions indicated by the authors were a query of literature, available scientific research in the field of outsourcing and an analysis of cases of using production outsourcing against the background of an analysis of their accounting treatment in selected entities.

Findings: The authors point to an ambiguous and debatable approach to recognizing in the books of account assets received by the service recipient from the service provider as goods or finished goods. Based on the analysis they tend to treat the elements created as a result of external services as finished goods.

Practical implications: Due to the multiplicity of different forms of outsourcing, as well as barriers to companies' ability to use it, the results of the research cannot be generalized to all manufacturing enterprises. The conclusions drawn by the authors suggest the need for further exploration of the indicated research field.

Originality: The contribution of the authors is the presentation of the legitimacy of outsource manufacturing and an attempt to organize the accounting treatment of the effects of external services provided by the contract manufacturer in the books of the outsourcing recipient.

Keywords: outsource manufacturing, outsourcing accounting records, finished goods, outsourcing problems.

Category of the paper: case study.

1. Introduction

Transnational integration of the modern economy is most often perceived in the context of observing the global flow of goods, services and investments. There has been a growing increase in this phenomenon for many years. Supply of services is strictly integrated with

human activity, beginning with agriculture to all the currently known branches of manufacturing (Bryson, Daniels, 2007, pp. 12-13). Currently, market competitiveness is of key importance which reflects the company's potential perceived through its resources, skills and abilities that provide an advantage over other companies operating in the same sector (Walczak, 2010, p. 5). In this respect there is also a departure from the previous simple division into goods and services in the economy replacing it with the concept of a bunch of benefits (Chase, Garwin, 1989).

It is a derivative of the evolution of new concepts of managing a business entity, where lean management and Business Process Reengineering currently play an important role. As a result of their implementation, the management, including production and distribution logistics, has become a challenge for enterprises, requiring more and more often the employment of specialized companies supporting activities in this area. As noted by J. Grabowska, a multi-directional view of the actions taken and the level of complexity of production processes as well as the constant pressure to reduce costs along with focusing on the key goals of the business entity (core business) require that all processes (activities, resources) be entrusted to specialized outsourcing providers (Grabowska, 2012, pp. 83-86). Therefore, as it follows from the above considerations, outsourcing means transferring the function previously performed by employees of a given enterprise to an external company, i.e. the so-called service provider, not directly related to the company, but specializing in a specific field.

It increases the quality of the business and often improves the image of the business entity. It also gives the opportunity to achieve the expected market competitiveness and the already indicated reduction of incurred costs. Thus, it favors the possibility of replacing labor by capital in some service sectors, which affects the growth of productivity itself (Greenfield, 1966, p. 115).

In this context, the paper aim is to indicate the method of recording production outsourcing in the accounting records, especially the one related to the transfer of manufacturing of products. The purpose will be achieved based on the answer to two questions: *What is outsource manufacturing?* and *How should the effect of outsource manufacturing be recorded in the context of an order to produce finished goods?*

The research was conducted based on a literature review, available scientific research in the field of outsourcing and an analysis of practical examples of the use of production outsourcing against the background of the analysis of their functioning in selected companies.

2. Literature review and research in the field of outsourcing

Outsourcing in the area of production and services allows to focus on the selected activity. The literature indicates numerous, often separate definitions of outsourcing. However,

it is crucial to indicate its undoubtedly positive impact on the activities conducted by outsourcing recipients and outsourcing providers (Toborek-Mazur, Partacz, 2022).

A review on outsourcing in the literature indicates that outsourcing is defined as a management concept that serves to achieve greater efficiency. It is associated with technological progress on the one hand, and on the other hand, with worldwide globalization tendencies, which clearly intensified in the second half of the 20th century. During this time, and more specifically in the 1970s, outsourcing emerged as an innovative management concept in the United States. Its main assumption was to convey mandatory, but not basic – from the point of view of the unit's activities and obligations, e.g. in the field of cleaning or property protection. Currently, it is slightly different and it concerns more complicated processes.

One of the outsourcing division criteria was proposed by D. Brown and S. Wilson (Brown, Wilson, 2005). The authors distinguished the outsourcing levels into: tactical, strategic and transformational outsourcing. This distinction is the basis for determining the difference in the service provider's involvement in the core activity as a distinguishing feature of a given type of outsourcing (Małkus, 2013, p. 52).

Moreover, Ch. L. Gay and J. Essinger pointed out that outsourcing considered from a strategic perspective is one of the most important and most beneficial business methodologies today, as it enables organizations of all types to fully use their capabilities and achieve optimal efficiency and flexibility in responding to customer needs (Gay, Essinger, 2002, p. 7).

Continuing the considerations, it should be emphasized that various types of outsourcing are mentioned in the literature, which is illustrated in Table 1.

Table 1.
Types of outsourcing

| Classification Criteria | Type |
|---|---|
| The duration of the spin-off | <ul style="list-style-type: none"> • strategic outsourcing, • tactical outsourcing. |
| Area of separated functions | <ul style="list-style-type: none"> • outsourcing of core functions, • outsourcing of auxiliary functions, • outsourcing of managerial functions. |
| The purpose of the spin-off | <ul style="list-style-type: none"> • recovery outsourcing, • adaptive outsourcing, • developmental outsourcing. |
| The scope of spin-off | <ul style="list-style-type: none"> • total outsourcing, • partial outsourcing. |
| Accepted form of subordination after spin-off | <ul style="list-style-type: none"> • capital outsourcing, • contract outsourcing. |
| Spin-off area | <ul style="list-style-type: none"> • selected features, • selected processes, • functional areas. |
| Type of business activity | <ul style="list-style-type: none"> • production, • trade, • services. |

Source: author's own studies based on (Świetla, 2014, p. 79).

J. Stigler presented the company's development path, which is based on functional internal differentiation, leading to specialization and then to fragmentation. As a result, he pointed out that along with the development of a business entity, the demand for production services increases, which in turn stimulates the development of external service providers providing these services (Stigler, 1956, pp. 187-188).

The success or failure of an outsourcing project depends on many factors such as: project size, duration, contract structure and the form of its management between stakeholders (Khan, Khan, Khan, Ilyas, 2022). The effectiveness of outsourcing is determined by the scope of cooperation, which usually goes beyond one corporation. As noted by L. Cai and L. Wang, outsourcing is widely used in the agricultural sector. In China, agricultural production outsourcing services are rapidly developing, which have become one of the important ways to improve agricultural productivity and promote food safety rules, supplementing labor shortages resulting from the relocation of non-agricultural sectors (Cai, Wang, 2021).

The general increase in the importance of outsourcing in recent years has been noticeable especially after the global economic crisis of 2007-2009, when the use of outsourcing allowed to increase the profitability of industrial enterprises. Research conducted by A. Maziarczyk indicated the usefulness of outsourcing in the development of the company (Maziarczyk, 2021).

As noted by A. Grześ, the basis of outsourcing concerns the long-term separation of selected features and processes or their parts from the structures of a business entity and their transfer to external, capital-related or independent entities operating in various locations, both domestic and foreign ones. This is most often based on the possibility of work division (fragmentation) and subcontracting (Grześ, 2017, p. 13).

M.J. Radło also noted that the growing integration of the world economy is accompanied by the growing disintegration of production processes in the world, which is a derivative of the development of global production chains. For this purpose, he put forward seven theses concerning, among others, the fragmentation of services, their impact on the development of economies and the role of using external service providers in this respect, which he then verified (Radło, 2013, pp. 11-14).

In this context, it is worth emphasizing that nowadays, in addition to the development of previously popular consumer services (e.g. tourism, catering), there has been a demand for production services also called indirect (e.g. business, logistics) (Kłosiński, 2002, p. 16).

Most often, the need for indirect services is reported by entities that then use them in their own operations. In addition, as H I. Greenfield pointed out (Greenfield, 1966, p. 116), the use of services by a business entity effects the conditions of production in a way comparable to the effects of using physical inputs.

As it has been commonly noted, the progress of the role of services is a continuous process, perceived as a requirement of civilization development in the modern economy. It should be pointed out that the evolution of modern services is favored by the liberalization of activities and the internationalization of the sector on global markets, generating the value of national

GDP. Thus, it can be concluded that the increase in the role of services in national economies is an element resulting directly from the development of these economies.

Research in the indicated scope of research was carried out, against the background of German entities, by K. Witczyńska, who determined that the dynamic changes in the European economy caused the disintegration of the production process and forced economic entities to adapt to the location of individual stages of production in selected locations or to move the entire production to with lower costs, e.g. in the regions of Central and Eastern Europe. In conclusion, she pointed out that part of the activity remains in the country of origin, while fragments are located abroad in order to take advantage of the comparative advantages of individual countries (Witczyńska, 2018, pp. 668-669).

According to E. Grandys, the global competition present in the markets is a key factor conducive to the search for organizational solutions aimed at reducing costs. In addition, she notes that the cost of labor has a decisive share in the costs, and the higher the labor costs, the less competitive the business entity becomes in the global economy (Grandys, 2011, p. 44).

As M.F. Corbett also points out, the use of outsourcing has a significant impact on increasing the global value of the business entity using it, which is often a derivative of the implementation of innovative solutions (Corbett, 2004, p. 65). A formula can be used here:

$$GBPOV = [(BWP) \times (WSD + WE)]^*$$

where:

BWP – current value of the entity,

WSD – increase in operating speed,

WE – increase in flexibility,

* – power that proves the innovativeness of the entity.

As can be seen from the previous considerations, more and more often the use of production outsourcing results from the dilemma faced by entrepreneurs. They can use a wide range of production strategies, under which it is possible to produce specific goods on their own (make), outsource production to external entities (buy) or a hybrid approach (make & buy). This approach results from the implementation of diverse production concepts resulting from the selection of specific strategic assumptions, the potential of the business entity and the impact of the environment itself. As it is emphasized, the transnational production strategy is predominantly evolutionary, which is the result of the approach of business entities to emerging opportunities, limitations and risk factors resulting from changes both in the enterprise itself and in the industry in which it operates (Młody, 2017).

The analysis of entrepreneurs' assessments shows that the future of service development is perceived as a field requiring speed of decision-making, flexibility, networking, the spirit of openness and freedom (Kostecki, 2001, p. 213).

It has been noticed in production entities, which more and more often use production outsourcing services. It consists in transferring selected processes to an external entity for independent implementation and often also for management. Such a relationship means that the service provider takes responsibility for the effective implementation of manufacturing processes along with the entire spectrum of activities related to it, e.g. hire employees, operation of machinery and equipment, production quality control, delivery dates, etc.

In the context of the considerations contained in this part of the study, it is worth pointing out that the goal is to answer the question: *what is outsource manufacturing?* The purpose has been achieved.

3. Advantages and disadvantages of using outsourcing in a production company

As a result of the implementation of outsourcing, the company can obtain benefits in the form of cost reduction, because there is no need to raise them when it is necessary to create or maintain jobs. It means maintaining the desired number of jobs. The risk of technology obsolescence is borne by the service provider. It means that outsourcing provides access to modern information technologies and achievements in the field of management and organization. It leads to an increase in the company's efficiency by getting rid of routine and time-consuming tasks and increases the stability of employment. At the same time, it should be remembered that errors in the introduction of outsourcing may result in failure to achieve cost reduction and deterioration of the quality of services that were performed independently. It can also cause problems between the client and the service provider (Switana, 2021).

Undoubtedly, the main benefit of outsourcing is that it allows you to reduce costs, mainly capital and operating costs, in a short time. At the same time, by delegating some of the responsibilities, it allows the company to focus on basic activities (Szymaniak, 2008, p. 38). Finally, it enables the implementation of strategic assumptions, thanks to the flexibility resulting from the need to adapt to changing market conditions, reducing the risk associated with investments in modern technologies (Marcinkowska, 2012, p. 13).

The most frequently indicated benefits resulting from the use of outsourcing of production processes are:

- freeing up own resources for core business implementation,
- access to specialized staff,
- transfer of responsibility for the quality of tasks performed,
- saving space and time,
- securing the continuity of production and deliveries,
- improvement and modernization of production processes,
- transparent system of settlements.

Analyzing the experience of Polish entrepreneurs, it can be concluded that more and more companies decide to use outsourcing. The main premise of this action is a significant reduction in operating costs and an increase in its efficiency and quality. However, the use of such a way of functioning may, in the long term, affect the negative assessment of this phenomenon, especially when the outsourcing recipient fails to effectively control the purchased services. Therefore, delegating the implementation of individual processes to external entities has both advantages and disadvantages. Table 2 presents the most important advantages and disadvantages of the outsourcing process.

Table 2.

List of key advantages and disadvantages of outsourcing

| Outsourcing assessment | Advantages of outsourcing | Disadvantages of outsourcing |
|------------------------|---|---|
| Functional | <ul style="list-style-type: none"> • access to expertise and older as well as newest technology, • focusing on managers and staff on strategic planning and key activities, • quick response to legal changes, the latest technologies and business strategies, • impact on the improvement of operating activities, greater efficiency of business processes, • changes in corporate processes and culture. | <ul style="list-style-type: none"> • barriers to contract termination in the event of ineffective performance, • lack of control over the management of short-term decisions, • lack of response to changes in key processes over a longer period of time, • limited flexibility of activity under the influence of being attached to one service provider, • loss of control over activities and inability to assess the competence of the contractor, • loss of professionalism of own staff in the scope of entrusted tasks. |
| Financial | <ul style="list-style-type: none"> • access to the latest technologies without the need for capital investments, • saving time for managers, • smooth cash flows in order to carry out predetermined tasks, • reduction of salaries and necessary equipment costs. | <ul style="list-style-type: none"> • lack of modern solutions offered by the contractor, • the need for costly control over the correctness of performed tasks, • difficulties in changing the service provider or take over the separated activity back to the enterprise structure due to high costs, • high costs of the contract and its possible changes. |

Source: author's own studies based on (Świetla, 2014, pp. 94, 100).

With the careless selection of processes transferred in order to separate them from the structure of the business entity, it can be noticed more and more often that not all services or products are performed at an appropriately high level. Although entrepreneurs choose selective outsourcing, which means that only a specific part of the process is outsourced, transferring control over even a part of the process can lead to many irregularities. By handing over the procedure to contractors who are not always experienced, you can end up with a product that will not meet the quality expected by the ordering party. The consequence may be a reduction in future consumers' trust in the principal (Toborek-Mazur, Partacz, 2022, p. 173). In addition, if the outsourcing concerns a semi-finished product or a material that is an element of a future fixed asset, for example a computer or means of transport, the quality of the product transferred

to the contractor will affect the final production result (Szmajser, Kędzior, Andrzejewski, Świetła, 2022).

It is worth emphasizing that regardless of whether outsourcing concerns a selected production line, a machine park or a team of employees with specific qualifications, it has become very popular due to the reduction of costs of using own resources and releasing them for other purposes. In addition, outsourcing is a liberal form of cooperation. It is definitely more difficult to sell a specialized machine or to dismiss an ineffective employee than to terminate the form of cooperation with an external entity. Breaking the contract even with a notice period of several months is significantly less expensive than launching a new specialized production department.

The main reason for entrusting control over the production process is money. The principal does not purchase further machinery and equipment and therefore often does not have to incur liabilities. It is worth noting that both the prices of equipment and the costs of subsequent sources of financing are extremely high, and ensuring full use of the owned machinery park is very demanding in the changing economic environment. An additional challenge for entrepreneurs is the need to employ qualified employees, who must be guaranteed a job in order not to lead to the existence of spare capacity in the entity. On the one hand, using outsourcing, the principal limits its resources, thanks to which it increases financial stability and improves the assessment of its profitability, on the other hand, it can lead to downtime in the company due to improper acquisition of external processes.

4. Problems of outsource manufacturing in accounting records

As it was noticed during the conducted research, it is more effective to outsource production or services to an external entity, which is paid for the performed process based on an issued invoice. The more so that the contractor uses its own machinery and employees (Wawak, Sołtysik, 2015, p. 194). He bears the costs of maintaining the machine park, salaries and pays taxes as an employer. For its part, the principal may partially limit the use of its own machines, tools and control and diagnostic systems. For its part, however, it often offers proven know-how, which is essential for the company, especially in the first stage of development.

In this context, it is worth emphasizing that entrepreneurs more and more often decide to use production outsourcing, omitting the development of their own machinery, or limiting the purchase of subsequent machines and devices. By transferring selected production processes to external companies, the principals use the experience and knowledge in the field of not only manufacturing technology, but also planning, purchasing and control of raw materials, quality procedures, etc., which are provided by the external entity. In addition, entrepreneurs settle accounts with the contractor on the basis of invoices for the service provided, containing

information, e.g. on the number of products delivered. If, for example, an entrepreneur decides to transfer his recipe and production order to an external company, the latter will issue an invoice for the service provided, which should contain information about both the value and the quantity of the products.

The authors, cooperating with business practice and managers of accounting services of entities using production outsourcing processes, consider how to record the entity ordering production in the area of outsourced processes and their effects. Therefore, it is necessary to answer the second of the research questions: how should the outsource manufacturing be recorded in the context of the production of finished products?

According to the authors, despite the fact that the contractor receives the finished products back, he should account for this transaction on an equal footing with his own production. It is not reasonable to consider an asset made as part of a commissioned service as a good. Invoiced costs of the service are eligible for the costs of basic operating activities, charging them to account 402 "Outsourced services" and/or group of accounts no. 5. Acceptance of finished products manufactured by an external company in the client's accounting records is presented in table 3.

Table 3.

Records of receipt of finished goods manufactured by an external company

| Lp. | An economic operation | Dt | Ct |
|-----|--|--|---|
| 1. | Invoice for the service – production of finished products | | |
| | a) Gross invoice | 300 „Purchase settlement” | 202 „Suppliers accounts” |
| | b) Input VAT | 221-1 „Input VAT” | 300 „Purchase settlement” |
| | c) Including the net value of the invoice in operating costs in parallel | 402 „Outsource services” 500 „Costs of core activity” | 300 „Purchase settlement” 490 „Settlement costs” |
| 2. | PW- finished goods acceptance | | |

Source: author's own studies.

Analyzing the case where the service recipient's company deals with clothing trade, and the purchase of materials and templates needed for their production is purchased on its own and transferred to the sewing room (an external company). Clothes are sewn on the basis of designs made by the ordering company. The sewing room transfers the finished product to an external warehouse not belonging to the ordering company, from which it is then sent directly to end recipients (including natural persons).

According to the authors, if a company commissions an external company to sew clothes according to its own designs and from its entrusted materials, then the asset produced as part of such an order should be treated as a finished product, and the service provided by the service provider should be treated as a third-party service. In this case, the costs invoiced by the subcontractor are also accounted for as production, as shown in Table 4.

Table 4.

Recording of the costs of the service by an external company at client's accounting records.

| Lp. | An economic operation | Dt | Ct |
|-----|--|--|--|
| 1. | Invoice for the service – sewing clothes a) Gross invoice b) Input VAT c) Including the net value of the invoice in operating costs in parallel | 300 „Purchase settlement” 221-1 „Input VAT” 402 „Outsource services” 500 “Costs of core activity” | 202 „Suppliers accounts” 300 „Purchase settlement” 300 „Purchase settlement” 490 „Settlement costs” |
| 2. | PW- finished goods acceptance | | |

Source: author's own studies.

If the company entrusts another entity with materials or raw material, their value should be recorded in account 311 – „Outside materials” until the service is performed by that entity. The records on this account should take into account the quantity and value settlement. In connection with this, the document Wz. After the order is completed by the external entity and the entrusted stock is settled, its value should be included in the costs of used materials, which is presented in table 5.

Table 5.

Records of inventory removal at contractor's accounting records

| Lp. | An economic operation | Dt | Ct |
|-----|--|--|---|
| 1. | Wzentrusting an external company with materials | 311 „Outside materials” | 310 „Materials” or 300 „Purchase settlement” |
| 2. | Completion of materials after the service* in parallel | 401 “Materials and energy” 500 „Costs of core activity” | 311 „Outside materials” 490 „Settlement costs” |

* and the contractor's settlement of the materials.

Source: author's own studies.

The acceptance of finished products made by an external company is booked by the contractor on the basis of the PZ document on account 600 „Finished goods”. According to the authors, if a production unit outsourced a service to an external company, consisting in the performance of the entire production process, then the asset made under this order should be treated as its own product. Finished products stored in foreign warehouses can also be treated as own stock (Partacz, 2022). Records of finished products manufactured by an external company and transferred to external warehouses are presented in table 6.

Table 6.*Records of finished goods manufactured by the contractor in the accounting records*

| Lp. | An economic operation | Dt | Ct |
|-----|--|---|---|
| 1. | Pz - finished goods acceptance | 600, „Finished goods” (analytical account as “third-party warehouse”) | 500 „Costs of core activity” or 580 – „Settlement of operating costs” |
| 2. | Wz – release of finished goods transferred to the recipient from a third-party warehouse | 701 „Costs of sold goods” | 600, „Finished goods” (analytical account as “third-party warehouse”) |

Source: author’s own studies.

To sum up, it should be stated that outsource manufacturing in the accounting policy of the contracting entity should be presented as the effect of own production and the products obtained should be treated as own finished goods, not goods. Similarly, stocks stored in external warehouses and transferred to an external recipient should be recorded similarly to the sales of the outsourcing provider’s own finished products.

5. Summary and conclusions

Although researchers do not agree on the final direction of the development of outsource manufacturing and see both advantages and disadvantages in it, they are basically in favor of its benefits. It all depends on what processes will be separated and what supervision over them the ordering party is able to provide. As M. Matejun emphasizes in his research, outsourcing more and more commonly concerns either the supply area (which connects it with the production of goods) or production as such. In terms of procurement and production, he assumes that all elements and components for machines and devices previously necessary for production, which were manufactured on site, can now be imported from suppliers offering products at favorable prices. A new look at the supply process with the use of outsourcing assumes, above all, the concentration of a business entity on key areas of operation and means resignation from the production of a wide range of previously manufactured elements in favor of these, which will be considered crucial. By focusing on the strengths of own activities and acquiring some components from suppliers specialized in them, production becomes more effective, which is, among others, a derivative of cooperation with cooperators. With this use of outsource manufacturing, suppliers provide a broader technological foundation and more advanced research and development. Moreover such a solution reduces the range of production (Matejun, 2006, p. 22).

The research conducted by K. Kolińska and A. Koliński shows that 50% of enterprises outsource specific tasks for implementation (Kolińska, Koliński, 2010). On the other hand, 29% of enterprises accept outsourcing orders from other companies. Outsourcing of production

processes is frequently used activity optimizing the costs of an economic activity, both from the point of view of the ordering company and the receiving company.

The group of 15% of companies that outsource production processes are mainly large and medium-sized enterprises. On the other hand, 31% of enterprises accepting uncomplicated production orders from other companies belong mainly to the SME sector (Kolińska, Koliński).

The advantages of outsourcing are to ensure maximum profit, reduce costs, increase productivity, flexibility for service provider and higher quality of redirecting the company's resources (Khan, Khan, Khan, Ilyas, 2022).

Continuing the discussion, it is worth stressing that not every production process can be outsourced. There are companies that carry out very advanced projects that require the use of specialized equipment, hard to find on the market, and the employment of specialized employees undergoing ongoing training. This type of investment in both property and personnel is very capital- and time-intensive. Therefore, ordering such production without proper control is not possible even when estimating the profitability of the project. Against the background of the conducted research, the authors came to the conclusion that proper control over the course of the outsourcing process will be ensured by the participation of both parties (outsourcing provider and outsourcing recipient) in the group of companies (Toborek-Mazur, Partacz, 2022). Capital ties between the cooperating entities should foster the transparency of cooperation and the achievement of the adopted goals on a win-win basis.

The decision to outsource manufacturing is not an easy one. Many entities, however, decide to further train employees and manufacture based on their own machinery. Due to investing in internal development and taking care of the condition of the machine park and improving the competences of employees, the quality of the manufactured products may turn out to be much higher than in the case of using the outsourcing process. However, it does not diminish the importance of the role played by the ongoing control of cooperation between the parties.

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EMPLOYERS' EXPECTATIONS OF HARD AND SOFT COMPETENCIES OF ECONOMICS GRADUATES

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Purpose: The purpose of the research was to identify employers' expectations regarding the hard and soft competencies of economics graduates.

Design/methodology/approach: The research was conducted in 312 companies in the Małopolska region that employ graduates of economic studies. The survey was cross-sectional and consisted of collecting opinions directly from employers in various industries, representing companies of different sizes, as well as various institutions. Computer-assisted surveying (CAPI method) and telephone survey (CATI method) were used as research tools. The results of the study were subjected to statistical analysis.

Findings: Employers consider soft competencies of economics graduates more important than hard competencies. The most desirable soft competencies are responsibility, ethical conduct, ability to organize own work and ability to communicate effectively. Among hard competencies, employers consider subject matter knowledge in marketing, accounting and finance, logistics, personnel management and information technology, IT skills (such as office packages, e.g. MS Office) and analytical skills (information and data processing, reasoning) to be the most important. For the most part, differences in the perceived importance of competencies by employers of business graduates do not depend on the size of the company, the industry, or the percentage of business graduates employed at the company.

Research limitations/implications: Further research will be related to identifying the competencies required from the perspective of new challenges, such as digitization and the replacement of human labor by artificial intelligence.

Practical implications: Findings from the research can help align the educational offerings of economics degree programs with current labor market expectations. In addition, the results of the research can provide valuable information for students who are planning their careers and want to know what employers expect in terms of competencies.

Originality/value: The result of the research is the ranking of expected competencies according to employers, as well as the determination of the relationship between hard and soft competencies of economics graduates.

Keywords: hard and soft competencies, economic studies, competencies of graduates, competency gap.

Category of the paper: research paper.

1. Introduction

Employee competencies play a key role in today's labor market. They consist of skills, knowledge and personality traits that allow an employee to effectively carry out assigned tasks. Changes in the conditions for the functioning of the organization and the increase in the complexity of operations cause the necessity of continuous improvement and development of employee competencies. This situation creates a special challenge for universities. It requires constant monitoring of employers' expectations and updating educational programs.

The article presents the results of a study of employers' expectations regarding the competencies of economics graduates. The research was carried out at companies in the Małopolska region, where graduates of economic studies constitute a significant percentage of the workforce. The survey, which was cross-sectional in nature, consisted of collecting opinions directly from employers in various industries representing enterprises of different sizes, as well as various institutions, employing graduates of economic studies. The analysis conducted as part of the study looked at both hard and soft competencies. The result of the research was the development of a ranking of competencies according to importance, as indicated by employers, as well as the determination of the relationship between hard and soft competencies.

The conclusions of the research can be useful for universities that educate in the field of economics and management. They can help identify the needs of the labor market and adapt the educational offer to the current requirements of employers. In addition, the results of the research can provide valuable information for students who are planning their careers and want to know what employers expect in terms of competencies.

2. Previous research on the competence of university students and graduates

With advances in technology and the introduction of new technologies, the requirements for workforce competencies are changing. In the context of digitalization, robotization and automation of work, skills related to programming, data analysis, automation or robotics are becoming crucial. Also important are skills related to creativity, innovation, problem solving or communication, which allow employees to effectively use new technologies and implement innovations in the workplace (Van Laar, Deursen, Van Dijk, Haan, 2020).

Contemporary approaches to assessing employee competencies highlight the importance of both hard and soft skills. Hard competencies, such as technical and administrative skills, are measurable and require specialized knowledge that is necessary to perform specific tasks in the workplace. Soft competencies, on the other hand, include interpersonal and social skills that

allow for effective collaboration and effective use of technical skills at work (Hendarman, Tjakraatmadja, 2012). Soft competencies include communication skills, problem solving, creativity, empathy, flexibility, adaptability to change, stress management and effective time management. These competencies allow employees to better understand the needs of their co-workers, customers, and to effectively manage projects and teamwork (Cimatti, 2016, Dwi Riyanti, Sandroto, Warmiyati, 2016).

The issue of the competence of students and university graduates is an issue that attracts the attention of researchers in many fields. Studies conducted in this area are primarily aimed at assessing the compatibility between the educational processes implemented and the expectations of the labor market. They make it possible to indicate the extent of the competency gap. This research is concerned with three main categories of competencies: academic, professional, and social and emotional. Academic competencies are related to the acquisition of analytical skills, problem-solving abilities, critical thinking and creativity (Anthony, Garner, 2016). Professional competencies relate to specific knowledge and specialized skills (Muff, Delacoste, Dyllick, 2022). Social and emotional competencies are related to the ability to form social relationships, work in teams, manage emotions effectively, and empathize (Anthony, Garner, 2016). Academic and social competencies are mainly soft competencies. Professional competencies, on the other hand, refer primarily to hard competencies.

Research on the competencies of university students and graduates is usually conducted through a combination of quantitative and qualitative methods, such as surveys, assessments, interviews and observations (Glass, Metternich, 2020).

The importance of soft and hard competencies for career success has also been the subject of much research into the competencies of college students and graduates. The most common research conducted in this regard was concerned with determining the relationship between soft and hard competencies. Studies have also been undertaken that have addressed various specific aspects related to the competency categories in question, such as the importance of soft and hard competencies during a job interview (DeLong, Elbeck, 2018), the development of competencies during the initial period of employment (Succi, Wieandt, 2019), and changes in expected competencies (Patacsil, Tablatin, 2017). Previous research indicates the predominance of soft competencies over hard competencies. This observation applies to most contemporary professions (Harjanto, 2019; Ahmad, Noorul, 2019). It is also emphasized that professional competencies become obsolete very quickly. They can also often be replenished very quickly through various forms of effective training. Values, attitudes, social skills, take much longer to form. At the same time, they represent an enduring ability to build and maintain interpersonal relationships.

Changes in the conditions of business development and the new challenges of civilization make the problem of researching the competencies of university students and graduates constantly topical. The complexity of the problem and the multidimensionality of the competence categories also require the development of research methods in this area.

3. The course of research in the identification of hard and soft competencies expected by entrepreneurs of graduates of economic studies

The methodology of the research conducted in identifying the hard and soft competencies expected by entrepreneurs of economics graduates included five stages:

1. Development of a model of competencies of an economics graduate.
2. Preparation of a research tool in the form of a questionnaire.
3. Determination of the research area.
4. Implementation of the research proper.
5. Analysis of research results and formulation of conclusions.

It was also allowed to adjust the competency model developed in the first stage of the research procedure if such a need is identified after the empirical research (Figure 1).

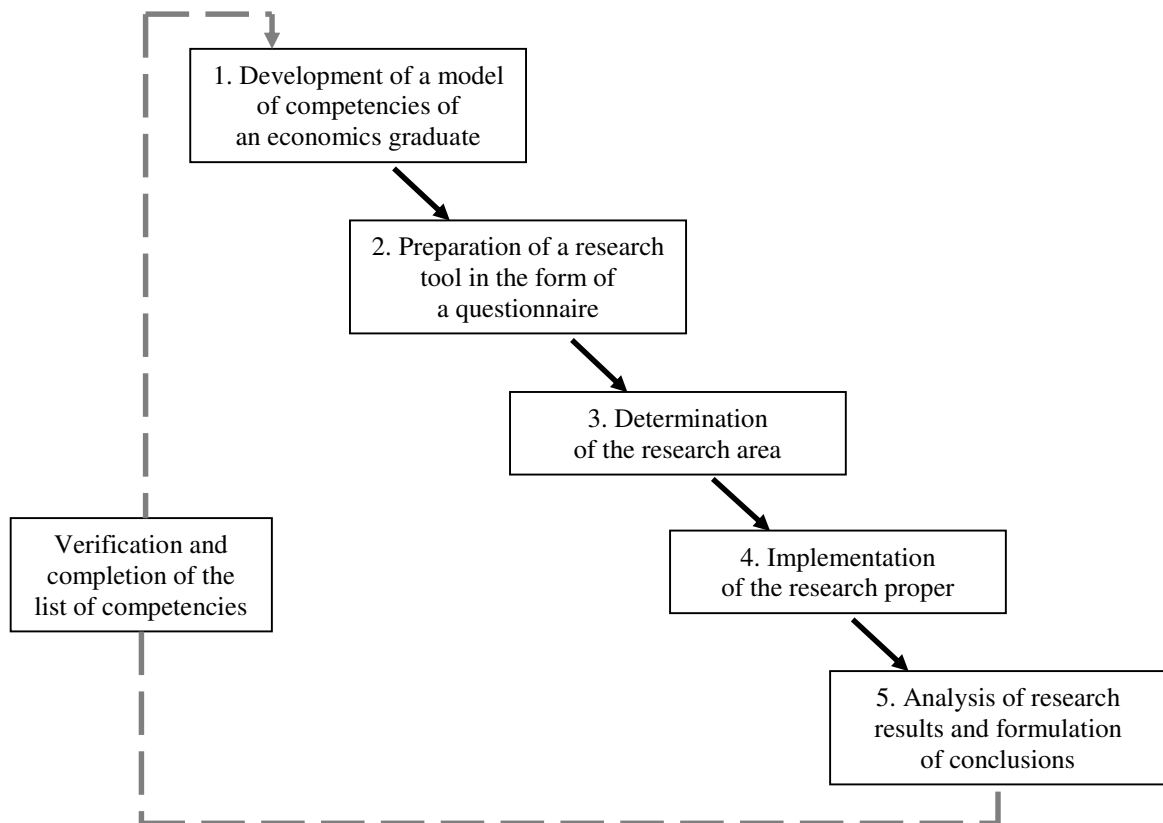


Figure 1. Research methodology in the task "Survey of entrepreneurs in the leading industries of the Małopolska region regarding the identification of jobs and expectations regarding the competence of employees".

Source: own elaboration.

The first stage of the research consisted in developing a model of competencies of a graduate of economic studies. The basis for the development of the model was the analysis of literature and reports, concerning the assessment of professional competencies of university graduates.

The following were used as research methods: the method of analysis and logical construction, expert evaluation and desk research. The model distinguished between hard and soft competencies, which were embedded in such elements as knowledge, skills and attitudes. Seven categories of competencies related to general and content knowledge, foreign language skills, and IT and analytical skills were considered hard competencies. Soft competencies, on the other hand, included twelve categories, among which were skills such as effective communication, teamwork, decision-making, organization of own work, and attitudes such as creativity, openness to learning and continuous development, critical thinking (logical argumentation), self-reliance, flexibility and adaptability, responsibility, ethical conduct and tolerance for employee diversity.

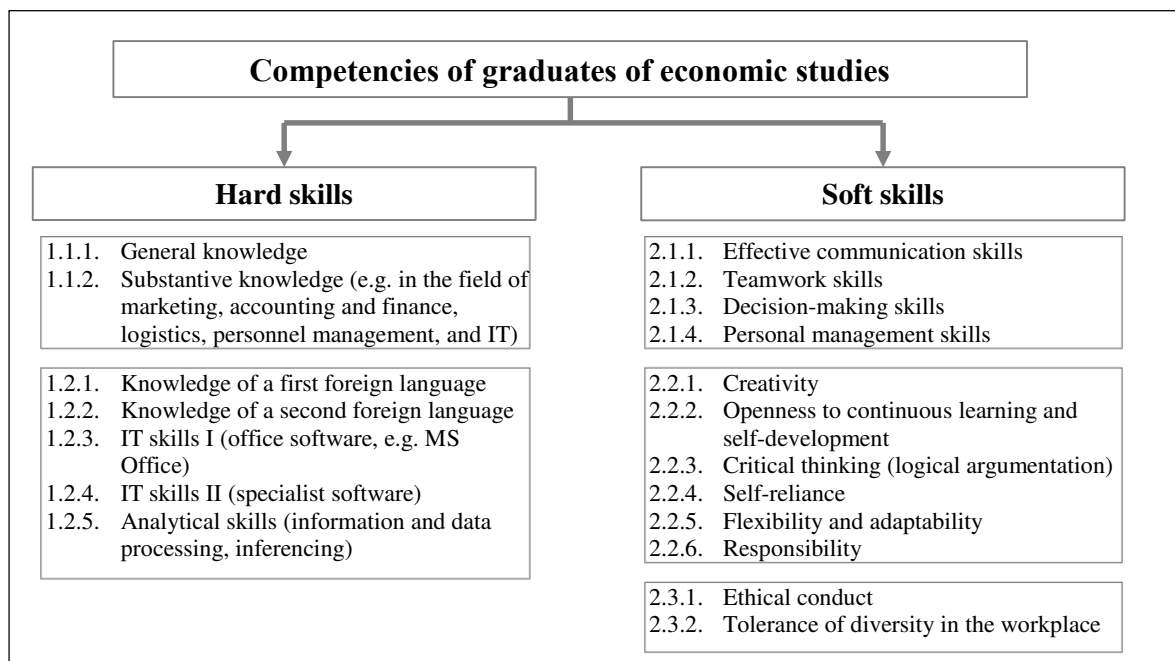


Figure 1. Competency model for economics graduates.

Source: own study.

The list of competencies developed as part of the literature study was reviewed as part of the proper research stage.

The study adopted four research hypotheses:

H1: for economics graduates, employers place more importance on soft competencies than hard competencies.

H2: the perceived importance of competencies of economics graduates depends on the size of the company.

H3: perception of the importance of competencies of economics graduates depends on the industry in which the company operates.

H4: the perception of the importance of competencies of economics graduates depends on the percentage of economics graduates employed at the enterprise.

The next stage of the research was the development of a survey form as the main research tool. The form's first question asked respondents to identify the key category of employees from a proposed list of occupations. This list included the professions in which economics graduates most often find work. The second question asked respondents to assess the importance of the competencies of economics graduates from an enterprise perspective. The third question asked respondents to assess the level of competence possessed by newly hired economics graduates at the company.

Leading enterprises in the Małopolska region, which by virtue of their business profile represent a potential place of employment for graduates of economic studies, were selected as the object of the study. The survey, due to the representativeness of the sample, was planned to be conducted on a sample of 360 enterprises. Ultimately, 312 enterprises took part in the survey. Technical and organizational aspects of the survey were outsourced to Agencja Badań Marketingowych i Opinii Holding Profit Spółka z o.o., based in Kraków (31-162 Kraków, ul. Staszica 7/5, NIP: 864-000-26-96, REGON: 005670308). The survey was computer-assisted (CAPI method) and conducted under the supervision of the agency's auditors, using also a telephone survey (CATI method). In designing the survey, it was assumed that information would be obtained from companies with the following positions dedicated to graduates of economic studies:

- economic IT specialist,
- accountant/financier,
- administrative specialist,
- e-commerce specialist,
- IT specialist/administrator,
- logistics specialist,
- marketing/sales/advertising/PR specialist,
- real estate specialist,
- tourism specialist,
- quality management/quality control specialist,
- personnel management/payroll/HR specialist.

It was assumed that the preferred respondents were employees of HR departments, direct supervisors of newly hired graduates of economic studies, and persons indicated by the boards of directors of the surveyed enterprises.

The survey was dominated by small entities with up to 50 employees. The second-largest group was organizations ranging in size from 51 to 250 employees. The least numerous were entities with more than 250 employees. The structure of the survey sample is presented in Figure 3 and Table 1.

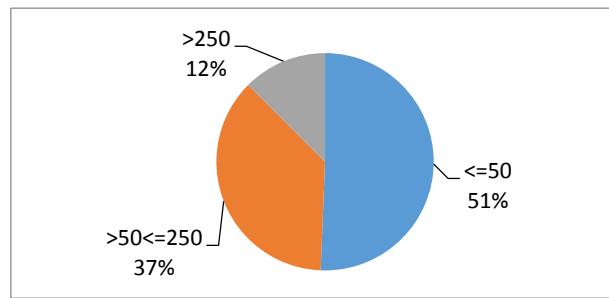


Figure 3. Structure of respondents in terms of the number of people employed.

Source: own study.

Table 1.

Structure of respondents in terms of the number of people employed

| No. | Size of the organization | Volume | Percentage share |
|-----|--------------------------|--------|------------------|
| 1 | <= 50 persons | 158 | 51% |
| 2 | > 50 <= 250 | 115 | 37% |
| 3 | > 250 | 39 | 12% |

Source: own study.

The sample was diversified in terms of the assignment of entities to industries (Figure 4 and Table 2). The Polish Classification of Activities (PKD) was used. The largest share of the sample was from Section O (26%) (public administration and defense; compulsory social security), Section C (19.9%) (manufacturing) and Section M (12.2%) (professional, scientific and technical activities). The first group included, among others, local government units, institutions engaged in public finance, education or social policy. Section C entities included manufacturers of, among others: steel structures, electronics, sanitary and plumbing fixtures, machinery and equipment, aircraft engine parts, household chemicals or woodwork. Section M, in turn, included advertising agencies, research companies, management consulting firms, marketing, human resources or research and development units. The smallest share of respondents by industry was in Section L (1.9%) (Real estate activities), Section I (2.6%) (Accommodation and food service activities), Section H (2.9%) (Transportation and warehousing) and Section N (3.2%) (Administrative and support service activities).

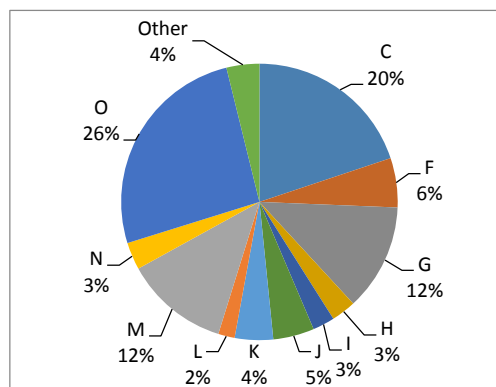


Figure 4. Structure of the sample in terms of assigning entities to industries according to the PKD classification.

Source: own elaboration.

Table 2.

Structure of the sample in terms of the assignment of entities from industries according to the PKD classification

| No. | Section symbol | Section name | Volume | Percentage share |
|-----|----------------|--|--------|------------------|
| 1 | C | Manufacturing | 62 | 20% |
| 2 | F | Construction | 18 | 6% |
| 3 | G | Wholesale and retail trade; repair of motor vehicles and motorcycles | 39 | 13% |
| 4 | H | Transportation and storage | 9 | 3% |
| 5 | I | Accommodation and food service activities | 8 | 3% |
| 6 | J | Information and communication | 15 | 5% |
| 7 | K | Financial and insurance activities | 14 | 4% |
| 8 | L | Real estate activities | 6 | 2% |
| 9 | M | Professional, scientific and technical activities | 38 | 12% |
| 10 | N | Administrative and support service activities | 10 | 3% |
| 11 | O | Public administration and defence; compulsory social security | 81 | 26% |
| 12 | Other | Other | 12 | 4% |

Source: own elaboration.

The surveyed facilities were also characterized by different levels of the percentage of economics graduates employed (Figure 5 and Table 3).

By far the largest number of facilities had a percentage of 10% or less. This was followed by subjects above 10 to 30%. The fewest were above 30%.

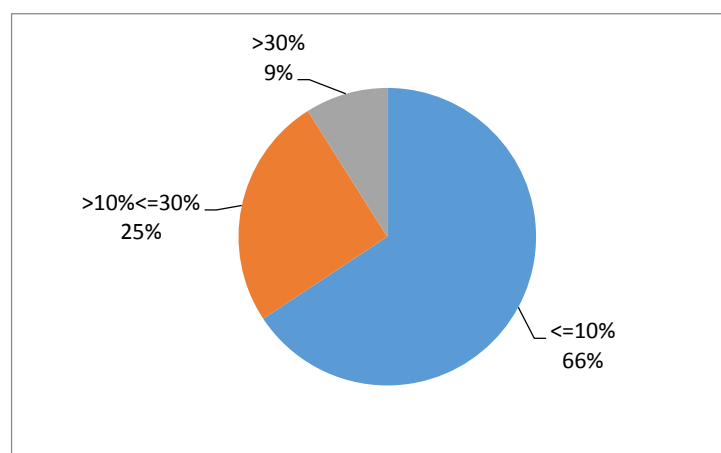


Figure 5. Structure of the sample in terms of percentage of employed economics graduates.

Source: own study.

Table 3.

Structure of the sample in terms of percentage of employed economics graduates

| No. | Percentage of employed economics graduates | Volume | Percentage share |
|-----|--|--------|------------------|
| 1 | <= 10% | 205 | 66% |
| 2 | > 10% <= 30% | 79 | 25% |
| 3 | > 30% | 28 | 9% |

Source: own elaboration.

For the purpose of preparing this study, a detailed analysis of question two of the survey was conducted, which reads: "How important in your company is it for newly hired employees to have the competencies listed below (applies to graduates of economic studies). Please use a scale from 1 to 5, where 1 means that the competency is not important at all, and 5 means that

it is a key competency." Thus, the idea was that respondents were to evaluate the importance of the competencies included in the model of the economics students and graduates they employ from the point of view of the tasks they are assigned to perform in their jobs.

Table 4 shows the adopted scale for assessing the importance of the competencies of students and graduates of economic studies from the point of view of the surveyed companies.

Table 4.

Adopted ranges for assessing the importance of competencies of students and graduates of economic studies employed in the surveyed companies

| Verbal evaluation | Interval |
|----------------------|------------|
| Not important at all | <1; 1,8) |
| Low-important | <1,8; 2,6) |
| Moderately important | <2,6; 3,4) |
| Very important | <3,4; 4,2) |
| Key competency | <4,2; 5> |

Source: own elaboration.

The ranges were set at equal intervals for the theoretical possible extreme ratings - the lowest at level 1 and the highest at level 5. The purpose of adopting them is to allow grading the importance of the importance of competencies from the point of view of the entrepreneurs surveyed.

The results of the study were subjected to statistical analysis, in which, in addition to determining the average values of the importance ratings of competencies, tests of significance of differences between the averages were carried out. On this basis, the hypotheses adopted in the study were verified and final conclusions were formulated.

4. Soft and hard competencies of economics graduates in the opinion of employers

According to the adopted rating scale, the surveyed employers included the following competencies of graduates as key competencies: responsibility (4.48), ethical conduct (4.44), ability to organize own work (4.37), ability to communicate effectively (4.33), self-reliance (4.30), openness to learning and continuous development (4.29), ability to work in a team (4.26), substantive knowledge (e.g., marketing, accounting and finance, logistics, personnel management, information technology) (4.25). Except for the last one, all of those mentioned fall into the category of "soft" competencies. In the group of very important competencies were: decision-making skills (4.13), flexibility and adaptability (4.15), IT skills I (office packages, e.g. MS Office) (4.12), critical thinking (logical argumentation) (4.11), analytical skills (information and data processing, reasoning) (4.04), creativity (3.99), tolerance for employee diversity (3.75), general knowledge (3.57). The group of moderately important competencies included knowledge of the first foreign language (3.36), IT skills II (specialized programs)

(3.31). Only knowledge of a second foreign language (2.38) was classified as low-importance competence. Figure 6 and Table 5 shows the average responses regarding the importance of each competency among the entire surveyed group of respondents.

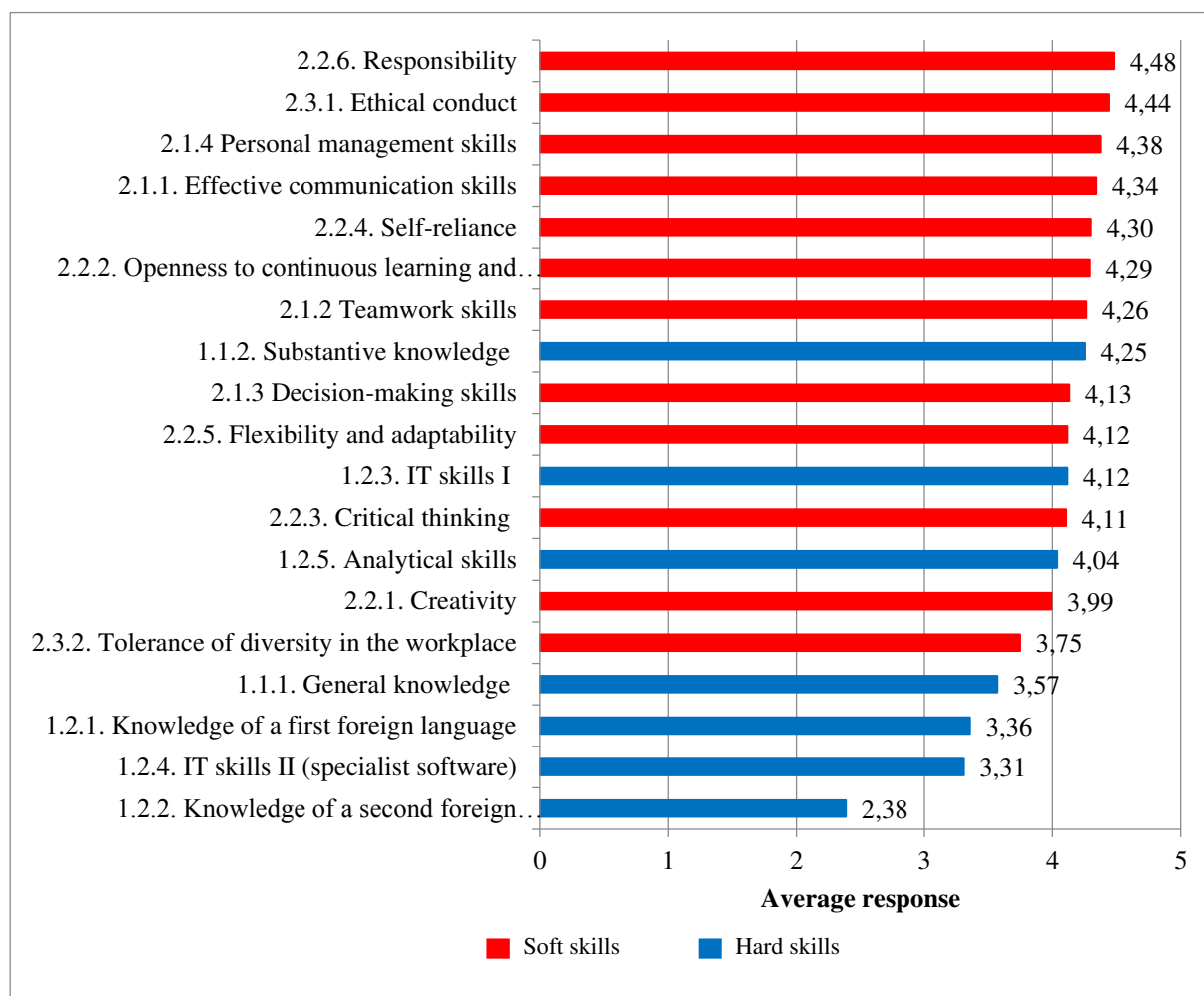


Figure 6. Importance of competencies of economics graduates according to employers.

Source: own study.

Table 5.

Importance of competencies of economics graduates according to employers

| No. | Competence | Competence category | Average response |
|-----|--|---------------------|------------------|
| 1 | 2.2.6. Responsibility | S | 4,48 |
| 2 | 2.3.1. Ethical conduct | S | 4,44 |
| 3 | 2.1.4. Personal management skills | S | 4,38 |
| 4 | 2.1.1. Effective communication skills | S | 4,34 |
| 5 | 2.2.4. Self-reliance | S | 4,30 |
| 6 | 2.2.2. Openness to continuous learning and self-development | S | 4,29 |
| 7 | 2.1.2. Teamwork skills | S | 4,26 |
| 8 | 1.1.2. Substantive knowledge (e.g. in the field of marketing, accounting and finance, logistics, personnel management, and IT) | H | 4,25 |
| 9 | 2.1.3. Decision-making skills | S | 4,13 |
| 10 | 2.2.5. Flexibility and adaptability | S | 4,12 |
| 11 | 1.2.3. IT skills I (office software, e.g. MS Office) | H | 4,12 |

Cont. table 5.

| | | | |
|----|---|---|------|
| 12 | 2.2.3. Critical thinking (logical argumentation) | S | 4,11 |
| 13 | 1.2.5. Analytical skills (information and data processing, inferencing) | H | 4,04 |
| 14 | 2.2.1. Creativity | S | 3,99 |
| 15 | 2.3.2. Tolerance of diversity in the workplace | S | 3,75 |
| 16 | 1.1.1. General knowledge | H | 3,57 |
| 17 | 1.2.1. Knowledge of a first foreign language | H | 3,36 |
| 18 | 1.2.4. IT skills II (specialist software) | H | 3,31 |
| 19 | 1.2.2. Knowledge of a second foreign language | H | 2,38 |

Source: own elaboration.

Soft competencies were rated as key or very important. The averages for responses with regard to soft competencies are shown in Figure 7 and Table 6.

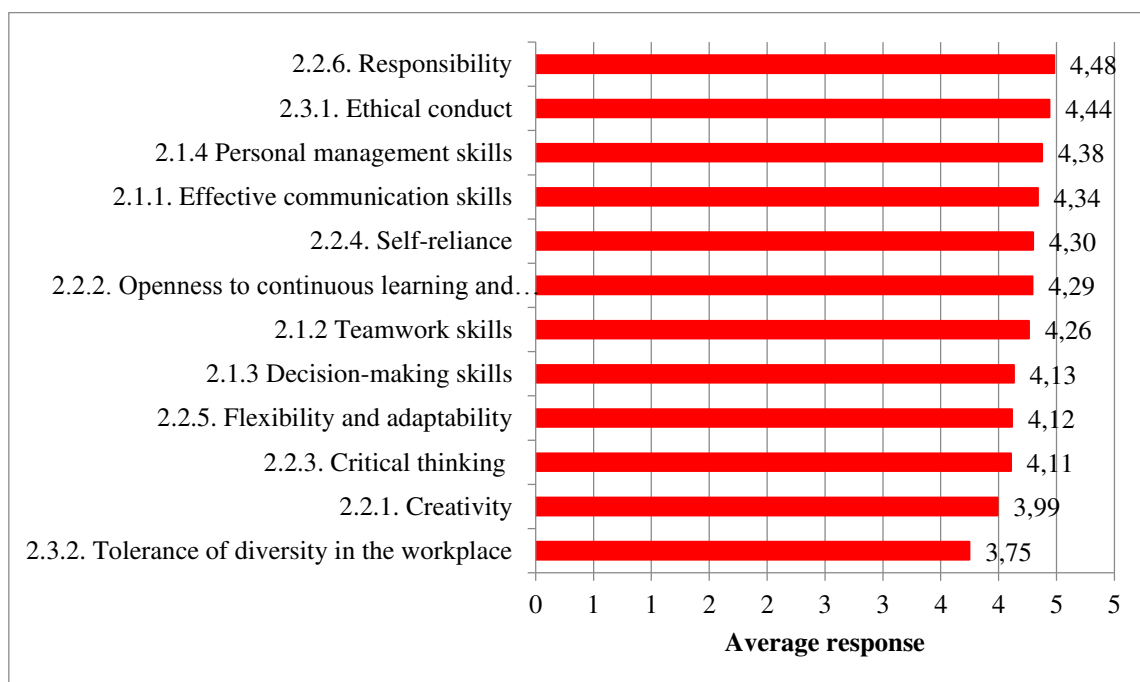


Figure 7. Importance of soft skills of economics graduates according to employers.

Source: own study.

Table 6.

Importance of soft competencies of economics graduates according to employers

| No. | Competence | Average response |
|-----|---|------------------|
| 1 | 2.2.6. Responsibility | 4,48 |
| 2 | 2.3.1. Ethical conduct | 4,44 |
| 3 | 2.1.4. Personal management skills | 4,38 |
| 4 | 2.1.1. Effective communication skills | 4,34 |
| 5 | 2.2.4. Self-reliance | 4,30 |
| 6 | 2.2.2. Openness to continuous learning and self-development | 4,29 |
| 7 | 2.1.2. Teamwork skills | 4,26 |
| 8 | 2.1.3. Decision-making skills | 4,13 |
| 9 | 2.2.5. Flexibility and adaptability | 4,12 |
| 10 | 2.2.3. Critical thinking | 4,11 |
| 11 | 2.2.1. Creativity | 3,99 |
| 12 | 2.3.2. Tolerance of diversity in the workplace | 3,75 |

Source: own elaboration.

As for hard competencies, only one was included in the key competencies (subject matter knowledge, e.g., marketing, accounting and finance, logistics, personnel management, information technology, - the last item in the key competencies). Three competencies to important (IT skills - office packages, e.g. MS Office, analytical skills - information and data processing, reasoning, general knowledge). Two to moderately important (knowledge of the first foreign language, IT skills in specialized programs) and one to unimportant (knowledge of a second foreign language). Ratings of the importance of hard competencies were much more varied than those of soft competencies (Figure 8 and Table 7).

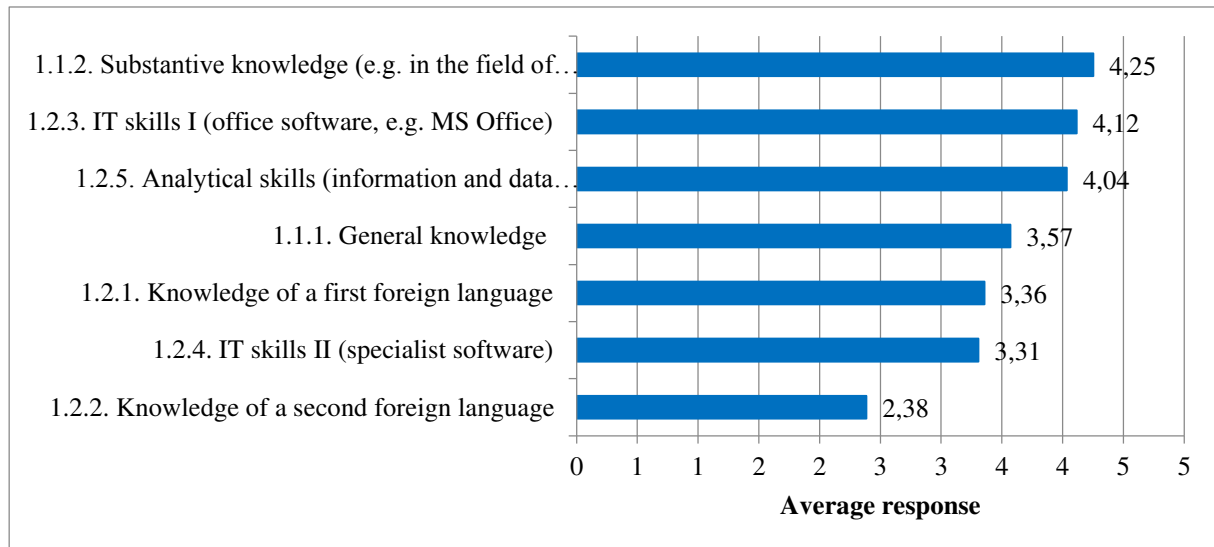


Figure 8. Importance of hard competencies of economics graduates according to employers.

Source: own study.

Table 7.

Importance of hard competencies of economics graduates according to employers

| No. | Competence | Average response |
|-----|--|------------------|
| 1 | 1.1.2. Substantive knowledge (e.g. in the field of marketing, accounting and finance, logistics, personnel management, and IT) | 4,25 |
| 2 | 1.2.3. IT skills I (office software, e.g. MS Office) | 4,12 |
| 3 | 1.2.5. Analytical skills (information and data processing, inferencing) | 4,04 |
| 4 | 1.1.1. General knowledge | 3,57 |
| 5 | 1.2.1. Knowledge of a first foreign language | 3,36 |
| 6 | 1.2.4. IT skills II (specialist software) | 3,31 |
| 7 | 1.2.2. Knowledge of a second foreign language | 2,38 |

Source: own elaboration.

The average of all responses for soft skills was 4.22, higher than the average response for hard skills of 3.57 (Figure 9). Testing using the Mann-Witney test confirmed the significance of the differences between the averages ($p < 0.001$). Thus, the statement that in the case of economics graduates, employers attach more importance to soft competencies than hard competencies turned out to be true. Thus, hypothesis H1 was positively verified. Thus, the analyses presented here prove that employers assign higher importance to soft competencies than to hard competencies.

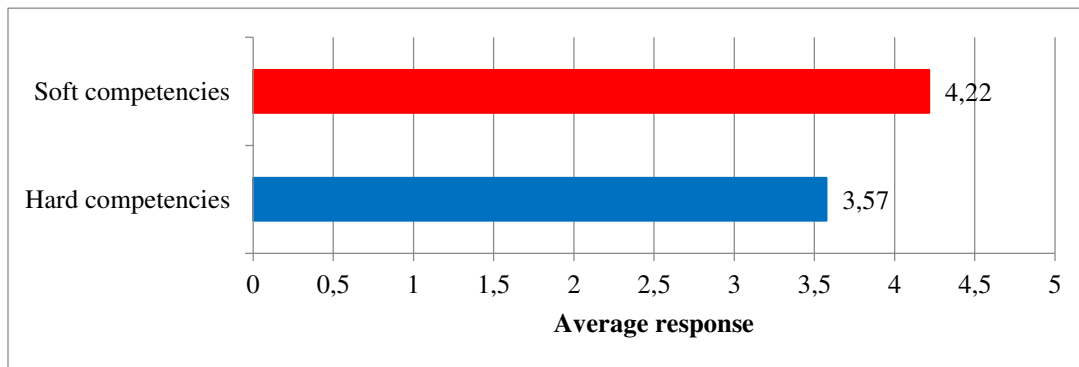


Figure 9. Average responses by soft and hard competencies.

Source: own elaboration.

Figure 10 and Table 8 shows the average responses to the question on the importance of graduate competencies by size of the surveyed companies.

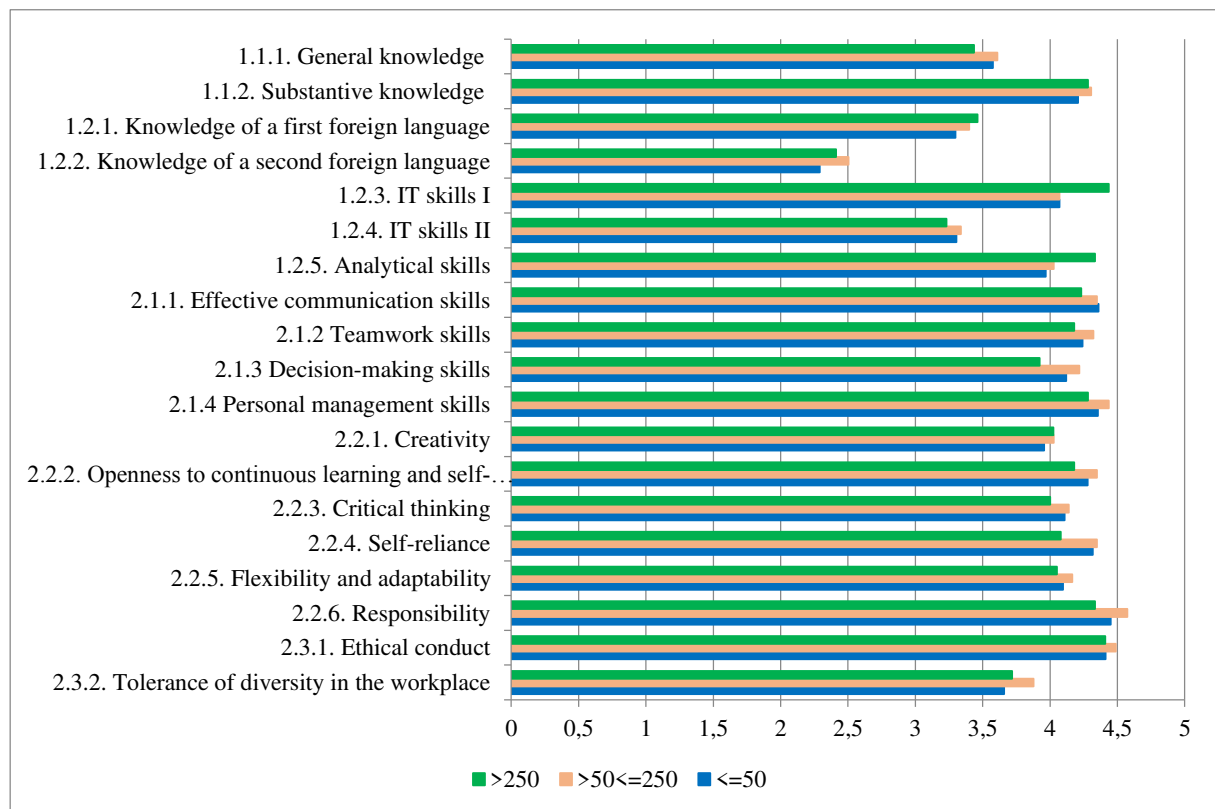


Figure 10. Average indications of the importance of competencies for each size of the surveyed companies.

Source: own study.

Table 8.

Average indications of the importance of competencies for each size of the surveyed enterprises

| No. | Competence | ≤ 50 | > 50 ≤ 250 | > 250 |
|-----|---|------|------------|-------|
| 1 | 1.1.1. General knowledge | 3,58 | 3,61 | 3,44 |
| 2 | 1.1.2. Substantive knowledge | 4,21 | 4,30 | 4,28 |
| 3 | 1.2.1. Knowledge of a first foreign language | 3,30 | 3,40 | 3,46 |
| 4 | 1.2.2. Knowledge of a second foreign language | 2,29 | 2,50 | 2,41 |
| 5 | 1.2.3. IT skills I | 4,07 | 4,07 | 4,44 |
| 6 | 1.2.4. IT skills II | 3,30 | 3,34 | 3,23 |
| 7 | 1.2.5. Analytical skills | 3,97 | 4,03 | 4,33 |
| 8 | 2.1.1. Effective communication skills | 4,36 | 4,35 | 4,23 |
| 9 | 2.1.2 Teamwork skills | 4,24 | 4,32 | 4,18 |
| 10 | 2.1.3 Decision-making skills | 4,12 | 4,22 | 3,92 |
| 11 | 2.1.4 Personal management skills | 4,35 | 4,43 | 4,28 |
| 12 | 2.2.1. Creativity | 3,96 | 4,03 | 4,03 |
| 13 | 2.2.2. Openness to continuous learning and self-development | 4,28 | 4,35 | 4,18 |
| 14 | 2.2.3. Critical thinking | 4,11 | 4,14 | 4,00 |
| 15 | 2.2.4. Self-reliance | 4,32 | 4,35 | 4,08 |
| 16 | 2.2.5. Flexibility and adaptability | 4,10 | 4,17 | 4,05 |
| 17 | 2.2.6. Responsibility | 4,45 | 4,57 | 4,33 |
| 18 | 2.3.1. Ethical conduct | 4,41 | 4,49 | 4,41 |
| 19 | 2.3.2. Tolerance of diversity in the workplace | 3,66 | 3,88 | 3,72 |

Source: own elaboration.

Statistical analysis of the respondents' answers, in terms of assessing the importance of each competency included in the model, broken down by the size of the surveyed companies, using the Kruskal-Wallis test, showed the following significant differences:

- 1.2.3 IT Skills I - between organizations with more than 250 employees and the others included in the survey,
- 1.2.5 Analytical skills - between organizations with up to 50 people and those with more than 250 people.

The revealed differences in the assessment of the importance of competencies of companies of different sizes allow us to conclude that hypothesis H2 is true, but only in the cases indicated above. Although the differences are significant from a statistical point of view, they are small in absolute terms. The remaining differences in average values from a statistical point of view are not significant.

Figure 11 and Table 9 shows the average responses to the question on the importance of individual competencies in the cross-section of the membership of the surveyed organizations in the PKD section.

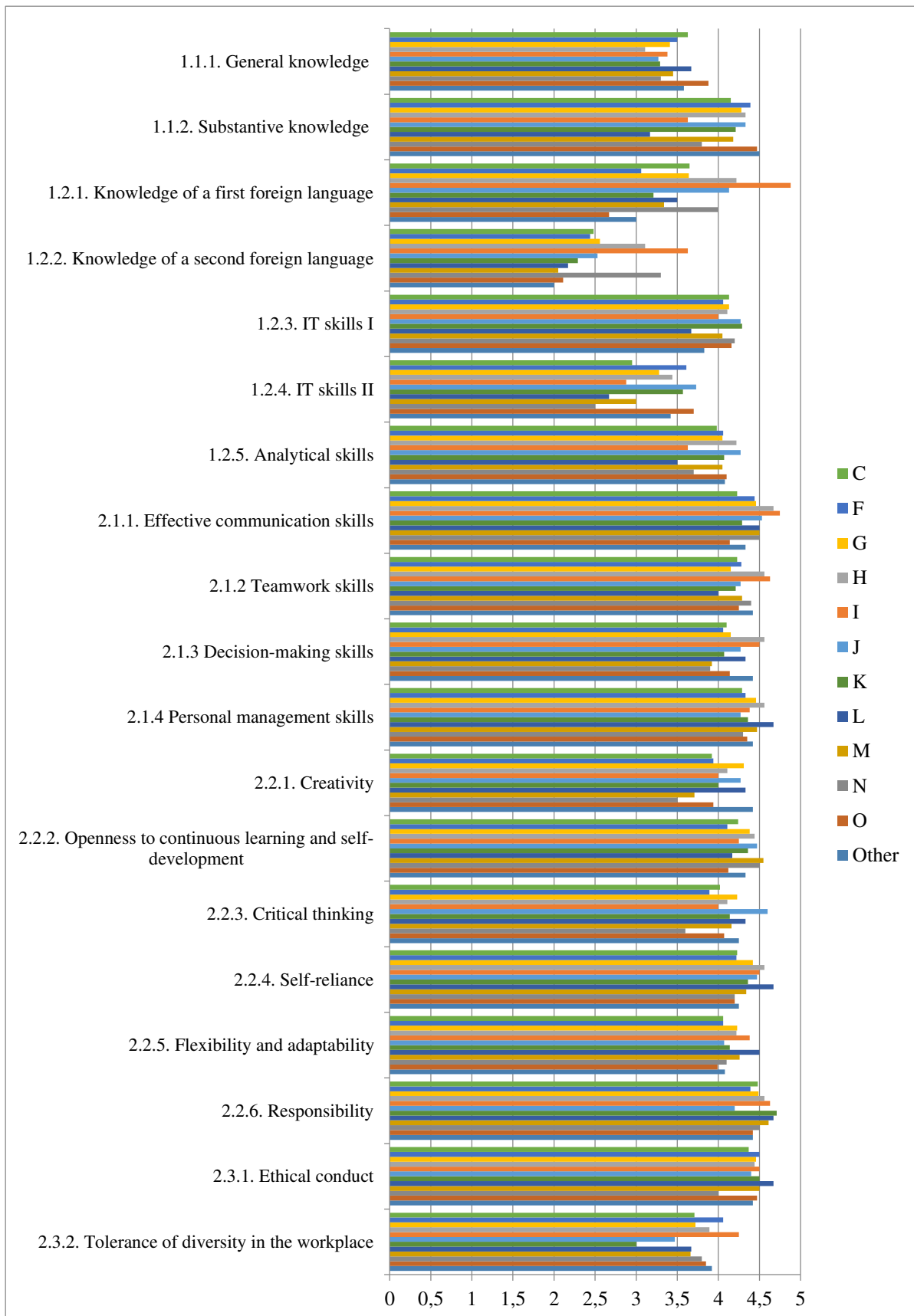


Figure 11. Average indications of the importance of competencies for all surveyed sections.

Source: own study.

Table 9.*Average indications of the importance of competencies for all surveyed sections*

| No. | Competence | Section | | | | | | | | | | | |
|-----|---|---------|------|------|------|------|------|------|------|------|-----|------|-------|
| | | C | F | G | H | I | J | K | L | M | N | O | Other |
| 1 | 1.1.1. General knowledge | 3,63 | 3,5 | 3,41 | 3,11 | 3,38 | 3,27 | 3,29 | 3,67 | 3,45 | 3,3 | 3,88 | 3,58 |
| 2 | 1.1.2. Substantive knowledge | 4,15 | 4,39 | 4,28 | 4,33 | 3,63 | 4,33 | 4,21 | 3,17 | 4,18 | 3,8 | 4,47 | 4,5 |
| 3 | 1.2.1. Knowledge of a first foreign language | 3,65 | 3,06 | 3,64 | 4,22 | 4,88 | 4,13 | 3,21 | 3,5 | 3,34 | 4 | 2,67 | 3 |
| 4 | 1.2.2. Knowledge of a second foreign language | 2,48 | 2,44 | 2,56 | 3,11 | 3,63 | 2,53 | 2,29 | 2,17 | 2,05 | 3,3 | 2,11 | 2 |
| 5 | 1.2.3. IT skills I | 4,13 | 4,06 | 4,13 | 4,11 | 4 | 4,27 | 4,29 | 3,67 | 4,05 | 4,2 | 4,16 | 3,83 |
| 6 | 1.2.4. IT skills II | 2,95 | 3,61 | 3,28 | 3,44 | 2,88 | 3,73 | 3,57 | 2,67 | 3 | 2,5 | 3,7 | 3,42 |
| 7 | 1.2.5. Analytical skills | 3,98 | 4,06 | 4,05 | 4,22 | 3,63 | 4,27 | 4,07 | 3,5 | 4,05 | 3,7 | 4,1 | 4,08 |
| 8 | 2.1.1. Effective communication skills | 4,23 | 4,44 | 4,46 | 4,67 | 4,75 | 4,53 | 4,29 | 4,5 | 4,5 | 4,5 | 4,14 | 4,33 |
| 9 | 2.1.2 Teamwork skills | 4,23 | 4,28 | 4,15 | 4,56 | 4,63 | 4,27 | 4,21 | 4 | 4,29 | 4,4 | 4,25 | 4,42 |
| 10 | 2.1.3 Decision-making skills | 4,1 | 4,06 | 4,15 | 4,56 | 4,5 | 4,27 | 4,07 | 4,33 | 3,92 | 3,9 | 4,14 | 4,42 |
| 11 | 2.1.4 Personal management skills | 4,29 | 4,33 | 4,46 | 4,56 | 4,38 | 4,27 | 4,36 | 4,67 | 4,47 | 4,3 | 4,35 | 4,42 |
| 12 | 2.2.1. Creativity | 3,92 | 3,94 | 4,31 | 4,11 | 4 | 4,27 | 4 | 4,33 | 3,71 | 3,5 | 3,94 | 4,42 |
| 13 | 2.2.2. Openness to continuous learning and self-development | 4,24 | 4,11 | 4,38 | 4,44 | 4,25 | 4,47 | 4,36 | 4,17 | 4,55 | 4,5 | 4,12 | 4,33 |
| 14 | 2.2.3. Critical thinking | 4,02 | 3,89 | 4,23 | 4,11 | 4 | 4,6 | 4,14 | 4,33 | 4,16 | 3,6 | 4,07 | 4,25 |
| 15 | 2.2.4. Self-reliance | 4,23 | 4,22 | 4,42 | 4,56 | 4,5 | 4,47 | 4,36 | 4,67 | 4,34 | 4,2 | 4,2 | 4,25 |
| 16 | 2.2.5. Flexibility and adaptability | 4,06 | 4,06 | 4,23 | 4,22 | 4,38 | 4,07 | 4,14 | 4,5 | 4,26 | 4,1 | 3,99 | 4,08 |
| 17 | 2.2.6. Responsibility | 4,48 | 4,39 | 4,49 | 4,56 | 4,63 | 4,2 | 4,71 | 4,67 | 4,61 | 4,5 | 4,42 | 4,42 |
| 18 | 2.3.1. Ethical conduct | 4,37 | 4,5 | 4,46 | 4,44 | 4,5 | 4,4 | 4,5 | 4,67 | 4,5 | 4 | 4,47 | 4,42 |
| 19 | 2.3.2. Tolerance of diversity in the workplace | 3,71 | 4,06 | 3,72 | 3,89 | 4,25 | 3,47 | 3 | 3,67 | 3,66 | 3,8 | 3,85 | 3,92 |

Source: own elaboration.

The study, on the differences in the perceived importance of competencies in the cross-section of the questioned entities' affiliation to the PKD section, showed the significance of differences between the average responses for the following competencies:

- 1.2.1. Knowledge of first foreign language,
- 1.2.2. Knowledge of a second foreign language,
- 1.2.4. Computer skills II (specialized programs),
- 2.2.1. Creativity,
- 2.2.2. Openness to learning and continuous development,
- 2.2.3. Critical thinking (logical argumentation).

The identification of significant differences gives rise to the statement of positive verification of hypothesis H3 only in the case of the above-mentioned competencies and between some sections. For the remaining competencies, the differences in mean indications are statistically insignificant.

The average responses to the question on the assessment of the importance of individual competencies included in the model in newly hired employees with the criterion of dividing the respondents by the percentage of employed economics graduates are presented in Figure 12 and Table 10. The differences in the hierarchy of the importance of individual competencies for the three categories of organizations distinguished in the study, from the point of view of the percentage of employed economics graduates, are small.

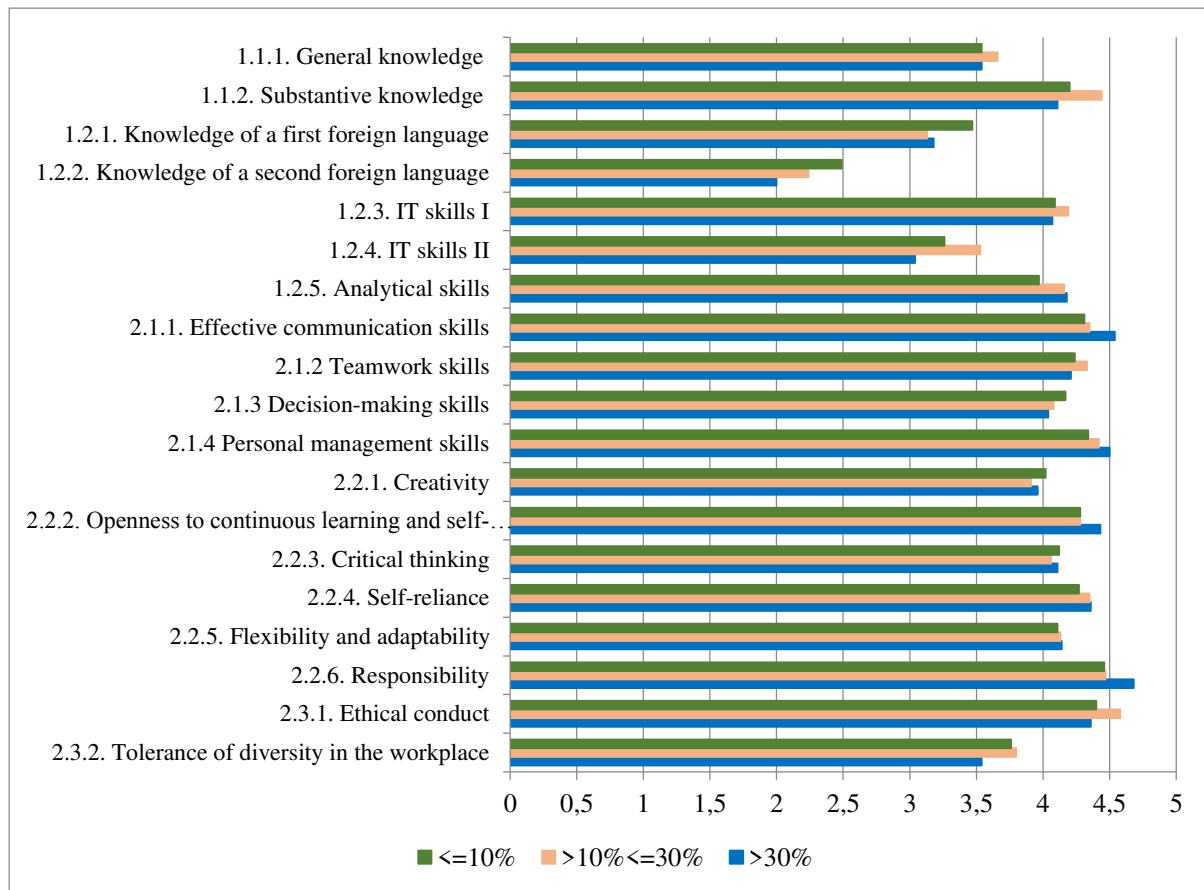


Figure 12. Average responses to the question on the importance of competencies by percentage of employed economics graduates.

Source: own study.

Table 10.

Average responses to the question on the importance of competencies in cross-section of the percentage of economics graduates employed

| No. | Competence | <= 10% | > 10% <= 30% | > 30% |
|-----|---|--------|--------------|-------|
| 1 | 1.1.1. General knowledge | 3,54 | 3,66 | 3,54 |
| 2 | 1.1.2. Substantive knowledge | 4,2 | 4,44 | 4,11 |
| 3 | 1.2.1. Knowledge of a first foreign language | 3,47 | 3,13 | 3,18 |
| 4 | 1.2.2. Knowledge of a second foreign language | 2,49 | 2,24 | 2 |
| 5 | 1.2.3. IT skills I | 4,09 | 4,19 | 4,07 |
| 6 | 1.2.4. IT skills II | 3,26 | 3,53 | 3,04 |
| 7 | 1.2.5. Analytical skills | 3,97 | 4,16 | 4,18 |
| 8 | 2.1.1. Effective communication skills | 4,31 | 4,35 | 4,54 |
| 9 | 2.1.2. Teamwork skills | 4,24 | 4,33 | 4,21 |
| 10 | 2.1.3. Decision-making skills | 4,17 | 4,08 | 4,04 |
| 11 | 2.1.4. Personal management skills | 4,34 | 4,42 | 4,5 |
| 12 | 2.2.1. Creativity | 4,02 | 3,91 | 3,96 |
| 13 | 2.2.2. Openness to continuous learning and self-development | 4,28 | 4,28 | 4,43 |
| 14 | 2.2.3. Critical thinking | 4,12 | 4,06 | 4,11 |
| 15 | 2.2.4. Self-reliance | 4,27 | 4,35 | 4,36 |
| 16 | 2.2.5. Flexibility and adaptability | 4,11 | 4,13 | 4,14 |
| 17 | 2.2.6. Responsibility | 4,46 | 4,47 | 4,68 |
| 18 | 2.3.1. Ethical conduct | 4,4 | 4,58 | 4,36 |
| 19 | 2.3.2. Tolerance of diversity in the workplace | 3,76 | 3,8 | 3,54 |

Source: own elaboration.

The Kruskal-Wallis test showed the significance of differences between the averages for only two competencies:

- 1.1.2 Substantive knowledge - between organizations employing up to 10% and organizations employing > 10% <= 30% of economics graduates,
- 1.2.1 Knowledge of the first foreign language - between organizations employing up to 10% and organizations employing in the range of > 10% <= 30% of economics graduates.

The identified differences make it possible to conclude that hypothesis H4 has been positively verified only in the cases mentioned above. The differences between the average indications for the other competencies in the analyzed cross-section (percentage of employed graduates of economic studies) should be considered insignificant.

5. Summary

The survey conducted indicates that employers perceive soft competencies of economics graduates as more important than hard competencies. The most desirable soft competencies they expect from economics graduates are responsibility, ethical conduct, ability to organize own work and ability to communicate effectively. Among hard competencies, employers consider subject matter knowledge in marketing, accounting and finance, logistics, personnel management and information technology, IT skills (such as office packages, e.g. MS Office) and analytical skills (information and data processing, reasoning) to be the most important. On the other hand, knowledge of a second foreign language is considered the least important competency.

For the most part, differences in the perceived importance of competencies by employers of economics graduates do not depend on the size of the company, the industry in which the company operates or the percentage of economics graduates employed at the company. Only two competencies out of 19 were found to depend on the size of the enterprise, six competencies were found to depend on the industry, and two were found to depend on the percentage of economics graduates employed at the enterprise.

The dynamics of changes in the socio-economic and technological environment of enterprises creates the need for continuous monitoring of the degree to which the competencies of economics graduates match current and future expectations of employers. Recognizing the competence needs reported by employers should therefore lead to a reorientation of study programs, apprenticeship programs, as well as the instruments used - methods and techniques of student education.

Further research in this area will be related to the identification of competencies required from the perspective of new challenges, such as digitization and the replacement of human labor by artificial intelligence.

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EMPLOYING NEURODIVERSE PEOPLE ANALYSIS OF MANAGEMENT'S OPINIONS

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Purpose: This study aims to determine the employment opportunities of neurodiverse people, related to the assessment of the suitability of their skills and the adaptation of working conditions to their needs by the managers in Poland.

Design/methodology/approach: We evaluated the above-mentioned employment opportunities on the basis of a statistical analysis of empirical data collected among the 51 managers of various organisational entities in a Polish company.

Findings: Having studied the opinions of managers, we found that most of the unique skills of neurodiverse workers are perceived as valuable. At the same time, some critical adaptations required to meet their needs are regarded as problematic and thus may potentially pose a barrier to broader employment of neurodiverse people. In addition, the obtained results deepen the previous findings of researchers on the basis of the science of management and quality by verifying whether there is a relationship between managers' assessment of the usefulness of the skills of neurodiverse people and possible, in the opinion of managers, adaptations of working conditions.

Research limitations/implications: The limitation of the conducted research is the number of managers who took part in the survey. It needs to be emphasized that due to the purpose of the study, number of respondents was less important than the diversity of organisational entities, which they represented. Nevertheless, conducted research contributes to raising awareness of neurodiversity and may be the basis for further research.

Practical implications: The practical rationale for undertaking research in this area is the five times lower employment rate of neurodiverse people in Poland compared to the average for the European Union. The awareness of the managers' opinions about mentioned issues allows for institutional and organizational solutions to be prepared thus to increase the employment of these people.

Originality/value: To the best of the authors' knowledge, this is the first paper to examine employment opportunities of neurodiverse people in various organisational entities in a company. Findings from this study may be of interest to various groups, including neurodiverse people, organizations, state institutions and other researches.

Keywords: neurodiversity, autism, employment, skills, adaptation of working conditions.

Category of the paper: Research paper.

1. Introduction

The term neurodiversity, as adopted, refers to the cognitive differences within the human species that characterize high-functioning autism (Jaarsma, Welin, 2012, p. 20; Silberman, 2017, p. 23). The adoption of such a way of perceiving neurodiversity is consistent with its original understanding and results from the specific conditions and characteristics of autism compared to other neurodevelopmental differences, i.e. ADHD, dyslexia, dyscalculia, etc. The term "high-functioning autism" (HFA) refers to communication skills - verbal communication (Jaarsma, Welin, 2012, p. 20). In the light of the adopted assumptions, neurodiversity can therefore be treated as a variant of human diversity with specific advantages (Silberman, 2017, p. 23).

The belief that it is possible to build a competitive advantage based on the use of diverse human resources is strongly embedded in the science of management and quality. Although the dimensions of this diversity include disability (Loden, Rosener, 1991), the issue of neurodiversity thus far has not been included in it.

The findings of the researchers in the science of management and quality in the above-mentioned scope concern essentially two areas: the benefits for organizations resulting from the employment of autists and the need to adapt working conditions to their needs (Austin, Pisano, 2017; Whelpley, Perrault, 2021; Carrero et al., 2019; Mpofu et al., 2019).

Researchers point to the deficiency in research on neurodiversity and present proposals for deepening (Spoor et al., 2021; Mellifont, 2020; Richards, Sang, 2016) or extending the research carried out by taking into account other data (Priscott, Allen, 2021). In particular, there is an insufficient number of empirical studies in this area, which results in the lack of a consistent methodology for managing neurodiversity (Doyle, McDowall, 2021).

In management practice, an important question is to determine how managers perceive the usefulness of skills of neurodiverse employees and whether they are willing to adjust working conditions to their needs. Therefore, it seems particularly important in Poland, where the employment rate is ten times lower than the European average and amounts to only 2%, which may result from the low awareness of the management of organizations about neurodiversity.

We have conducted empirical research in response to the mentioned research gap and due to the low employment rate of people with autism in Poland.

The purpose of the conducted research was to empirically verify the usefulness of the skills of neurodiverse people for achieving goals, as perceived by the heads of organizational entities, and the possibility of adjusting working conditions to their needs.

The research was targeted at the management of the Water Authority of the City of Cracow which is the largest water supply and sewage company in the Lesser Poland Voivodeship. The choice of this enterprise was based on the size of employment, employing both manual and white-collar workers and the diversified scope of tasks of, which in the authors' opinion, increases the chance of identifying those among individual organizational entities of the enterprise with the greatest employment opportunities for neurodiverse people.

2. Neurodiversity in the organization - the results obtained from the literature review

First of all, considering employment opportunities for neurodiverse people in organizations requires to show the scale of occurrence and specificity of autism. In the European Union, the number of people with autism is estimated at 5 million (0.6%). It is worth noting that the number of diagnoses of autism is growing dynamically whereas in the 1980s it was diagnosed in one in every 2000 children (0.05%) and currently in 3 to 6 children in every 1000 (0.3-0.6%).

In Poland, the diagnosis of autism was started in the 1980s and its specificity was not taken into account in the disability adjudication system until 2010. Currently, according to the data of the Electronic National Disability Assessment Monitoring System, the judgments about autism or Asperger's syndrome constitute 20% of all certificates of disability issued in 2010-2019. As a result, it can be assumed that 45000 diagnosed people in Poland does not fully reflect the scale of the phenomenon (Supreme Audit Office, 2020, p. 6).

The International Statistical Classification of Diseases and Health Problems went into effect in Poland on the 1st of January 2022. The criteria for diagnosing the AUTISM SPECTRUM DISORDER, according to the ICD-11 for Mortality and Morbidity Statistics:

1. Persistent deficits in initiating and sustaining social communication and reciprocal social interactions that are outside the expected range of typical functioning given the individual's age and level of intellectual development. Specific manifestations of these deficits vary according to chronological age, verbal and intellectual ability, and disorder severity.
2. Persistent restricted, repetitive, and inflexible patterns of behaviour, interests, or activities that are clearly atypical or excessive for the individual's age and sociocultural context.
3. The onset of the disorder occurs during the developmental period, typically in early childhood, but characteristic symptoms may not become fully manifest until later, when social demands exceed limited capacities.

4. The symptoms result in significant impairment in personal, family, social, educational, occupational or other important areas of functioning. Some individuals with Autism Spectrum Disorder are able to function adequately in many contexts through exceptional effort, such that their deficits may not be apparent to others. A diagnosis of Autism Spectrum Disorder is still appropriate in such cases.

It should be emphasized that, in accordance with the concept of neurodiversity, the above-mentioned differences in the cognitive mechanisms characterizing people with autism constitute a natural variance within the human species (Jaarsma, Welin, 2012, p. 20) and are distinguished by "specific advantages that contributed to the development of technology and culture" (Silberman, 2017, p. 23). It is recognized that "differences make us individuals – the way we deviate from the norm, differences in the structure of the brain" (Grandin, Panek, 2021, p. 142).

In this approach, it is noticed that neurodivergent people have special skills, abilities and aptitudes, which include:

- the ability to perceive details in an isolated way, focus on a selected action (Lorenz, Heinitz, 2014, as cited in Roberson et al., 2021, p. 409),
- the ability to remember and analyse large amounts of data (Austin, Pisano, 2017, p. 97),
- associative thinking, creativity, predispositions in terms of routine work (Grandin, Panek, 2021, pp. 163-178, 266, 267),
- strict adherence to the rules (Baron-Cohen et al., 2009, pp. 1377-1383).

Making use of the specific skills of neurodiverse people can contribute to gaining a competitive advantage, increasing productivity, improving quality, innovation and employee engagement (Austin, Pisano, 2017, pp. 96-103) as well as improving the image of the organization (Whelpley, Perrault, 2021, pp. 210, 213, 215).

Despite the undoubted economic benefits for the organization, the employment of neurodiverse people remains at a low level (Roux et al., 2015, after Krzemińska et al., 2019, p. 453). In Poland, the employment rate of people with autism is 2%, while in the European Union it is 10% (Polish Economic Institute, JIM Foundation, 2022, p. 4).

The reason for the low employment is the lack of knowledge of the specificity of autism and the special skills of neurodiverse people among employers and organizations of the labour market environment and difficulties in adapting human resource management practices to the specificity of their functioning (Wehman et al., 2016, pp. 61-72).

The need to ensure non-standard working conditions (Krzemińska et al., pp. 455, 456) results from the difficulties experienced by people with autism and includes:

- resignation from the job interview (due to communication difficulties, as indicated by: Szulc et al., 2021, pp. 858-872),
- ensuring unchanging working conditions, the possibility of choosing the way of performing work and reducing the number of social interactions (related to attachment to routine, striving for predictability: Prizant, Fields-Meyer, 2017, pp. 28, 32, 34, 37, 56, 82, 86, 99, 146),
- reduction of sensory stimuli (caused by sensory hypersensitivity: Grandin, 2021, pp. 99, 102),
- accepting a different way of thinking and providing support in difficult emotional situations (due to the emotional lability of neurodiverse people: Prizant, Fields-Meyer, 2017, pp. 28, 32, 34, 37, 56, 82, 86, 99, 146).

Based on the analysis of the literature review, an attempt was made to determine the employment opportunities of neurodiverse people, related to the assessment of the suitability of their skills and the adaptation of working conditions to their needs by the managers in Poland.

3. Methods

The research is based on the survey conducted on the managers of Cracow Water Authority. We surveyed all of the 51 managers employed in the company. The diagnostic tool used was a survey questionnaire composed of questions related to the two domains:

- possibilities to adjust working conditions to the specific needs of neurodiverse people,
- suitability of the skills of neurodiverse people to the tasks supervised by the surveyed managers.

The study aimed to determine the possibilities and areas of using the potential of neurodiverse people in the workplace.

In the first question we asked the respondents to determine which of the listed skills/abilities/predispositions of neurodiverse employees may contribute to achieving the goals of the organizational units they manage. Among the mentioned characteristics are:

- ability to focus on a chosen task/aspect of action,
- ability to isolate details,
- ability to remember and analyze large amounts of information,
- creativity (unconventional thinking),
- associative thinking,

- predisposition to routinized tasks (preference for repetitive tasks),
- rigid adherence to rules and regulations.

The second question concerned the possibility of introducing the following adaptations to the needs of neurodiverse people in the workplace:

- forgoing the job interview,
- providing the ability to choose a way of working,
- restricting sensory stimuli (diversity and intensity of sounds/colors/smells/textures),
- ensuring unchanging work conditions,
- providing support in emotionally difficult situations,
- accepting different ways of thinking by colleagues,
- limiting the number of interpersonal interactions.

Responses to the survey questions were measured on the Likert scale.

Given the diversity of the jobs performed in the studied company, we expect the responses to be clustered around the specific jobs. Thus, we propose to analyse the data with the hierarchical clustering techniques. When using hierarchical clustering, a tree-based model is produced, with the root including the entire sample we want to divide, and the leaves of the model containing individual data points. In this study, we used the well-known Ward's clustering criterion (Murtagh, 2014). We used the numeric representatives of the survey questions as inputs to the clustering algorithm, so we treated our data as an interval one, and we assigned a value from 1 (Strongly disagree) to 5 (Strongly agree) to our 5-point Likert scale [i].

Having identified the clusters, we examine and assess specific attitudes towards neurodiverse workers within the detected groups. To objectize the analysis, we use a pairwise t-test with Holm correction (Holm, 1979) to test the null hypothesis that the means for a given response in the detected clusters are equal. On this basis, statistically significant differences in the opinions of the respondents were identified.

4. Results

Among the proposed adjustments, in the opinion of the majority of respondents (Figure 1), it is possible to:

- Provide support in emotionally difficult situations.
- Accept different ways of thinking by colleagues.

In other cases, the majority of surveyed managers deny the possibility of implementing the adjustments. In particular, it relates to forgoing the job interview.

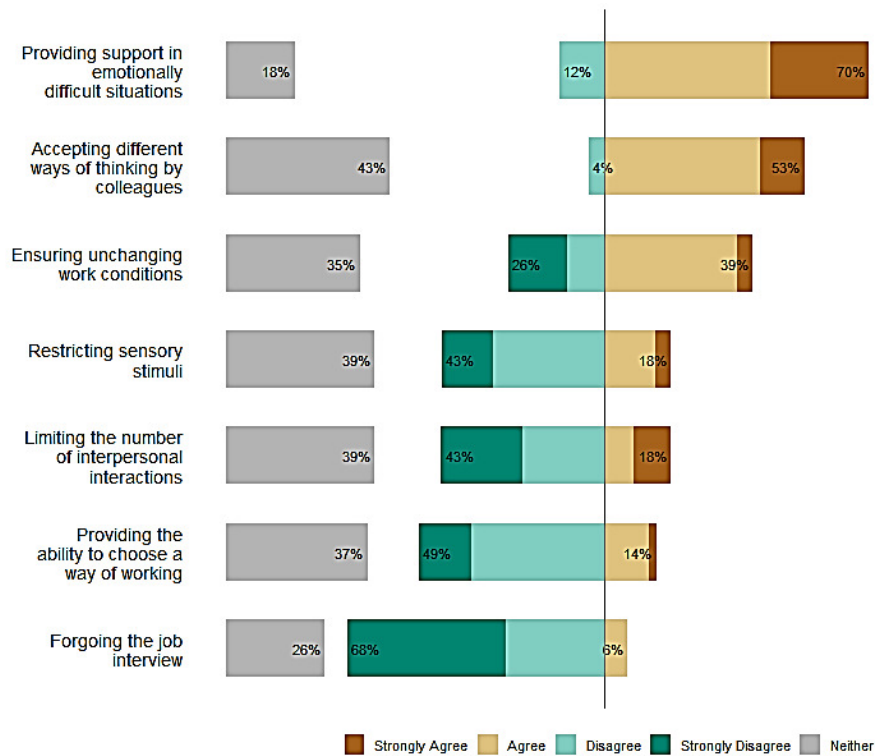


Figure 1. Please specify the possibility of introducing the following adjustments of working conditions to the needs of neurodiverse people in the organizational unit managed by you.

Source: Own elaboration based on the conducted questionnaire research.

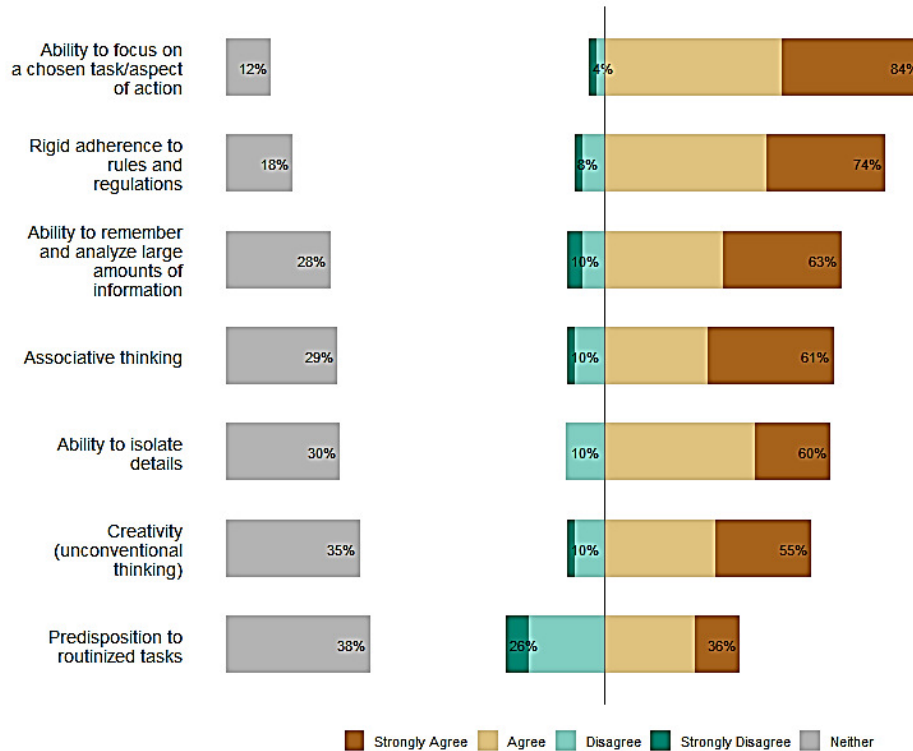


Figure 2. Please specify which of the following skills/abilities/predispositions of neurodiverse employees can contribute to achieving the objectives of the organizational unit you manage.

Source: Own elaboration based on the conducted questionnaire research.

The graph (Figure 2) shows a definite advantage of positive assessments of the usefulness of skills of neurodiverse people. Only in the area of predisposition to routinized tasks, there was a predominance of answers denying its usefulness in the process of achieving the goals of an organizational unit. Among the skills of neurodiverse people, the majority of surveyed managers found them useful:

- Ability to focus on a chosen task/aspect of action (84% of respondents).
- Rigid adherence to rules and regulations (74% of respondents).

On this basis, a conclusion can be drawn about the positive perception of the unique abilities, skills and predispositions of neurodiverse people and the possibility of using them in the process of achieving goals in various functional areas of the company's activity.

However, one should be cautious in overly optimistic interpretation of the obtained results. In addition to the unique abilities, skills and predispositions included in the study, neurodiverse people experience difficulties in the area of communication, interpersonal relationships and repetitive patterns of behaviour and interests. The second part of the survey, in which the possibility of adapting working conditions was assessed, includes a reference to these difficulties. For this reason, the conclusions ought to be formulated together.

It is therefore worth noting that in the areas where neurodiverse people experience difficulties (these are also the diagnostic criteria for autism), the majority of respondents denied the possibility of adaptation. These are the following adjustments to working conditions:

- Forgoing the job interview (denied by 94% of respondents).
- Providing the ability to choose a way of working (denied by 86% of respondents).
- Restricting sensory stimuli (diversity and intensity of sounds/colors/smells/textures) (denied by 82% of respondents).
- Limiting the number of interpersonal interactions (denied by 82% of respondents).

Therefore, taking into account the possibilities of adjustment in areas specific to autism, the results in terms of the usefulness of skills of neurodiverse people are not so favourable.

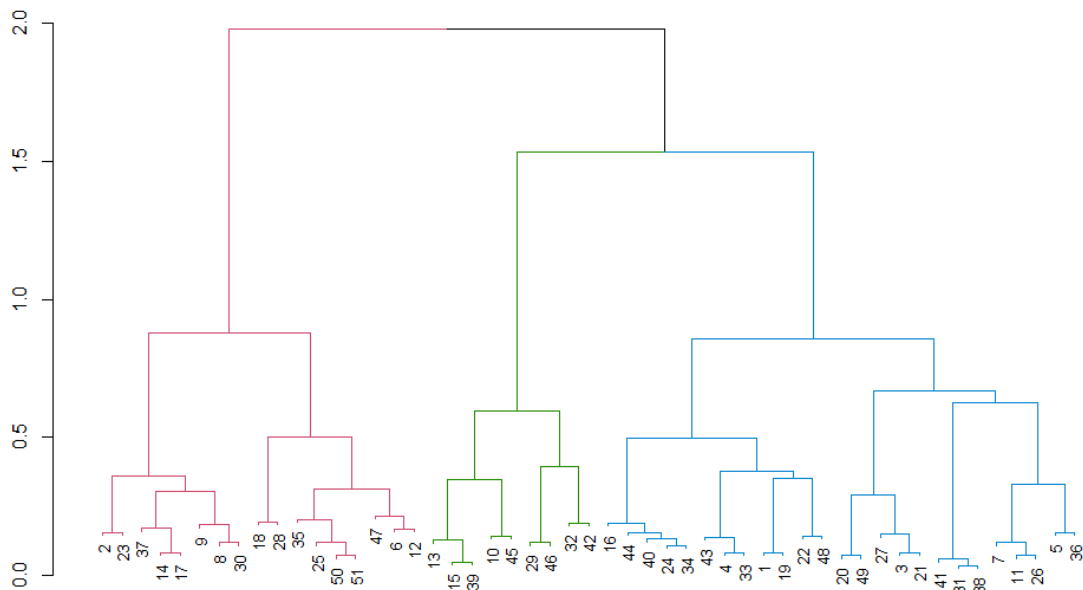


Figure 3. Outcome of the cluster analysis with responses to the questions on the possibilities to **adjust working conditions** as clustering variables.

Source: Own elaboration based on the conducted questionnaire research.

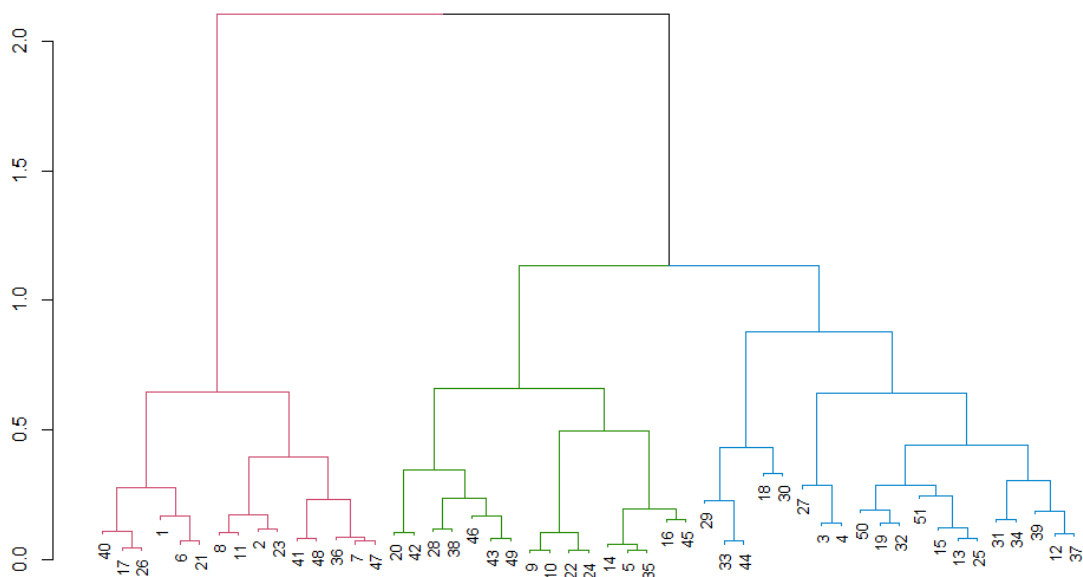


Figure 4. Outcome of the cluster analysis with responses to the questions on the **suitability of neurodiverse workers skills** as clustering variables.

Source: Own elaboration based on the conducted questionnaire research.

The conducted cluster analysis (Figure 3 and Figure 4) shows that the skills of neurodiverse workers can be useful in various organizational units of the company. As a result of the application of the cluster analysis, we expected to obtain groups that bring together organizational units of the enterprise similar in terms of tasks performed. However, it emerged that the resulting clusters are not related to the functional areas of the company and to the

implementation of mental/manual tasks by these organizational units [ii]. The same conclusions may apply to the possibility of adapting working conditions to the needs of neurodiverse people. This means that the mentioned possibilities were similarly assessed by organizational units representing various functional areas of activity and differentiated by the type of work performed (manual/mental).

Table 1.

Variables' means. Clusters based on the responses to the questions on the possibilities to adjust working conditions

| Variable | Cluster | | |
|--|--------------------------|--------------------------|--------------------------|
| | A | B | C |
| Ability to focus on a chosen task/aspect of action | 4,52 ^{BC} | 3,94 ^A | 3,56 ^A |
| Ability to isolate details | 3,68 | 3,94 | 3,33 |
| Ability to remember and analyze large amounts of information | 3,80 | 3,94 | 3,56 |
| Creativity (unconventional thinking) | 3,84 ^C | 3,88 ^C | 2,89 ^{AB} |
| Associative thinking | 4,08 ^c | 3,82 | 3,11 ^a |
| Predisposition to routinized tasks (preference for repetitive tasks) | 3,28 | 3,06 | 3,00 |
| Rigid adherence to rules and regulations | 4,08 | 3,76 | 4,00 |
| Forgoing the job interview | 1,28^{BC} | 2,44^{AC} | 3,00^{AB} |
| Providing the ability to choose a way of working | 2,08^B | 3,24^{AC} | 2,44^B |
| Restricting sensory stimuli (diversity and intensity of sounds/colors/smells/textures) | 2,60 | 2,88 | 2,33 |
| Ensuring unchanging work conditions | 2,68^B | 3,76^{AC} | 2,56^B |
| Providing support in emotionally difficult situations | 3,00^C | 3,35^C | 1,44^{AB} |
| Accepting different ways of thinking by colleagues | 2,40^B | 3,12^{AC} | 2,22^B |
| Limiting the number of interpersonal interactions | 2,00^B | 3,59^{AC} | 2,56^B |

Note: letter A, B, C in the upper index refer to the p-value of the pairwise t-test (with Holm correction) with the null hypothesis of equal means. Upper case letter points to clusters with means statistically different at $p < 0.05$. Lower case letter points to clusters with means statistically different at $p < 0.1$

Source: Own elaboration based on the conducted questionnaire research.

At first, we turn to the analysis of clusters identified on the basis of responses to survey questions on the possibilities to adjust working conditions. The characteristics of the discovered clusters are presented in Table 1. Out of the 3 clusters, group B is marked by higher possibilities of adjusting working conditions in terms of:

- providing the ability to choose a way of working;
- ensuring unchanging work conditions;
- providing support in emotionally difficult situations;
- accepting different ways of thinking by colleagues;
- limiting the number of interpersonal interactions;
- average possibilities of Forgoing the job interview.

The cluster B lumps together, among others, the following organizational units: management office, administration department, environmental protection team, technical department. These units employ both white-collar and manual workers and carry out various functional tasks.

Concurrently, managers in cluster B assess the usefulness of the skills of neurodiverse people, such as creativity (unconventional thinking), higher than cluster C and the ability to focus on a chosen task/aspect of action lower than Cluster A. We presume that these results illustrate organizational specificity - organizational units where employee creativity is important are also characterized by greater opportunities to adjust working conditions. In this context, it is worth noting higher ratings of managers of organizational units from cluster B in terms of the ability to: isolate details and remember and analyse large amounts of information (although these results are statistically insignificant). Such an interpretation is confirmed by the relatively low values of the following variables in cluster B (bearing in mind the fact that they are not statistically significant):

- predisposition to routinized tasks (preference for repetitive tasks),
- rigid adherence to rules and regulations.

Table 2.

Variables' means. Clusters based on the responses to the questions on the suitability of neurodiverse workers' skills

| Variable | Cluster | | |
|--|--------------------|--------------------|--------------------|
| | A | B | C |
| Ability to focus on a chosen task/aspect of action | 4,67 ^B | 3,80 ^A | 4,13 |
| Ability to isolate details | 4,27 ^B | 3,16 ^{AC} | 3,81 ^B |
| Ability to remember and analyse large amounts of information | 4,53 ^{cB} | 3,25 ^{Ac} | 3,81 ^{ab} |
| Creativity (unconventional thinking) | 4,60 ^{BC} | 3,45 ^A | 3,13 ^A |
| Associative thinking | 4,93 ^{BC} | 2,90 ^{AC} | 3,94 ^{AB} |
| Predisposition to routinized tasks (preference for repetitive tasks) | 3,00 ^c | 2,74 ^C | 3,81 ^{AB} |
| Rigid adherence to rules and regulations | 4,20 ^B | 3,45 ^{AC} | 4,38 ^B |
| Forgoing the job interview, | 1,87 | 2,05 | 1,94 |
| Providing the ability to choose a way of working | 2,80 | 2,40 | 2,44 |
| (e.g. cont. Table 2) | | | |
| Restricting sensory stimuli (diversity and intensity of sounds/colors/smells/textures) | 2,73 | 2,65 | 2,56 |
| Ensuring unchanging work conditions | 2,53 | 3,20 | 3,25 |
| Providing support in emotionally difficult situations | 3,13 | 2,74 | 2,69 |
| Accepting different ways of thinking by colleagues | 2,67 | 2,60 | 2,56 |
| Limiting the number of interpersonal interactions | 2,20 | 2,75 | 2,88 |

Note: letter A, B, C in the upper index refer to the p-value of the pairwise t-test (with Holm correction) with the null hypothesis of equal means. Upper case letter points to clusters with means statistically different at $p < 0.05$. Lower case letter points to clusters with means statistically different at $p < 0.1$.

Source: Own elaboration based on the conducted questionnaire research.

Using responses to the survey questions on the suitability of the neurodiverse workers' skills as input to the clustering algorithm, we obtain different divisions (see Table 2 for the characteristics). The results confirm the distinction between managers that are concerned mostly on rule-based and routinized behavior, and the managers who value creativity, isolating details and associative thinking.

The highest assessments of the usefulness of the skills of neurodiverse people were recorded in group A, which highly values:

- ability to focus on a chosen task/aspect of action,
- ability to isolate details,
- ability to remember and analyse large amounts of information,
- creativity (unconventional thinking),
- associative thinking.

At the same time, managers of organizational units in cluster A rated relatively low:

- predisposition to routinized tasks (preference for repetitive tasks),
- rigid adherence to rules and regulations.

Comparing cluster A to other groups, we see rather limited evidence on the concurrence of high adaptation possibilities and high assessments of the skills of neurodiverse workers. Looking for a confirmation of the relationship between possibilities to adjust working condition and valuing skills connected to creativity (visible in clusters presented in Table 1), we found more nuanced outcomes. The group of managers valuing these skills are rather skeptical to limit the number of interpersonal interactions and to ensure constant working conditions, but they see possibilities to provide the ability to choose a way of working, and to provide support in emotionally difficult situations.

5. Conclusion

In this article neurodiversity is associated with autism and can therefore be treated as a variant of human diversity with specific advantages (Silberman, 2017, p. 23). The literature indicates a number of benefits resulting from the employment of neurodiverse people, the achievement of which requires appropriate adjustments to working conditions. Taking into consideration the paucity of empirical research in management and quality sciences and the context of the low employment of neurodiverse people in Poland we set out to check employment opportunities for neurodiverse people related to the usefulness of their specific skills and possibility of adjusting working conditions to their needs. For this purpose we used the results of a survey conducted among the executives of the Water Authority of the City of Cracow. The results were subjected to statistical analysis using hierarchical clustering techniques.

Analysis of respondents' answers shows a definite advantage of positive assessments of the, described by various authors, usefulness of skills of neurodiverse people in the process of achieving the objectives of organizational units. In particular, their managers found the following useful: ability to focus on a chosen task/aspect of action and rigid adherence to rules

and regulations. Only in the area of predisposition to routinized tasks, there was a predominance of answers denying its usefulness.

It is worth noting that in the areas where neurodiverse people experience difficulties, the majority of respondents denied the possibility of adaptation. The following adjustments to working conditions found little support among surveyed managers: forgoing the job interview, providing the ability to choose a way of working, restricting sensory stimuli (diversity and intensity of sounds/colours/smells/textures), limiting the number of interpersonal interactions.

The conducted cluster analysis shows that the skills of neurodiverse workers can be useful in various organizational units of the company, which are not related to the functional areas of the company and the implementation of mental/manual tasks by these organizational units. The same conclusions may apply to the possibility of adapting working conditions to the needs of neurodiverse people. The analysis also revealed that the groups of managers who place the greatest value on the unique skills of neurodiverse people are not the ones who are most eager to adapt working conditions. The lack of correlation between the ability to adapt to these conditions and the assessment of the usefulness of the skills may be an impediment to broader participation of neurodiverse workers in the labour market. Our analysis, on the other hand, revealed that there are units across different organizational areas where conditions are adaptable and where skills - particularly those related to creativity - are valued. These specific units may be the best places to hire neurodiverse people. The follow-up studies, which we aim to undertake in the future, can build upon this finding.

These results correspond to the researchers' findings regarding the possibility of gaining a competitive advantage (in this study, we referred to it as the achievement of the goals of an organizational unit) based on various human resources. In the light of the findings of our study, a potential barrier to employment of these people may be indicated in the literature as a necessity to adapt working conditions to the needs of neurodiverse people. For this reason, the obtained results may be the basis for further analyses of both management theoreticians and practitioners. Further research in the area may result in finding solutions to increase employment which are possible to be implemented in enterprises. The outcome may also be useful to public institutions in Poland, which could gain measurable benefits for the state budget by increasing the employment of neurodiverse people.

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Footnotes

- [i] See (Wu, Leung, 2017) for the discussion on the controversy behind such a treatment.
- [ii] Organizational units highly evaluating the skills of neurodiverse employees include a variety of departments, such as: Department of the Water Supply System, Financial Department, IT department, Customer service centre, Investment implementation department, Warehouse of the purchasing department and Technical department.

THE USE OF THE TAX ON MEANS OF TRANSPORT AS AN INSTRUMENT AFFECTING THE NUMBER OF ELECTRIC AND HYBRID VEHICLES – A CASE STUDY

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Purpose: The aim of the work is to determine whether and how the local government authorities of the largest cities in Poland apply reliefs and exemptions in the tax on means of transport to support owners of hybrid and electric trucks. In addition, an answer was sought to the question whether the amount of the aforementioned preferences was correlated with the dynamics of the number of vehicles powered in whole or in part by electricity in the analyzed period.

Methodology: The study covered all 63 cities in Poland with poviats rights. The resolutions adopted by the local government authorities of these centers in 2018-2020 regarding the rates of tax on means of transport were reviewed. Based on the texts of legal acts, the criteria used for granting tax preferences were defined, the amount of reliefs was calculated, and the statistical tool in the form of the Pearson correlation coefficient was used to check whether there is a relationship between the scale of tax benefits and the growth rate of the number of hybrid and electric vehicles.

Findings: It was found that only half of the municipalities used reduced tax rates in the analyzed period, while different requirements regarding the level of exhaust gas emissions were adopted in different local government units, so that owners of hybrid and electric trucks in individual cities could usually benefit from the reduction on an equal footing with owners of similar vehicles with lower but also different emission standards from Euro 1 to Euro 6.

Practical implications: The results of the research can be used by local governments. They show, among other things, that the mere reduction of tax rates is insufficient for the promotion of environmentally friendly means of transport and that these activities should also be supported by other solutions.

Originality/value: In the literature, the subject of differentiation of tax rates on means of transport to stimulate the increase in the number of rolling stock powered by electricity has not been generally taken up so far or has been the subject of research very rarely.

Keywords: local government, tax, means of transport, hybrid and electric drive.

Category of the paper: Research paper.

1. Introduction

The need to protect the natural environment is a challenge for many entities managing the economy and operating at various levels, including local government units. They are equipped with a whole range of competences, the use of which should have a positive impact on the condition of natural resources and the possibility of exploring them in a manner consistent with the principles of sustainable development. It is worth noting that conservation activity is an important component of this concept, and local authorities have an important role to play here, which has been emphasized in many works dedicated to sustainable development for many years (Harris, 2000; OECD, 2002; Kates et al., 2005). Although the legal systems in force in individual countries differ from each other in terms of the scope of powers of local officials in the field of environmental protection (Mazur, 2011, p. 12), there are objectively observed possibilities for local governments to influence pro-ecological behavior, inter alia, by using economic instruments, including tax (European Commission, 2012, p. 23). Tools of this type include the tax on means of transport. For example, as stated in one of the OECD reports published in December 2020, in every third out of 37 member countries of this organization it is local authorities that tax the possession or use of motor vehicles. The same study points out that in most of these countries, when determining tax rates, the level of carbon dioxide emissions is taken into account (OECD, 2020).

Poland is one of the countries where local authorities are empowered to apply different rates of tax on means of transport. In the Polish legal system, the tax on means of transport is regulated by the Act of 12 January 1991 on Local Taxes and Fees (Act, 1991). Pursuant to Article 8 of this legal act, this tax is subject to taxation:

- Trucks with a maximum permissible weight of more than 3.5 tonnes and less than 12 tonnes and equal to or greater than 12 tonnes.
- Tractors and ballast tractors adapted for use together with a semi-trailer or a trailer with a permissible total weight of a combination of vehicles from 3.5 tonnes and less than 12 tonnes and equal to or greater than 12 tonnes.
- Trailers and semi-trailers which, together with the motor vehicle, have a permissible total weight of 7 tonnes and less than 12 tonnes and equal to or greater than 12 tonnes, except for those related solely to agricultural activity conducted by an agricultural tax payer.
- Buses.

The amount of tax rates on means of transport is determined by the commune council by way of a resolution, with the legislator adopting upper quota limits (Art. 10). The tax obligation rests with natural persons and legal persons who own vehicles (Art. 9). Article 12 gives municipal councils the right to introduce additional objective exemptions other than those provided for in the Act, excluding exemptions for trucks, tractors, trailers and semi-trailers with a weight equal to or greater than 12 tons.

It is reasonable to ask whether and to what extent local government authorities want to use these powers to improve air quality by giving tax advantages to owners of vehicles using those types of propulsion that can be considered relatively the most environmentally friendly. Another important issue seems to be the effectiveness of such an impact. These problems will be discussed in this paper on the example of a group of the largest cities that, in the Polish local government conditions, operate with *poviat* rights. The subject of interest is the tax levied on owners of trucks with hybrid or electric drive in 2018-2020. The aim of the work is, in particular, to find answers to the following questions:

- Do local government entities managing cities introduce lower tax rates on means of transport or tax exemptions for owners of trucks with hybrid and electric drive and what is the scale of preferences?
- What are the benchmark criteria for benefiting from the preferential tax rate?
- Does the application of higher discounts lead to a faster increase in the number of hybrid and electric vehicles?

2. Literature review

Taxes are more and more often perceived in the literature as tools the use of which can positively affect the state of the environment and its protection. Some works emphasize, among other things, that a properly constructed tax system can stimulate the desired attitudes, both rewarding for commitment and discouraging certain behaviors (Bouwma et al., 2015; Postula, Radecka-Moroz, 2020). As it is noted in one of the reports, they can be used as an impact instrument in the exploitation of various environmental resources, but also in the situation of using preparations harmful to the environment (artificial fertilizers, pesticides), the amount of which must be appropriate to provide an appropriate signal for potential taxpayers (Bräuer et al., 2006). As Binning and Young (1999, p. 17) write, the benefits of such protection are greater than what is directly obtained from the exploration of natural ecosystems, provided that the protection itself is treated as a profitable form of activity. Considering taxes as tools for environmental protection, Wasiuta (2015) points to their greater flexibility and easier modification and adaptation to changing conditions.

A certain part of the publication is devoted to the issue of using taxes imposed by local governments to achieve environmental goals. The real estate tax is considered the most promising in this respect (Podstawka, Rudowicz, 2010; Kettunen et al., 2017). However, the potential of this tax is not properly used to promote pro-ecological behavior, as evidenced, *inter alia*, by the results of research presented in works on the tax policy of selected cities in Poland (Śmiechowicz, 2013; Adamczyk, Dawidowicz, 2017; Dziuba, 2015). Some authors seem to see the possibilities of environmentally friendly use of forest tax. As concluded by

Dziuba and Życzkowska (2021), the policy of communes in Poland in the field of this tax is characterized by low activity of local governments. On the other hand, another recently published study points out that the protection of forest areas through an appropriate tax policy can be seen as an investment for the future, contributing to the potential increase in budgetary revenues of municipalities with a high level of afforestation (Kołoszko-Chomentowska, 2022).

As mentioned above, not in all countries, taxation of the possession of means of transport is the responsibility of local governments. For this reason, the issue of the possibility of influencing the decarbonisation of means of transport through appropriate tax solutions is often discussed without the role of local officials in this process. Mostly the emphasis is on taxes levied on car manufacturers, road taxes or taxes contained in fuels. This group of works includes both those discussing the effects of using single instruments in selected countries (Mabit, 2014; Giblin, McNabola, 2009; Ciccone, 2018; Sánchez-Braza et al., 2014; Yan, Eskeland, 2018) and those proposing a more comprehensive approach to decarbonisation (Lam, Mercure, 2021; Jenn et al., 2018). In a report prepared for the needs of the European group for clean transport Transport & Environment, the main topic of which is the transition to the new European standard for measuring CO₂ emissions in vehicles, the author not only refers to the impact of this process on the increase in the amount of taxation of car manufacturers, but also criticizes the fact of taxing the vehicles themselves, not their use, stating that it leads to buying excessively large and too broadcasting cars (Poliscanova, 2019). Delucchi and Murphy (2008), based on data from the US economy, argue that the owners of petroleum-powered vehicles enjoy many tax preferences in the form of subsidies, although they do not dare to state unequivocally that the liquidation of these facilities it could reduce the use of vehicles with traditional propulsion in favor of alternative means of transport. In publications relating to the tax on means of transport levied on vehicle owners in Poland, the topic of their importance as a source of income for municipalities seems to be dominant (Felis, Rosłaniec, 2017; Dziuba, 2014; Giżyński, Burchat, 2017). Sometimes attention is also paid to the impact of this tax on the activity and competitiveness of business entities (Suproń, 2018; Skica et al., 2011).

Based on the above literature review, it should be stated that in previous studies, the issue of the impact of local governments on the development of environmentally friendly means of communication through tax instruments, including preferences in the tax on means of transport, was not properly addressed. According to the author, this gap should be eliminated, especially since, as it was said earlier, the use of such tools is possible in many countries, and it would be useful to decide whether they are potentially promising solutions and how they could be used to reducing exhaust gas emissions.

3. Research materials and methodology

The study covered 63 largest cities in Poland, which, being local government units, operate in the Polish legal system as communes with poviats rights. According to the data of the Central Statistical Office (GUS), an institution collecting and publishing statistical data in Poland, the total number of people in these centers at the beginning of 2017 was 12,6 mln people, which constituted approx. 33% of the total population of the country (Statistics Poland, 2017). The analysis covered the years 2018-2020.

In order to examine to what extent the local government authorities of these urban centers use their right to grant reliefs in tax on means of transport for owners of trucks with hybrid and electric drives, the method of analyzing resolutions adopted by these units was used. Based on these documents, it was determined what solutions were adopted in individual cities in the field of taxation of trucks with hybrid and electric drive, and the amount of relief (if introduced) was calculated in subsequent years according to the following formula (1):

$$U = \left(1 - \frac{x_N}{x_P}\right) \times 100\% \quad (1)$$

where:

U – relief (w %),

x_N – the amount of the lower tax rate in a given year,

x_P – the amount of the basic tax rate in a given year.

Due to the fact that local government authorities sometimes adopted different solutions in their resolutions regarding the methods of determining tax rates, the following principles were applied for calculation purposes:

- When the city council differentiated the rates according to the year of production, the basic rate was the rate for the oldest vehicles.
- When the city council introduced two separate rates for hybrid and electric vehicles, the average of these rates was used in the calculations.
- When separate rates were not adopted for electric and hybrid vehicles, the calculations took into account the rates assigned to vehicles with the highest exhaust emission standard included in the resolution.

The data on the number of vehicles was obtained from the database of the Central Statistical Office under the name Local Data Bank (Statistics Poland, 2022). The index formula was used to illustrate the dynamics of changes in the analyzed period (2):

$$i = \frac{x_d}{x_p} \times 100\% \quad (2)$$

where:

i – index of change,

x_d – value of the variable in a given period (number of vehicles at the end of a given year),

x_p – value of the variable in the base period (number of vehicles at the end of the preceding year).

In order to check whether there is a relationship between the amount of the tax relief and the dynamics of the increase in the number of electric and hybrid vehicles, a statistical tool was used in the form of the Pearson linear correlation coefficient calculated by the formula (3):

$$r = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}} \quad (3)$$

where:

r – Pearson's linear correlation coefficient,

x – relief in the tax on means of transport for electric and hybrid trucks applicable in a given year in a given local government unit,

\bar{x} – average relief in tax on means of transport for electric and hybrid trucks in a given year in the group of local government units applying the tax preference,

y – index of change in the number of electric and hybrid trucks in a given year in a given local government unit applying a tax preference,

\bar{y} – average index of change in the number of trucks with electric and hybrid drive in a given year in a group of local government units applying a tax preference.

In addition, to determine whether the number of hybrid and electric trucks increased faster in the cities introducing the discounts than in the cities not applying the preferences, the average annual indexes of change in this number in both groups were calculated and compared.

4. Research results

Based on the texts of the resolutions of the city councils of the 63 largest Polish cities from 2018-2020 regarding the rates of the tax on means of transport, it can be concluded that the application of preferences in this tax for owners of trucks with hybrid and electric drive was decided in 31 urban centers, which accounted for 49,2% of the total number of entities covered by the analysis. The scale of benefits was varied, as was the criterion regarding the type of drive used. While in some cities (e.g. Warszawa, Poznań) a separate, lower tax rate was adopted for

vehicles with hybrid or electric drive, in others (e.g. Łódź, Kraków, Wrocław) owners of relevant trucks paid lower rates on an equal footing with owners of vehicles that meet selected EURO emission standards. The most frequently used criterion for the application of the reduced tax rate was the vehicle's propulsion with the exhaust emission standard of at least EURO 5, less often local municipalities adopted a lower limit for exhaust emissions at the level of any EURO standard and EURO 2 standard (Figure 1). It should be noted that the local authorities of some towns have introduced quite non-standard solutions in this respect. For example, the local government of the city of Ostrołęka, located in the north-eastern part of the country, introduced the same lower tax rate on means of transport, among others, for owners of hybrid or electric vehicles, but also those equipped with an exhaust gas catalyst, engine sound reducer and gas drive. The city hall of Konin in the western part of Poland went even further, enacting the same reduction in the tax rate for 2020 for owners of electric and hydrogen vehicles.

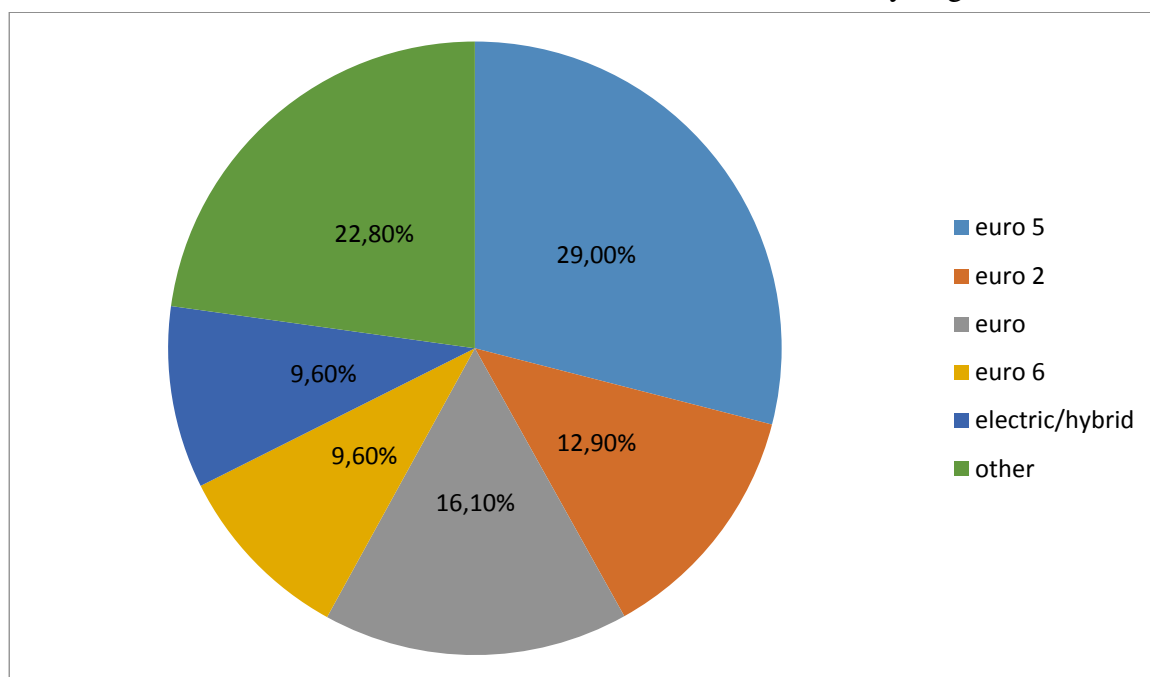


Figure 1. Exhaust emission criterion used by owners of trucks with hybrid or electric drive, paying a lower tax rate on means of transport, according to the percentage of local governments using a given solution.

Source: Own study.

Table 1 shows the amount of relief in the tax on means of transport resulting from the reduced rates of this tax applicable in the years 2018-2020 for owners of trucks with hybrid and electric drive in cities where local government authorities have adopted such a solution. As the data shows, most local governments applied tax preferences throughout the analyzed period, maintaining their mostly stable level. In isolated cases, the local authority introduced new, more favorable rates with some delay, and the most striking example in this respect is the city of Konin, where after two years of not applying any tax relief, it was decided to introduce a complete exemption for electric vehicles in the third year. This solution has also been adopted in several other local government units, while in one of the cities (Jaworzno) the abandonment of tax collection was extended in 2020 also to vehicles with hybrid drive.

Table 1.

The amount of tax relief on means of transport for owners of trucks with hybrid or electric drive

| Town | Relief (%) | | | Town | Relief (%) | | |
|-------------|------------|------|------|------------------|------------|------|------|
| | 2018 | 2019 | 2020 | | 2018 | 2019 | 2020 |
| Warszawa | 40 | 40 | 40 | Skierniewice | 6,1 | 6,1 | 6,1 |
| Kraków | 62,5 | 62,5 | 65,5 | Ostrołęka | 4,1 | 4,1 | 4,1 |
| Łódź | 9,6 | 9,6 | 9,6 | Siedlce | 22,3 | 15,6 | 3,8 |
| Wrocław | 50 | 50 | 50 | Krosno | 21,5 | 21,5 | 21,4 |
| Poznań | 62,8 | 86 | 86 | Tarnobrzeg | 6,2 | 6,2 | 6,2 |
| Gdańsk | 29,7 | 29,7 | 29,7 | Słupsk | 5,7 | 5,2 | 14,2 |
| Szczecin | 55,1 | 55,1 | 55,1 | Sopot | 22,1 | 21,9 | 21,5 |
| Lublin | 10,6 | 10,6 | 10,6 | Chorzów | 44,7 | 44,7 | 44,7 |
| Katowice | 49,7 | 51,1 | 51,3 | Jastrzębie-Zdrój | 50 | 50 | 50 |
| Częstochowa | 49,7 | 49,7 | 49,8 | Jaworzno | 0 | 0 | 100 |
| Radom | 16,6 | 16,6 | 16,6 | Tychy | 33,8 | 33,8 | 33,8 |
| Toruń | 48,7 | 48,5 | 48,4 | Kielce | 9,9 | 9,9 | 9,9 |
| Olsztyn | 58,9 | 58,9 | 58,9 | Konin | 0 | 0 | 50 |
| Zabrze | 0 | 39,9 | 39,9 | Leszno | 6,4 | 6,4 | 6,4 |
| Ruda Śląska | 18,2 | 18,2 | 18,2 | Koszalin | 8,8 | 8,8 | 8,8 |
| Legnica | 7,9 | 50 | 50 | | | | |

Source: Own study.

Data from the Central Statistical Office clearly show that in the years 2018-2020 the number of hybrid and electric trucks in cities applying the discounts was increasing every year. The only exceptions to the rule are Warsaw, Ruda Śląska, Skierniewice and Chorzów, where a minimal decrease in the number of such vehicles was observed in 2020 (Table 2). It should be noted that in the surveyed group of urban centers the growth rate of the number of the discussed means of transport was similar and only in individual cases exceeded 10%.

Table 2.

The amount of tax relief on means of transport for owners of trucks with hybrid or electric drive

| Town | Previous year = 100 | | | Town | Previous year = 100 | | |
|-------------|---------------------|-------|-------|------------------|---------------------|-------|-------|
| | 2018 | 2019 | 2020 | | 2018 | 2019 | 2020 |
| Warszawa | 121,8 | 116,2 | 99,8 | Skierniewice | 103 | 104,2 | 99,7 |
| Kraków | 104,7 | 107,4 | 101,9 | Ostrołęka | 140 | 144,6 | 100 |
| Łódź | 112,8 | 111,2 | 101,2 | Siedlce | 104,9 | 110,6 | 100,5 |
| Wrocław | 102,2 | 101,9 | 100,8 | Krosno | 101,3 | 124,3 | 101 |
| Poznań | 106,7 | 106,2 | 102,6 | Tarnobrzeg | 101,1 | 103,3 | 100,3 |
| Gdańsk | 102,8 | 104,1 | 100,5 | Słupsk | 103,1 | 103,4 | 100,2 |
| Szczecin | 103,8 | 105,7 | 101,6 | Sopot | 100,5 | 101,3 | 100,5 |
| Lublin | 102,4 | 107,3 | 101,5 | Chorzów | 105,8 | 104,6 | 99,8 |
| Katowice | 104,3 | 104,8 | 101,5 | Jastrzębie-Zdrój | 101,2 | 110 | 101 |
| Częstochowa | 102,9 | 107,9 | 101 | Jaworzno | 101,6 | 102,1 | 103,1 |
| Radom | 110,7 | 121,2 | 103,7 | Tychy | 108,4 | 111,4 | 104,1 |
| Toruń | 106,4 | 104,7 | 100,1 | Kielce | 104,5 | 107 | 99,9 |
| Olsztyn | 103,7 | 107,5 | 101,6 | Konin | 119 | 116 | 103,6 |
| Zabrze | 101 | 102,7 | 100,5 | Leszno | 104,3 | 109,9 | 100,3 |
| Ruda Śląska | 105,1 | 107,2 | 99,4 | Koszalin | 102,8 | 107,3 | 102,1 |
| Legnica | 105,6 | 109,7 | 102,7 | | | | |

Source: Own study based on Local Data Bank (Statistics Poland, 2022).

The relationship between the amount of the relief in the tax on means of transport and the dynamics of the increase in the number of trucks with electric and hybrid drive was examined on the basis of the Pearson linear correlation coefficient. The calculated ratios for 2018, 2019

and 2020 indicate a generally very poor correlation of the above-mentioned data (Figure 2). According to J. Guilford's classification used by many authors to assess the strength of correlation (e.g. Van Aswegen, Engelbrecht, 2009; Putri et al., 2020), only in the last of the analyzed years it can be described as average. The obtained statistical result seems to correspond with the data presented in Figure 3, which compares the average indexes of changes in the number of electric and hybrid trucks in local government units applying reduced tax rates with analogous indicators for cities where tax preferences were not proposed at all. In the group of urban poviats in which it was decided to introduce tax support, the average dynamics indicator was lower each year than in the group of other local government units, with the largest difference in this respect recorded in the first of the analyzed years, i.e. 2018.

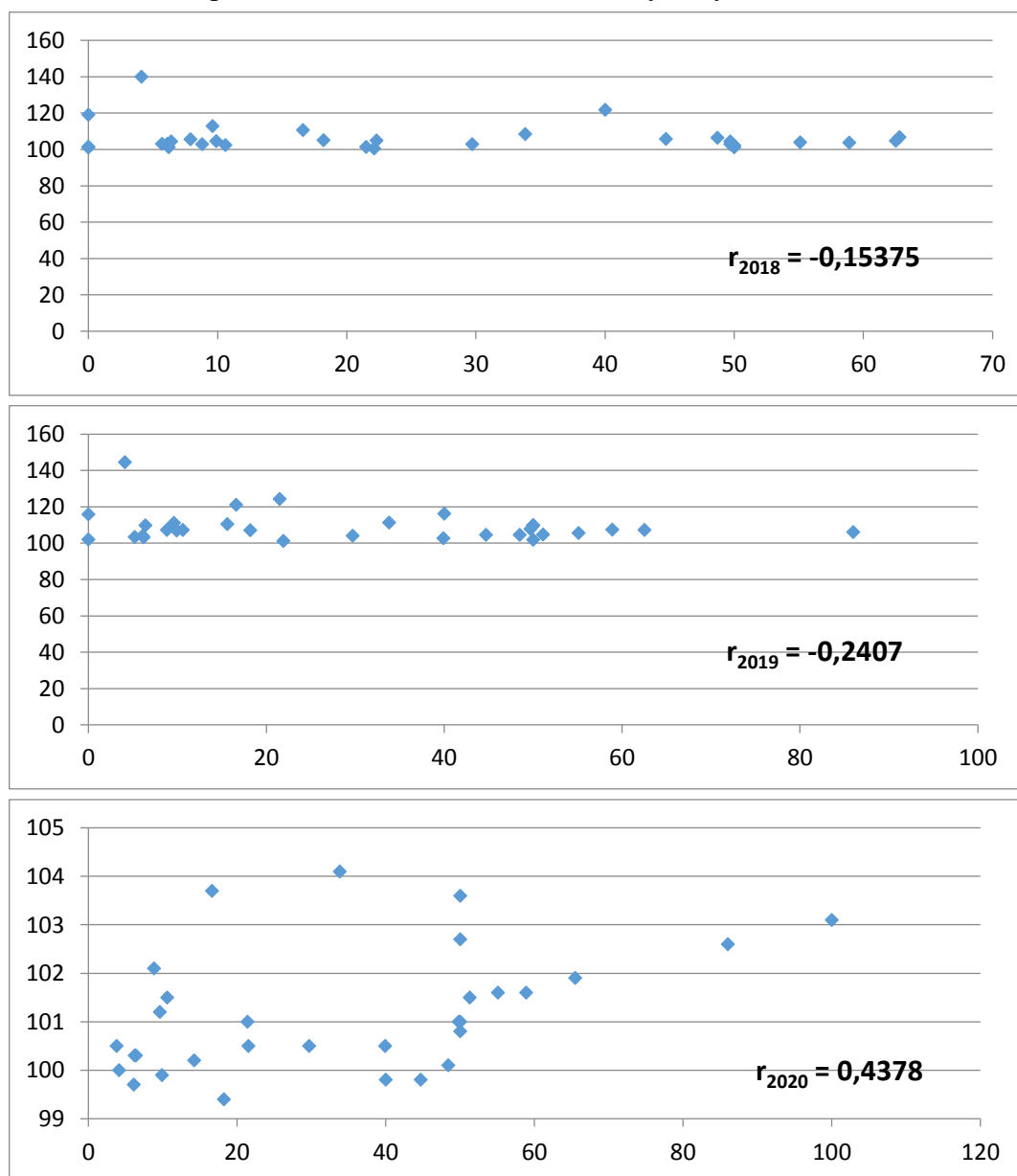


Figure 2. Pearson's linear correlation coefficient for 2018-2020 complex systems of polygamous holes made from one cluster to several coal deposits.

Source: Own study.

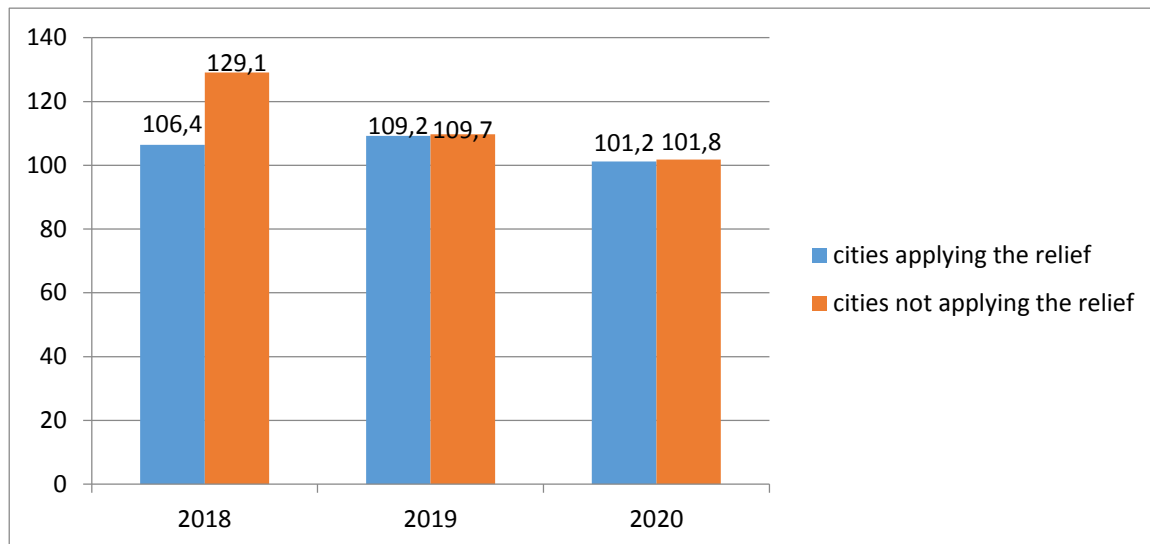


Figure 3. Average annual index of change in the number of electric and hybrid trucks in the surveyed urban centers in 2018-2020 Pearson's linear correlation coefficient for 2018-2020.

Source: Own study.

5. Conclusions

The results of the research discussed above entitle the formulation of the following conclusions corresponding to the research questions posed in the introductory part of the work:

- Local government authorities managing communes in Poland may apply discounts to owners of electric and hybrid vehicles in the form of lower tax rates on means of transport. Based on the review of resolutions adopted in 2018-2020 by city councils of the largest cities in Poland operating with poviats rights, it was found that at that time only half of local governments used this competence by reducing tax rates for owners of trucks powered entirely or partially by electricity.
- In the vast majority of centers it was not decided to introduce a separate lower tax rate for the discussed group of means of transport, thus their owners benefited from the relief on an equal footing with those who owned vehicles with a lower standard of exhaust emissions, such as EURO 5 or even EURO 1.
- In all analyzed centers, there was an increase in the number of trucks partially or entirely powered by electricity.
- There is no statistical evidence that the dynamics of the number of trucks with hybrid and electric drive in individual local government units is correlated with the amount of reliefs in the tax on means of transport applied by local governments. This is indicated not only by the values of the correlation coefficient, but also by comparing the average dynamics in cities applying preferences with centers that have not introduced appropriate reliefs.

There are some limitations in the study, the results of which are presented in this paper. Other factors that may potentially affect the number of electric vehicles in a given area have not been taken into account. The reduced rate of tax on means of transport is not the only tool that can be used by local governments to stimulate an increase in the number of hybrid and electric vehicles in a given area. For this reason, the results of the study should be treated as an introduction to a broader analysis. This is in line with the postulates of some authors writing about stimulating the development of means of communication driven by electric and hybrid motors (Lam, Mercure, 2021; Jenn et al., 2018). According to one study, potential users of hybrid and electric vehicles expect greater support from the city authorities in terms of subsidized parking spaces and the expansion of the charging station network (Inci et al., 2022, p. 14). An appropriate information campaign aimed at disseminating among vehicle users the knowledge about the amenities that they can count on in the event of changing the means of transport to "cleaner" is also important. Lack of promotion can also be considered as a factor that could reduce the effectiveness of all pro-environmental solutions, including tax ones (Jenn et al., 2018, p. 352). Of course, the aforementioned activities require increased financial involvement of municipalities. In Polish conditions, this topic was raised a few years ago in the work, where the authors showed that the level of financial participation of municipal authorities in the development of low-emission transport only through tax solutions has been rather low so far (Felis, Rosłaniec, 2017).

In the context of what was said earlier, the most important practical implication of the conducted study is the need to combine appropriate tax tools with other solutions stimulating the increase in the number of low-emission cars as part of the local government policy of supporting environmentally friendly transport. Continuing research in this area, in the era of increasing pressure to implement pro-ecological projects, and at the same time new challenges in the field of financing that local governments have recently faced, seems to be justified.

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ENVIRONMENTAL SUSTAINABILITY IN BUSINESS

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Purpose: The goal of the paper is to analyze the concept of environmental sustainability.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: Environmental sustainability is characterized by an interdisciplinary approach that considers the interconnectedness of environmental, social, and economic systems. It emphasizes long-term thinking, systems thinking, collaboration, policy and governance, education and awareness, economic considerations, and resilience and adaptation. Implementing sustainable business practices offers numerous benefits for organizations. These benefits include environmental conservation, cost savings, enhanced brand reputation, regulatory compliance, innovation and differentiation, employee engagement and retention, and long-term resilience. However, there are also potential disadvantages, such as initial costs, complex implementation, resistance to change, limited availability of sustainable technologies, complexity of measurement and reporting, supply chain challenges, and potential trade-offs. Despite the challenges, the advantages of implementing sustainable environmental business practices outweigh the drawbacks. The benefits include improved profitability, market competitiveness, customer loyalty, risk mitigation, and long-term business viability. By properly planning, managing change, and continuously improving, organizations can successfully navigate the challenges and reap the rewards of sustainable environmental practices.

Originality/value: Detailed analysis of all subjects related to the problems connected with the environmental sustainability in business.

Keywords: Industry 4.0; business practices, sustainability, sustainable business, sustainable business practices, CSR, environment, environmental sustainability.

Category of the paper: literature review.

1. Introduction

Environmental sustainability refers to the practice of utilizing resources and engaging in activities in a manner that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. It involves maintaining a delicate balance between human activities and the natural environment, ensuring that our actions do not deplete or harm natural resources, ecosystems, or the overall ecological balance (Liu et al., 2023).

The concept of environmental sustainability recognizes the interconnectedness and interdependence of ecological, social, and economic systems. It emphasizes the long-term preservation and conservation of natural resources, biodiversity, and the overall health of the planet. By adopting sustainable practices, we strive to minimize negative impacts on the environment, promote ecological integrity, and foster a more harmonious relationship between humans and nature (Cerciello et al., 2023).

The goal of the paper is to analyze the concept of environmental sustainability.

2. Sustainable business practices- main concepts

Achieving environmental sustainability requires a collective effort from individuals, businesses, governments, and international organizations (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022; Gajdzik, Wolniak, 2023, Michalak, Wolniak, 2023). It involves making conscious choices in our daily lives, adopting sustainable technologies and practices, supporting policies that prioritize environmental protection, and fostering a mindset of stewardship towards the planet. By embracing environmental sustainability, we can create a healthier and more sustainable future for ourselves and generations to come.

The concept of environmental sustainability can be defined as follows (Moghrabi et al., 2023; George et al., 2022; Das et al., 2021; D'Adamo et al., 2022):

- Environmental sustainability refers to the responsible use and preservation of natural resources to meet the needs of present and future generations, while maintaining the health and integrity of ecosystems.
- Environmental sustainability is the practice of using resources in a way that preserves the balance and well-being of natural systems, allowing for their long-term viability and the ability of future generations to meet their needs.

- Environmental sustainability involves making choices and taking actions that protect and enhance the quality of the environment, promote social well-being, and ensure economic prosperity, without compromising the ability of future generations to meet their own needs.
- Environmental sustainability is the recognition that human activities are interconnected with the environment, and it encompasses the responsible management of resources, reduction of waste and pollution, conservation of biodiversity, and the promotion of social and economic equity.
- Environmental sustainability involves maintaining and restoring the health of ecosystems, minimizing the depletion of natural resources, reducing greenhouse gas emissions, and fostering a society that values and protects the environment for the benefit of current and future generations.

Presented definitions highlight the importance of balancing environmental, social, and economic considerations to ensure the long-term well-being of both the planet and its inhabitants (Jananipriya and Usha, 2022).. Environmental sustainability is about taking a holistic approach to address the interconnectedness of environmental challenges and seeking solutions that promote harmony between human activities and the natural world (Singh et al., 2022).

Key principles of environmental sustainability include (George et al., 2022; Das et al., 2021, Lathabhavan, 2022; Singh et al., 2022; Cerciello et al., 2023, Liu et al., 2023; Pietro et al., 2021):

- **Conservation:** Protecting and preserving natural resources, such as water, air, forests, wildlife, and energy sources, to ensure their availability for future generations.
- **Renewable Energy:** Promoting the use of clean and renewable sources of energy, such as solar, wind, hydro, and geothermal power, to reduce reliance on finite fossil fuels and mitigate greenhouse gas emissions.
- **Waste Reduction and Recycling:** Minimizing waste generation, practicing recycling, and adopting responsible waste management strategies to reduce the consumption of resources and prevent pollution.
- **Biodiversity Preservation:** Protecting and restoring biodiversity by conserving ecosystems, habitats, and species, as well as promoting sustainable agricultural practices and responsible land use planning.
- **Sustainable Consumption and Production:** Encouraging responsible consumption patterns by promoting sustainable and ethical production methods, reducing resource consumption, and minimizing waste throughout the lifecycle of products and services.
- **Climate Change Mitigation:** Taking actions to reduce greenhouse gas emissions, adapt to the impacts of climate change, and promote resilience in the face of environmental challenges.

- **Social Equity:** Recognizing the importance of social justice and ensuring that sustainable practices benefit all members of society, including marginalized communities and future generations.

In the table 1 there is a presentation of the most important aspects of environmental sustainable business practices.

Table 1.

Most important aspects of environmental sustainable business practices

| Aspect | Description |
|--------------------------------|---|
| Interdisciplinary Approach | Environmental sustainability recognizes that environmental issues cannot be addressed in isolation. It requires an interdisciplinary approach that combines knowledge from various fields such as ecology, economics, social sciences, and policy-making. By integrating these perspectives, sustainable solutions can be developed that consider the environmental, social, and economic dimensions of the challenges at hand. |
| Long-Term Perspective | Environmental sustainability emphasizes long-term thinking and planning. It acknowledges that the consequences of our actions today can have far-reaching impacts on future generations. By taking a proactive approach and considering the long-term implications of our decisions, we can make choices that support the well-being of both current and future populations. |
| Systems Thinking | Environmental sustainability encourages us to think holistically and consider the interconnectedness of environmental, social, and economic systems. It recognizes that changes in one aspect of the system can have ripple effects on other components. For example, the degradation of ecosystems can lead to the loss of biodiversity, which in turn can impact the availability of natural resources and affect human well-being. By understanding these complex relationships, we can develop strategies that address the root causes of environmental challenges. |
| Collaboration and Partnerships | Achieving environmental sustainability requires collaboration and partnerships at various levels. It involves cooperation between governments, businesses, civil society organizations, and individuals. Collaborative efforts can lead to the sharing of knowledge, pooling of resources, and the development of innovative solutions that are more effective in addressing environmental issues. |
| Policy and Governance | Environmental sustainability relies on the development and implementation of effective policies and governance frameworks. Governments play a crucial role in creating and enforcing regulations that promote sustainable practices, protect natural resources, and incentivize sustainable investments. Policy measures may include setting emission reduction targets, implementing environmental impact assessments, promoting renewable energy incentives, and establishing protected areas for biodiversity conservation. |
| Education and Awareness | Environmental sustainability is closely linked to education and raising awareness about environmental issues. By promoting environmental literacy and fostering a sense of environmental responsibility, individuals can make informed decisions and adopt sustainable practices in their personal and professional lives. Education plays a key role in empowering individuals to become agents of change and advocates for environmental protection. |
| Economic Considerations | Environmental sustainability recognizes the importance of integrating environmental considerations into economic decision-making. It challenges the traditional view that economic growth and environmental protection are mutually exclusive. Sustainable economic models aim to decouple economic growth from resource consumption and environmental degradation, promoting the development of green technologies, sustainable business practices, and the creation of green jobs. |
| Resilience and Adaptation | Environmental sustainability also involves building resilience and adapting to environmental changes and uncertainties. Climate change, natural disasters, and other environmental disruptions pose significant challenges. By investing in resilient infrastructure, promoting adaptive strategies, and supporting vulnerable communities, we can enhance our ability to cope with and recover from environmental shocks. |

Source: Authors own work on the basis of: (George et al., 2022; Das et al., 2021, Lathabhavan, 2022; Singh et al., 2022; Cerciello et al., 2023, Liu et al., 2023; Pietro et al., 2021).

3. Benefits and disadvantages in implementation of sustainable business practices in organizations

Sustainable environmental business practices offer numerous benefits to both businesses and the environment. Some of the key benefits include (George et al., 2022; Das et al., 2021; Lathabhavan, 2022; Singh et al., 2022; Cerciello et al., 2023, Liu et al., 2023; Pietro et al., 2021):

- **Environmental Conservation:** By adopting sustainable practices, businesses can reduce their ecological footprint, minimize resource consumption, and preserve natural habitats. This helps in conserving biodiversity, protecting ecosystems, and mitigating climate change.
- **Cost Savings:** Sustainable environmental practices often lead to long-term cost savings for businesses. For example, implementing energy-efficient technologies and practices can reduce energy consumption and lower utility bills. Similarly, optimizing waste management processes can minimize disposal costs. Over time, these savings can contribute to improved profitability.
- **Enhanced Brand Reputation:** Consumers are increasingly conscious of environmental issues and tend to favor businesses that demonstrate a commitment to sustainability. By adopting sustainable environmental practices, businesses can improve their brand reputation and gain a competitive advantage. This can attract environmentally conscious customers, increase customer loyalty, and expand market share.
- **Regulatory Compliance:** Many countries and regions have implemented environmental regulations to protect the environment and promote sustainable practices. By complying with these regulations, businesses can avoid legal issues, penalties, and reputational damage. Sustainable environmental practices help businesses stay ahead of evolving regulations and demonstrate responsible corporate citizenship.
- **Innovation and Differentiation:** Embracing sustainable environmental practices often spurs innovation within organizations. It encourages businesses to develop and implement new technologies, products, and services that are environmentally friendly. This focus on sustainability can differentiate businesses in the market and create new opportunities for growth.
- **Employee Engagement and Retention:** Sustainable environmental practices can contribute to a positive work environment, fostering employee engagement and satisfaction. Employees often take pride in working for environmentally responsible organizations, which can lead to increased productivity and retention of talented individuals.

- **Long-Term Resilience:** Sustainability is inherently focused on long-term thinking and planning. By integrating sustainable environmental practices into their operations, businesses build resilience against environmental risks and uncertainties. This helps them adapt to changing market conditions, mitigate potential disruptions, and ensure long-term business viability.

While implementing sustainable environmental business practices offers numerous benefits, there are also some potential disadvantages that businesses may face (Yacob et al., 2022). These disadvantages include (George et al., 2022; Das et al., 2021, Lathabhavan, 2022; Singh et al., 2022; Cerciello et al., 2023, Liu et al., 2023; Pietro et al., 2021):

- **Initial Costs:** Transitioning to sustainable environmental practices often requires upfront investments in equipment, technologies, and infrastructure. These initial costs can be a barrier for small and medium-sized businesses with limited financial resources. However, it's important to note that many sustainable practices offer long-term cost savings and return on investment.
- **Complex Implementation:** Adopting sustainable environmental practices can involve complex changes in processes, supply chains, and organizational culture. It requires careful planning, coordination, and employee training. The complexity of implementation can pose challenges for businesses, especially if they lack the necessary expertise and resources to navigate the transition effectively.
- **Resistance to Change:** Employees and stakeholders may resist or be reluctant to embrace sustainable environmental practices. Change can disrupt established routines and require individuals to learn new skills or adapt to different ways of doing things. Overcoming resistance to change and gaining buy-in from employees and stakeholders can be a significant challenge during the implementation phase.
- **Limited Availability of Sustainable Technologies:** Depending on the industry or region, businesses may face limitations in the availability and affordability of sustainable technologies or resources. For example, renewable energy sources may not be readily accessible, or sustainable materials may be more expensive or have limited availability. This can hinder the adoption of certain sustainable practices.
- **Complexity of Measurement and Reporting:** Measuring and reporting on the environmental impact of sustainable practices can be complex. It requires collecting accurate data, implementing monitoring systems, and ensuring transparency in reporting. Businesses may face challenges in tracking and quantifying their progress toward environmental goals, which can affect their ability to communicate their sustainability achievements effectively.

- **Supply Chain Challenges:** Implementing sustainable environmental practices may require collaboration and coordination with suppliers and partners in the supply chain. Ensuring that suppliers adhere to sustainable standards and practices can be challenging, particularly if they operate in different regions or have different priorities. Maintaining consistency and alignment across the supply chain can be a significant hurdle.
- **Potential Trade-Offs:** In some cases, implementing certain sustainable practices may involve trade-offs or compromises. For example, switching to alternative materials may have different environmental impacts or affect product quality. Businesses need to carefully evaluate the potential trade-offs and find the right balance between sustainability goals and other operational considerations.

The advantages and disadvantages of implementing sustainable environmental business practices demonstrate the multifaceted nature of sustainability (Sani, Garg, 2023). While the initial costs, resistance to change, and complexities of measurement pose challenges, the benefits far outweigh the drawbacks (Anaman et al., 2023). Enhanced reputation, cost savings, regulatory compliance, innovation, and market opportunities are compelling incentives for businesses to embrace sustainability (Lathabhavan, 2022). With proper planning, effective change management, and continuous improvement, organizations can successfully navigate the challenges and reap the rewards of sustainable environmental practices (Sanchez-Planelles et al., 2022). It is clear that integrating sustainability into business strategies is not only an ethical imperative but also a strategic advantage for long-term success.

4. Examples of environmental sustainable business practices

Sustainable environmental business practices encompass a wide range of strategies and initiatives that organizations can adopt to minimize their environmental impact and promote long-term sustainability (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018, 2023; Grabowska et al., 2019, 2020, 2021). In table 2 there are examples of various types of sustainable environmental business practices and in table 3 the examples of their implementation in real organizations.

Table 2.
Types of sustainable environmental business practices

| Type of sustainable practice | Description |
|--|--|
| Energy Efficiency | Organizations can invest in energy-efficient technologies, such as LED lighting, smart thermostats, and energy management systems, to reduce energy consumption. They can also implement renewable energy sources like solar panels or wind turbines to generate clean energy on-site. |
| Waste Reduction and Recycling | Implementing waste management practices, such as recycling programs, composting, and waste segregation, can help organizations reduce the amount of waste sent to landfills. They can also adopt circular economy principles by reusing or repurposing materials and implementing closed-loop systems. |
| Water Conservation | Organizations can implement water-saving technologies and practices to minimize water consumption. This can include installing low-flow fixtures, using water-efficient irrigation systems, and adopting water recycling and rainwater harvesting techniques. |
| Sustainable Supply Chain Management | Organizations can work with suppliers to ensure sustainability throughout the supply chain. This involves selecting suppliers that adhere to environmental standards, promoting responsible sourcing of materials, and collaborating on initiatives like carbon footprint reduction and ethical labor practices. |
| Green Building Design | When constructing or renovating facilities, organizations can adopt green building design principles. This includes using sustainable materials, optimizing energy efficiency through insulation and natural lighting, and implementing water-saving fixtures and systems. |
| Carbon Footprint Reduction | Organizations can measure and monitor their carbon footprint and develop strategies to reduce greenhouse gas emissions. This can involve initiatives like energy-efficient transportation, promoting telecommuting and video conferencing, and offsetting emissions through carbon offset projects. |
| Product Lifecycle Management | Organizations can focus on sustainable product development and lifecycle management. This includes considering environmental impact throughout the product's lifecycle, from raw material sourcing to manufacturing, use, and disposal. They can implement design for sustainability principles, promote product durability and repairability, and explore product take-back and recycling programs. |
| Environmental Education and Awareness | Promoting environmental education and awareness among employees, customers, and stakeholders is crucial for fostering a culture of sustainability. Organizations can conduct training programs, awareness campaigns, and provide resources to educate individuals about environmental issues and sustainable practices. |
| Stakeholder Engagement and Collaboration | Engaging with stakeholders, including customers, communities, NGOs, and government agencies, is essential for effective sustainability initiatives. Organizations can collaborate with stakeholders to develop shared sustainability goals, seek feedback, and address concerns to drive meaningful change. |
| Reporting and Transparency | Organizations can enhance transparency by measuring, reporting, and disclosing their environmental performance. They can adopt sustainability reporting frameworks like the Global Reporting Initiative (GRI) or the Carbon Disclosure Project (CDP) to communicate their sustainability efforts and progress to stakeholders. |

Source: Authors own work on the basis of: (George et al., 2022; Das et al., 2021, Lathabhavan, 2022; Singh et al., 2022; Cerciello et al., 2023, Liu et al., 2023, Alfaras and Alfaras, 2021; Mohaghegh et al., 2021).

Table 3.
Examples of sustainable environmental business practices

| Organization | Type of sustainable practice | Description |
|-----------------------------|--|--|
| Google | Energy Efficiency | Google is committed to energy efficiency and has made significant investments in renewable energy. The company has implemented energy-efficient data centers and offices, and it has also purchased renewable energy to offset its carbon emissions. |
| Patagonia | Waste Reduction and Recycling | Patagonia, an outdoor clothing company, promotes waste reduction and recycling. They offer a product repair program, encouraging customers to repair their clothing rather than buying new items. Patagonia also uses recycled materials in their products and encourages customers to recycle their old garments. |
| Coca-Cola | Water Conservation | Coca-Cola is focused on water conservation. The company has implemented water-saving initiatives in its manufacturing processes, such as water recycling and rainwater harvesting. They also work with local communities to replenish water sources and protect watersheds. |
| IKEA | Sustainable Supply Chain Management | IKEA is known for its commitment to sustainable supply chain management. The company sources sustainably produced wood for its furniture and promotes responsible forestry practices. IKEA also invests in renewable energy projects and aims to produce as much energy as it consumes. |
| Interface | Green Building Design | Interface, a global carpet tile manufacturer, demonstrates sustainable building design. They have implemented green building practices in their factories and offices, including energy-efficient lighting, rainwater harvesting, and the use of recycled materials in their carpet tiles. |
| Tesla | Carbon Footprint Reduction | Tesla is a leader in carbon footprint reduction through its electric vehicles (EVs). By producing EVs and promoting clean energy, Tesla aims to reduce carbon emissions from transportation. The company also invests in the development of sustainable energy solutions, such as solar panels and energy storage. |
| Unilever | Product Lifecycle Management | Unilever focuses on sustainable product lifecycle management. The company has set ambitious goals to reduce its environmental impact, including using sustainably sourced ingredients, minimizing packaging waste, and promoting responsible product use and disposal. |
| National Geographic Society | Environmental Education and Awareness | The National Geographic Society is a renowned organization that focuses on environmental education and raising awareness about conservation. They publish magazines, produce documentaries, and develop educational resources to inform and inspire people about the importance of environmental stewardship. |
| Starbucks | Stakeholder Engagement and Collaboration | Starbucks is committed to stakeholder engagement and collaboration. The company works with coffee farmers to promote sustainable farming practices and ensure fair trade. Starbucks also engages customers in recycling initiatives and provides resources to educate them about sustainability. |
| Philips | Reporting and Transparency | Philips, a multinational electronics company, focuses on product innovation for sustainability. They develop energy-efficient lighting solutions, such as LED bulbs, to reduce energy consumption. Philips also offers products and systems for sustainable healthcare and promotes circular economy principles. |

Source: Authors own work on the basis of: (George et al., 2022; Das et al., 2021, Lathabhavan, 2022; Singh et al., 2022; Cerciello et al., 2023, Liu et al., 2023, Alfaras and Alfaras, 2021; Mohaghegh et al., 2021).

Presented examples showcase how real organizations across various industries are implementing sustainable environmental business practices to minimize their environmental impact and drive positive change. By adopting these practices, organizations demonstrate their commitment to sustainability and contribute to a more sustainable future.

5. Conclusion

In conclusion, achieving environmental sustainability requires a collective effort from individuals, businesses, governments, and international organizations. It involves making conscious choices in our daily lives, adopting sustainable technologies and practices, supporting policies that prioritize environmental protection, and fostering a mindset of stewardship towards the planet. By embracing environmental sustainability, we can create a healthier and more sustainable future for ourselves and generations to come.

The concept of environmental sustainability encompasses responsible use and preservation of natural resources, maintaining the health and integrity of ecosystems, and meeting the needs of present and future generations. It involves making choices and taking actions that protect the environment, promote social well-being, and ensure economic prosperity without compromising the ability of future generations to meet their own needs.

Environmental sustainability is characterized by an interdisciplinary approach that considers the interconnectedness of environmental, social, and economic systems. It emphasizes long-term thinking, systems thinking, collaboration, policy and governance, education and awareness, economic considerations, and resilience and adaptation.

Implementing sustainable business practices offers numerous benefits for organizations. These benefits include environmental conservation, cost savings, enhanced brand reputation, regulatory compliance, innovation and differentiation, employee engagement and retention, and long-term resilience. However, there are also potential disadvantages, such as initial costs, complex implementation, resistance to change, limited availability of sustainable technologies, complexity of measurement and reporting, supply chain challenges, and potential trade-offs.

Despite the challenges, the advantages of implementing sustainable environmental business practices outweigh the drawbacks. The benefits include improved profitability, market competitiveness, customer loyalty, risk mitigation, and long-term business viability. By properly planning, managing change, and continuously improving, organizations can successfully navigate the challenges and reap the rewards of sustainable environmental practices.

Integrating sustainability into business strategies is not only an ethical imperative but also a strategic advantage for long-term success. Businesses that embrace sustainable environmental practices demonstrate their commitment to environmental stewardship, gain a competitive edge

in the market, and contribute to a more sustainable future for all (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021, 2023; Rosak-Szyrocka et al., 2023; Gajdzik et al., 2023, Orzeł, Wolniak, 2021, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecula, Wolniak, 2022; Olkiewicz et al., 2021; Wolniak, 2013, 2016; Hys, Wolniak, 2018).

The organizations showcased in a paper exemplify the diverse approaches to sustainability. Google's focus on energy efficiency and renewable energy demonstrates its commitment to reducing carbon emissions. Patagonia's emphasis on waste reduction and recycling promotes a circular economy and encourages customers to adopt more sustainable consumption habits. Coca-Cola's efforts in water conservation highlight the importance of responsible water management in manufacturing processes. IKEA's sustainable supply chain management practices and investment in renewable energy contribute to a more sustainable and responsible business model. Interface's implementation of green building design principles showcases how organizations can reduce their environmental impact through sustainable infrastructure. Tesla's pioneering work in carbon footprint reduction through electric vehicles and clean energy solutions is driving the transition to a low-carbon transportation sector. Unilever's focus on product lifecycle management emphasizes the need for sustainable sourcing, responsible packaging, and responsible product use and disposal. The National Geographic Society's commitment to environmental education and awareness is instrumental in fostering a culture of environmental stewardship. Starbucks' stakeholder engagement and collaboration efforts demonstrate the importance of working with suppliers, customers, and communities to drive sustainability initiatives. Philips' emphasis on reporting and transparency helps communicate their sustainability efforts and progress to stakeholders while developing innovative, energy-efficient solutions for various industries.

By adopting sustainable environmental business practices, organizations showcase their dedication to minimizing their environmental impact and promoting long-term sustainability. These practices not only benefit the planet but also offer opportunities for cost savings, resource efficiency, and enhanced brand reputation. Moreover, they contribute to the achievement of global sustainability goals, such as those outlined in the United Nations' Sustainable Development Goals (SDGs).

It is essential for organizations to continue exploring and implementing sustainable practices, adapting them to their specific contexts and continuously improving their environmental performance. Collaboration and knowledge-sharing among organizations, policymakers, and other stakeholders are crucial for scaling up sustainable practices and creating a collective impact. With a collective effort, we can build a more sustainable future for generations to come, where businesses operate in harmony with the environment, promote social well-being, and drive positive change.

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FUNCTIONING OF PREDICTIVE ANALYTICS IN BUSINESS

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Purpose: The goal of the paper is to analyze the main features, benefits and problems with the predictive analytics usage.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: Predictive analytics is a powerful tool that leverages historical data and statistical models to forecast future outcomes and behaviors. It enables organizations to gain valuable insights, make informed decisions, and drive business growth. By analyzing patterns, correlations, and trends in data, predictive analytics can uncover hidden relationships and provide a deeper understanding of business processes, customer behavior, market trends, and other important factors. The benefits of predictive analytics are numerous. It enables organizations to forecast and predict future events, leading to proactive decision-making and the ability to anticipate trends and outcomes. It enhances decision-making processes, improves resource allocation, and provides enhanced customer insights. Predictive analytics also helps in risk mitigation, fraud detection, optimization of operations and pricing, product development, and marketing effectiveness. By leveraging these benefits, organizations can gain a competitive advantage and achieve sustainable success.

Originality/value: Detailed analysis of all subjects related to the problems connected with the predictive analytics.

Keywords: Industry 4.0; diagnostic analytics, business analytics, data analysis, predictive analytics.

Category of the paper: literature review.

1. Introduction

Predictive analytics is an advanced analytical discipline that utilizes historical data, statistical algorithms, and machine learning techniques to forecast future events, behaviors, and trends. It goes beyond diagnostic analytics, which focuses on understanding past events, by providing insights into what is likely to happen in the future. Predictive analytics enables

organizations to make proactive, data-driven decisions, anticipate outcomes, identify opportunities, and mitigate risks.

Predictive analytics is a powerful tool that enables organizations to anticipate future outcomes, behaviors, and trends. By leveraging historical data and sophisticated algorithms, organizations can make proactive decisions, identify opportunities, and mitigate risks. Predictive analytics has a wide range of applications across industries and domains, and its adoption can lead to enhanced operational efficiency, improved customer experiences, and increased competitiveness. To fully harness its benefits, organizations need to invest in data quality, develop robust models, and foster a data-driven culture.

The goal of the paper is to analyze the main features, benefits and problems with the predictive analytics usage.

2. Predictive analytics - definitions

At its core, predictive analytics leverages historical data to build models that can predict future outcomes or behaviors. These models are trained using various statistical and machine learning techniques, such as regression analysis, decision trees, neural networks, and clustering algorithms. By analyzing patterns, correlations, and trends in historical data, these models can make accurate predictions and generate valuable insights (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022; Gajdzik, Wolniak, 2023).

One of the key advantages of predictive analytics is its ability to identify hidden patterns and relationships that may not be apparent through traditional data analysis methods. It can uncover complex interactions between multiple variables and reveal the factors that contribute to specific outcomes. This empowers organizations to gain a deeper understanding of their business processes, customer behavior, market trends, and other important factors that drive success (Hurwitz et al., 2015).

Predictive analytics refers to the practice of using historical data, statistical modeling techniques, and machine learning algorithms to make predictions and forecasts about future events, behaviors, or outcomes. It involves analyzing patterns, correlations, and trends in the data to identify predictive patterns and develop models that can anticipate future scenarios (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018, 2023; Grabowska et al., 2019, 2020, 2021).

The process of predictive analytics typically involves several steps, including data collection, data cleaning and preprocessing, model selection, model training and validation, and applying the model to new data for making predictions (Patanjali, 2018; Nourani, 2021; Sharma et al.,

2020). Predictive analytics leverages various statistical and machine learning techniques such as regression analysis, decision trees, neural networks, clustering algorithms, and more.

The goal of predictive analytics is to uncover hidden insights and relationships in the data that may not be apparent through traditional analysis methods. By understanding these patterns and trends, organizations can make informed decisions, develop strategies, optimize operations, and gain a competitive advantage (Cam et al., 2021).

Predictive analytics finds applications across diverse industries and domains. In finance, it helps detect fraudulent transactions, predict credit risks, and optimize investment strategies (Greasley, 2019). In marketing, it enables personalized targeting, customer segmentation, and churn prediction. In healthcare, predictive analytics can aid in early disease detection, treatment optimization, and resource allocation. It also supports supply chain optimization, demand forecasting, predictive maintenance, and risk management in manufacturing and logistics (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021, 2023; Rosak-Szyrocka et al., 2023; Gajdzik et al., 2023, Orzeł, Wolniak, 2021, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecuła, Wolniak, 2022; Olkiewicz et al., 2021).

Implementing predictive analytics involves several stages. First, organizations need to define the problem they want to solve and identify the relevant data sources. They then collect, clean, and preprocess the data to ensure its quality and reliability. Next, they select the appropriate predictive models and algorithms based on the nature of the problem and the available data. The models are trained using historical data and validated to assess their accuracy and performance (Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023).

Once the predictive models are built and validated, they can be applied to new data to make predictions and generate insights. Organizations can use these insights to make informed decisions, develop strategies, optimize operations, and gain a competitive edge. It is important to note that predictive analytics is an iterative process, requiring continuous monitoring and refinement of models as new data becomes available and the business landscape evolves.

However, predictive analytics also faces certain challenges. Data quality and availability issues, inadequate or biased data, and the need for skilled data scientists and analysts are common hurdles. Additionally, ethical concerns related to privacy, security, and the potential for discriminatory outcomes should be carefully addressed.

There are following steps of predictive analytics implementation:

- Define the requirements. Understand the business problem you're trying to solve. Is it managing inventory? Reducing fraud? Predicting sales? Generating questions about the problem and listing them in order of importance is a good start. Collaborating with a statistician at this stage can help form metrics for measuring success. A business user or subject matter expert generally takes charge of this first step.

- Explore the data. Here, you'll want to loop in a statistician or data analyst or both. The job is to identify the data that informs the problem you're trying to solve and the goal. Consider the relevancy, suitability, quality and cleanliness of the data.
- Validate the results. Performance of the model can change over time due to shifts in customer preferences or the business climate, or unforeseen events such as a pandemic. Thresholds for updating models vary, requiring the joint expertise of a business user and a data scientist in this step.

Below in table 1 there is a comparison table highlighting the differences between diagnostic analytics and predictive analytics:

Table 1.
Comparison of diagnostic analytics and predictive analytics

| Aspect | Diagnostic Analytics | Predictive Analytics |
|------------------------------|--|--|
| Objective | Understand past events and their causes. The primary objective of diagnostic analytics is to understand why a certain event or outcome occurred in the past. It focuses on analyzing historical data to identify the root causes or factors that contributed to a particular result. | Forecast future events and behaviors. The main objective of predictive analytics is to make predictions and forecasts about future events or outcomes. It utilizes historical data and statistical modeling techniques to identify patterns and trends that can be used to anticipate future scenarios. |
| Focus | Historical data analysis. It focuses on understanding the past and gaining insights into historical events or outcomes. It is often used for post-event analysis, troubleshooting, and identifying opportunities for improvement. | Future data analysis. It focuses on future outcomes and aims to provide actionable insights for proactive decision-making. It helps organizations anticipate future scenarios, mitigate risks, optimize operations, and gain a competitive advantage. |
| Purpose | Identify root causes, patterns, and correlations in past events. | Make predictions, anticipate outcomes, and identify trends. |
| Data Usage | Analyze historical data. | Analyze historical data and apply it to new data. |
| Timeframe | Analysis of past events. It focuses on analyzing historical data to understand past events, trends, and patterns. It looks backward and explains what happened in the past. | Forecasting future events. It focuses on analyzing historical data to make predictions and forecasts about future events, behaviors, or outcomes. It looks forward and tries to anticipate what will happen in the future. |
| Analytical Techniques | Statistical analysis, data mining, data visualization. It typically involves retrospective analysis and seeks to answer questions such as "What happened?", "Why did it happen?", and "What were the contributing factors?" It often uses techniques such as data mining, root cause analysis, and exploratory data analysis to uncover insights from historical data. | Statistical modeling, machine learning algorithms. It involves analyzing historical data to build models that can make predictions about future events. It uses statistical modeling, machine learning algorithms, and data mining techniques to identify patterns and relationships in the data and make forecasts. |
| Decision-Making | Provides insights for informed decision-making based on past events. | Supports proactive decision-making by anticipating future outcomes. |
| Benefits | Performance improvement, risk mitigation, enhanced customer insights, process optimization, resource allocation. | Proactive decision-making, opportunity identification, risk mitigation, resource optimization. |

Cont. table 1.

| | | |
|------------------------------------|--|---|
| Limitations/ Challenges | Time-intensive, limited real-time insights, data quality and availability issues, lack of predictive capabilities, complexity of analysis. | Data quality and availability issues, need for skilled data scientists, ethical considerations. |
| Examples | Analyzing sales data to identify factors influencing revenue decline. | Predicting customer churn, forecasting sales demand. |
| Applications | Business intelligence, healthcare, finance, marketing, manufacturing, logistics. | Finance, marketing, healthcare, supply chain, maintenance, risk management. |

Source: Authors own work on the basis of: (Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023).

3. Benefits and problems of predictive analytics usage

Predictive analytics empowers organizations to make proactive decisions, anticipate future trends, mitigate risks, optimize operations, and drive business growth. By leveraging the benefits of predictive analytics, organizations can gain a competitive advantage and make data-driven decisions that lead to improved outcomes and success.

On the basis of literature analysis following benefits of predictive analytics can be formulated (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023; Tucci, 2022).

- **Forecasting and prediction:** Predictive analytics enables organizations to forecast future outcomes and events based on historical data and statistical models. By analyzing patterns, trends, and correlations in the data, predictive analytics can provide insights into future customer behavior, market trends, demand patterns, and other relevant factors. This helps organizations make more accurate predictions and forecasts, supporting proactive decision-making.
- **Improved decision-making:** This type of analytics provides organizations with data-driven insights that enhance decision-making processes. By leveraging predictive models, organizations can make informed decisions based on anticipated outcomes. This allows them to identify opportunities, mitigate risks, optimize resource allocation, and develop effective strategies for business growth.
- **Enhanced customer insights:** Type of analytics described in the paper helps organizations gain a deeper understanding of their customers' preferences, needs, and behaviors. By analyzing customer data, organizations can identify patterns and trends that enable them to personalize offerings, target specific customer segments, and improve customer experiences. This leads to increased customer satisfaction, loyalty, and retention.

- Risk mitigation and fraud detection: Predictive analytics is effective in identifying and mitigating risks. By analyzing historical data and patterns, organizations can identify potential risks, fraudulent activities, or anomalies that require attention. This enables organizations to take proactive measures to prevent fraud, minimize losses, and strengthen their risk management strategies.
- Optimization of operations and resources: Predictive analytics helps organizations optimize their operations and resource allocation. By analyzing data on resource utilization, demand patterns, and production processes, organizations can identify areas of inefficiency, anticipate demand fluctuations, and optimize their supply chain. This leads to improved operational efficiency, cost savings, and better utilization of resources.
- Product development and innovation: This analytics aids organizations in developing new products and services. By analyzing market trends, customer feedback, and historical data, organizations can identify emerging needs, gaps in the market, and potential areas for innovation. This helps organizations stay ahead of the competition and develop products that align with customer preferences and market demands.
- Improved marketing effectiveness: Predictive analytics enhances marketing effectiveness by enabling organizations to target the right audience with the right message at the right time. By analyzing customer data, organizations can segment their customer base, identify the most promising prospects, and personalize marketing campaigns. This leads to higher conversion rates, improved marketing ROI, and increased customer engagement.
- Optimization of pricing and revenue management: Predictive analytics helps organizations optimize their pricing strategies and revenue management. By analyzing historical sales data, market conditions, and customer behavior, organizations can determine optimal pricing levels, identify pricing trends, and implement dynamic pricing strategies. This allows organizations to maximize revenue, increase profitability, and maintain a competitive edge.
- It automates decision-making, reducing manual work.
- It speeds complex approval processes, enabling faster time to value.
- It enables faster response to changing market conditions, for example, automating stock trades faster than humans can.
- It improves resilience to fast-changing circumstances, helping enterprises, for example ride out supply chain disruptions.
- It operationalizes predictive analytics insights, increasing the value of existing analytics.

Predictive analytics empowers organizations to make data-driven decisions, optimize operations, enhance customer experiences, mitigate risks, and drive business growth (Sharma et al., 2020; Wolniak, 2013, 2016; Hys, Wolniak, 2018). By leveraging the power of predictive analytics, organizations can gain a competitive advantage, capitalize on emerging opportunities, and achieve sustainable success in today's dynamic business landscape.

Below are some of the key disadvantages and problems associated with the usage of predictive analytics (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023):

- **Anticipating Future Trends and Outcomes:** Predictive analytics leverages historical data and statistical models to forecast future events, trends, and outcomes. By analyzing patterns and correlations, organizations can gain insights into customer behavior, market trends, demand fluctuations, and other factors that impact their business. This enables proactive decision-making and allows organizations to stay ahead of the competition by anticipating and preparing for future changes.
- **Enhanced Decision-Making:** This type of analytics provides valuable insights that support informed decision-making. By using predictive models and algorithms, organizations can make data-driven decisions based on the likelihood of specific outcomes. This minimizes guesswork and subjective judgment, leading to more accurate and reliable decisions across various business functions such as marketing, finance, operations, and human resources.
- **Improved Resource Allocation:** Predictive analytics helps organizations optimize resource allocation by identifying areas where resources can be allocated most effectively. By analyzing data on customer preferences, market trends, and resource utilization, organizations can allocate their budget, workforce, and other resources in a way that maximizes efficiency and productivity. This leads to cost savings, improved operational performance, and better utilization of available resources.
- **Enhanced Customer Insights:** The type of analytics described in the paper enables organizations to gain a deeper understanding of their customers. By analyzing customer data, including past purchases, preferences, browsing behavior, and demographics, organizations can generate customer profiles and segmentation. This helps in personalizing marketing efforts, improving customer experiences, and tailoring products or services to meet specific customer needs. Ultimately, this leads to increased customer satisfaction, loyalty, and retention.
- **Risk Mitigation and Fraud Detection:** Predictive analytics is effective in identifying potential risks and detecting fraudulent activities. By analyzing historical data and patterns, organizations can identify anomalies, unusual behaviors, or potential fraud instances. This helps organizations take proactive measures to mitigate risks, prevent fraud, and protect their assets and reputation. Predictive analytics also supports effective risk management by identifying potential areas of concern and enabling organizations to develop strategies to minimize risks.

- **Optimization of Operations:** Predictive analytics helps organizations optimize their operational processes. By analyzing data on production, supply chain, inventory levels, and demand patterns, organizations can identify inefficiencies, streamline operations, and improve overall productivity. Predictive analytics also assists in identifying maintenance needs, equipment failures, and potential downtime, enabling organizations to take preventive measures and minimize disruptions.
- **Marketing Campaign Optimization:** This type of analytics plays a crucial role in optimizing marketing campaigns. By analyzing customer data, organizations can identify the most effective channels, messages, and timing for their marketing efforts. This enables organizations to target the right audience with personalized campaigns, resulting in higher conversion rates, improved return on investment (ROI), and overall marketing effectiveness.
- **Innovating Product Development:** Predictive analytics supports product development and innovation by identifying market trends, customer preferences, and emerging needs. By analyzing data on customer feedback, market research, and competitor analysis, organizations can identify new product opportunities, improve existing products, and align their offerings with market demands. This helps organizations stay competitive, drive innovation, and capture new market segments.

4. Example of descriptive analytics usage in business

Predictive analytics has numerous applications in various areas of business, enabling organizations to make data-driven decisions, anticipate future outcomes, and gain a competitive edge (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023). Predictive analytics can analyze historical sales data, market trends, customer behavior, and other relevant factors to forecast future sales and demand patterns. This helps businesses optimize inventory levels, plan production or procurement activities, and allocate resources effectively to meet customer demand.

By analyzing customer data, such as purchase history, interactions, and demographics, predictive analytics can identify customers who are at risk of churning or ending their relationship with the business. This allows organizations to take proactive measures, such as targeted marketing campaigns or personalized retention strategies, to retain valuable customers and reduce churn rates. Predictive analytics can be used to detect fraudulent activities by analyzing patterns, anomalies, and historical data. By applying machine learning algorithms to transactional data, businesses can identify suspicious behavior, flag potentially fraudulent transactions, and minimize financial losses due to fraud (Cam et al., 2021).

Predictive analytics can help businesses assess and manage various types of risks. For example, in the insurance industry, predictive models can be used to assess the likelihood of insurance claims, estimate potential losses, and determine appropriate premium rates. In financial institutions, predictive analytics can analyze market trends, customer data, and economic indicators to forecast credit risks and make informed lending decisions (Peter et al., 2023).

Predictive analytics can optimize supply chain operations by forecasting demand, optimizing inventory levels, and improving logistics and distribution processes. By analyzing historical data, market trends, and external factors like weather patterns, businesses can anticipate demand fluctuations, identify potential supply chain disruptions, and make informed decisions to enhance efficiency and minimize costs. Predictive analytics can assist businesses in optimizing pricing strategies by analyzing factors such as customer behavior, market conditions, competitor pricing, and product attributes. By leveraging predictive models, businesses can identify optimal price points, determine price elasticity, and develop dynamic pricing strategies to maximize revenue and profitability (Hurwitz et al., 2015).

Predictive analytics can analyze customer data, demographics, preferences, and past campaign performance to optimize marketing efforts. By predicting customer responses and behavior, businesses can personalize marketing campaigns, target specific customer segments, allocate marketing budgets effectively, and improve campaign ROI. This type of analytics can help organizations identify top-performing candidates, assess their fit with job requirements, and predict their likelihood of success within the company. By analyzing data from resumes, assessments, performance reviews, and employee demographics, businesses can make informed hiring decisions and develop strategies for talent retention and development.

Predictive analytics can be utilized in quality management to improve processes, identify potential issues, and enhance overall product or service quality. These are just a few examples of how predictive analytics can be applied in quality management. By leveraging predictive analytics techniques and technologies, organizations can proactively identify quality issues, optimize processes, and continuously improve the overall quality of their products or services.

Below are some of examples of usage of predictive analytics in quality management (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023):

- Predictive analytics can be employed to forecast the likelihood of defects or quality issues in manufacturing processes. By analyzing historical data on product defects, process parameters, and environmental factors, organizations can develop models that predict the probability of defects occurring during production. This enables proactive measures to be taken, such as adjusting process parameters, implementing preventive maintenance, or enhancing quality control practices to minimize defects and improve product quality.

- Predictive analytics can help evaluate and predict the performance of suppliers in terms of quality. By analyzing supplier data, including delivery times, product quality, and customer feedback, organizations can develop models that predict the likelihood of supplier-related quality issues. This enables organizations to make informed decisions when selecting suppliers, negotiate contracts based on predicted performance, and proactively address potential quality issues by working closely with suppliers.
- Predictive analytics can be used to analyze customer complaints and identify patterns or trends that may indicate potential quality issues. By analyzing data such as customer feedback, product reviews, and support tickets, organizations can develop models that predict the likelihood of future complaints or identify areas where quality improvements are needed. This enables organizations to take corrective actions, improve product design, address common customer pain points, and enhance overall customer satisfaction.
- This type of analytics can be employed to optimize equipment maintenance and reduce equipment failure rates. By analyzing sensor data, historical maintenance records, and environmental conditions, organizations can develop models that predict the likelihood of equipment failures or breakdowns. This enables organizations to implement proactive maintenance strategies, schedule maintenance activities based on predicted failure probabilities, and minimize unplanned downtime. By addressing maintenance needs in advance, organizations can ensure optimal equipment performance, reduce production interruptions, and improve overall product quality.
- Predictive analytics can be utilized to optimize manufacturing or service processes and improve quality outcomes. By analyzing process data, organizations can identify variables or factors that significantly impact product quality. Predictive models can then be developed to forecast the impact of process changes or adjustments on product quality. This enables organizations to optimize process parameters, identify the optimal process conditions for achieving desired quality levels, and continuously improve the quality of their products or services.
- Also predictive analytics can be employed to develop early warning systems that alert organizations to potential quality issues before they occur. By monitoring real-time data from various sources, such as production lines, quality control checkpoints, or customer feedback channels, organizations can develop predictive models that identify early indicators of quality issues. This enables organizations to take proactive measures, such as implementing corrective actions, conducting root cause analyses, or initiating preventive measures to avoid quality problems and ensure consistent product or service quality.

5. Conclusion

In conclusion, predictive analytics is a powerful tool that leverages historical data and statistical models to forecast future outcomes and behaviors. It enables organizations to gain valuable insights, make informed decisions, and drive business growth. By analyzing patterns, correlations, and trends in data, predictive analytics can uncover hidden relationships and provide a deeper understanding of business processes, customer behavior, market trends, and other important factors.

The benefits of predictive analytics are numerous. It enables organizations to forecast and predict future events, leading to proactive decision-making and the ability to anticipate trends and outcomes. It enhances decision-making processes, improves resource allocation, and provides enhanced customer insights. Predictive analytics also helps in risk mitigation, fraud detection, optimization of operations and pricing, product development, and marketing effectiveness. By leveraging these benefits, organizations can gain a competitive advantage and achieve sustainable success.

However, there are challenges associated with predictive analytics. Data quality and availability issues, biased data, and the need for skilled data scientists and analysts are common hurdles. Ethical concerns related to privacy, security, and potential discriminatory outcomes should also be carefully addressed.

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THE CONCEPT OF DIAGNOSTIC ANALYTICS

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Purpose: The goal of the paper is to analyze the main features, benefits and problems with the diagnostic analytics usage.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: The paper discusses the concept of diagnostic analytics, which is a powerful tool for organizations to understand the underlying factors and reasons behind specific outcomes or events. By analyzing historical data and applying statistical techniques, organizations can identify root causes, patterns, and correlations that explain past events. This understanding enables informed decision-making, performance improvement, risk mitigation, enhanced customer insights, process optimization, resource allocation, and continuous improvement.

Nevertheless, there are several challenges associated with diagnostic analytics. Firstly, the analysis process can be time-consuming due to the need for thorough examination and interpretation of data. Additionally, real-time insights may be limited as diagnostic analytics primarily focuses on historical data. Issues related to data quality and availability may also arise, impacting the accuracy and reliability of the analysis. Furthermore, diagnostic analytics lacks predictive capabilities, making it more challenging to anticipate future outcomes. The complexity of analysis, data privacy and security concerns, risks of bias and misinterpretation, and difficulties in identifying causal relationships further add to the challenges organizations face.

Originality/value: Detailed analysis of all subjects related to the problems connected with the diagnostic analytics.

Keywords: Industry 4.0; diagnostic analytics, business analytics, data analysis, real-time analytics.

Category of the paper: literature review.

1. Introduction

Diagnostic analytics is a branch of data analytics that focuses on examining historical data and identifying the root causes of various outcomes, events, or trends. It involves a thorough investigation and analysis of data to uncover patterns, relationships, and anomalies that can provide insights into why certain events occurred or certain outcomes were achieved.

Diagnostic analytics is a powerful approach to analyze historical data and understand the underlying causes of specific events or outcomes. By leveraging statistical and analytical techniques, organizations can gain valuable insights that drive informed decision-making and help improve future performance.

The goal of the paper is to analyze the main features, benefits and problems with the diagnostic analytics usage.

2. Diagnostic analytics - definitions

The primary objective of diagnostic analytics is to answer the question "Why did it happen?" It aims to go beyond simply describing what happened and delves into the underlying factors and reasons that led to a particular outcome. By understanding the causes and drivers behind past events, organizations can gain valuable insights and make informed decisions to improve future performance.

Diagnostic analytics relies on various statistical and analytical techniques to analyze historical data (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022; Gajdzik, Wolniak, 2023). These techniques include data mining, correlation analysis, regression analysis, hypothesis testing, and root cause analysis. By applying these methods, analysts can identify relationships between variables, detect trends and patterns, and uncover potential factors that influenced specific outcomes (Hurwitz et al., 2015).

The term diagnostic analytics can be defined as a branch of data analytics that focuses on the examination and analysis of historical data to understand the reasons behind specific outcomes or events. It involves the use of statistical analysis, data mining techniques, and other analytical tools to uncover patterns, correlations, and causal relationships within the data (Wolniak, Sułkowski, 2015, 2016; Wolniak, Grebski, 2018; Wolniak et al., 2019, 2020; Wolniak, Habek, 2015, 2016; Wolniak, Skotnicka, 2011; Wolniak, Jonek-Kowalska, 2021; 2022). The primary goal of diagnostic analytics is to identify the root causes of past events or trends, enabling organizations to gain insights into what happened and why it happened (Hwang et al., 2017).

One common application of diagnostic analytics is in the field of business intelligence, where organizations analyze operational data to gain insights into the performance of different departments, products, or processes (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018, 2023; Grabowska et al., 2019, 2020, 2021). For example, a retail company may use diagnostic analytics to understand why sales declined in a particular region or why a specific product line experienced low customer satisfaction. By examining data related to factors such as pricing, marketing campaigns, customer demographics, and competitor activity, the company can identify the key drivers behind the decline and take corrective actions (Patanjali, 2018; Nourani, 2021, Sharma et al., 2020).

Another area where diagnostic analytics plays a crucial role is in healthcare. Medical professionals and researchers often analyze patient data to understand the factors contributing to disease outbreaks, treatment effectiveness, or patient outcomes (Cam et al., 2021). By examining patient demographics, medical history, lifestyle factors, and treatment protocols, healthcare providers can identify patterns and risk factors that help in diagnosing diseases, improving treatment plans, and enhancing patient care (Greasley, 2019).

In addition to business and healthcare, diagnostic analytics finds applications in various other fields, including finance, marketing, manufacturing, and logistics. It enables organizations to uncover hidden insights, optimize processes, identify inefficiencies, and make data-driven decisions processes (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021, 2023; Rosak-Szyrocka et al., 2023; Gajdzik et al., 2023, Orzeł, Wolniak, 2021, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecuła, Wolniak, 2022; Olkiewicz et al., 2021).

While diagnostic analytics provides valuable insights into past events, it should be noted that it does not offer predictive capabilities. Its focus is on understanding what has already happened rather than forecasting future outcomes. For predictive analytics, organizations turn to other branches of data analytics, such as predictive modeling and forecasting (Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023).

Real-time analytics and diagnostic analytics are two distinct approaches to data analysis, each serving different purposes and timeframes. In the table 1 there is a comparison between those concepts.

Table 1.*Comparison of real-time analytics and diagnostic analytics*

| Aspect | Real-Time Analytics | Diagnostic Analytics |
|-------------------------|---|---|
| Focus | Immediate and up-to-the-minute data analysis. Real-time analytics is primarily focused on monitoring and detecting events as they happen. It is used to track ongoing processes, identify anomalies, and trigger immediate actions or alerts. Real-time analytics is particularly valuable for time-sensitive situations that require quick response or intervention. | Examination of historical data to identify root causes. Diagnostic analytics focuses on understanding the reasons and factors behind specific outcomes or events that have already occurred. It aims to uncover the root causes and patterns in historical data, enabling organizations to gain insights into what happened and why. Diagnostic analytics is commonly used for retrospective analysis, performance evaluation, and process improvement. |
| Time Frame | Real-time or near real-time data processing. Real-time analytics focuses on analyzing data as it is generated or shortly after. It provides immediate insights and analysis of data in real-time or near real-time, allowing for quick decision-making and immediate actions. | Analysis of past data to understand what happened. Diagnostic analytics, on the other hand, looks at historical data to understand past events and identify the underlying causes. It analyzes data that has already been collected and processed, usually covering a longer time frame. |
| Purpose | Monitoring, detecting, and reacting quickly. | Understanding the reasons and factors behind specific outcomes. |
| Data Sources | Streaming data, sensors, IoT devices, etc. Real-time analytics relies on streaming data sources such as sensors, IoT devices, social media feeds, or live transactional data. It requires continuous data ingestion and processing to deliver up-to-the-minute insights. | Historical data from databases, data warehouses, or systems. Diagnostic analytics typically utilizes historical data from databases, data warehouses, or other data repositories. It involves examining data that has already been collected and stored over a period of time. |
| Analysis Techniques | Data streaming, complex event processing. Real-time analytics employs techniques like data streaming, complex event processing, and real-time data visualization. It often involves applying algorithms and rules to analyze data in motion and make instantaneous decisions or trigger automated responses. | Statistical analysis, root cause analysis, hypothesis testing. Diagnostic analytics utilizes techniques such as statistical analysis, root cause analysis, hypothesis testing, and data mining. It focuses on exploring historical data, identifying correlations, patterns, and causal relationships to explain past events or outcomes. |
| Decision-Making | Immediate actions or responses based on data. Real-time analytics supports immediate decision-making based on real-time insights. It enables organizations to take instant actions, such as adjusting pricing, optimizing inventory, or responding to emerging trends or threats. | Informed decision-making for future improvements. Diagnostic analytics informs decision-making for future improvements. It helps organizations understand the factors that contributed to past outcomes and enables them to make data-driven decisions to optimize processes, enhance performance, and avoid similar issues in the future. |
| Application Examples | Fraud detection, real-time dashboards. | Identifying sales decline causes, patient outcome analysis. |
| Predictive Capabilities | Limited. | Focuses on explaining what happened rather than predicting. |
| Data Volume | Handles high volume and velocity of data. | Analyzes large volumes of historical data. |
| Importance of Time | Critical importance on real-time insights. | Less emphasis on real-time insights, focuses on historical. |
| System Requirements | Real-time data processing and analytics. | Access to historical data, data storage. |

Source: Authors own work on the basis of: (Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023, Scappini, 2016, Peter et al., 2023).

3. Benefits and problems of diagnostic analytics usage

The usage of diagnostic analytics empowers organizations with valuable insights into the root causes of outcomes, informs decision-making, drives performance improvement, mitigates risks, enhances customer understanding, optimizes processes, and enables continuous improvement. By leveraging historical data and analytical techniques, organizations can gain a competitive edge, increase operational efficiency, and make data-driven decisions to achieve their goals.

On the basis of literature analysis following benefits of diagnostic analytics can be formulated (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023):

- **Root Cause Identification:** Diagnostic analytics enables organizations to identify the root causes behind specific outcomes or events. By analyzing historical data and applying statistical techniques, organizations can gain insights into the factors that led to certain results. This understanding helps in addressing issues at their source and implementing targeted solutions.
- **Informed Decision-Making:** This type of analytics provides organizations with a solid foundation for making informed decisions. By uncovering the underlying causes and relationships between variables, decision-makers can better understand the impact of various factors on outcomes. This knowledge allows them to develop effective strategies, optimize processes, and allocate resources more efficiently.
- **Performance Improvement:** By analyzing past data, diagnostic analytics helps organizations improve their performance. It reveals inefficiencies, bottlenecks, and areas for improvement. Organizations can identify patterns, trends, and correlations that impact performance, enabling them to make data-driven adjustments to enhance productivity, quality, and overall operational effectiveness.
- **Risk Mitigation:** Described method plays a crucial role in risk management. By understanding the root causes of risks and analyzing historical data, organizations can proactively identify potential risks and take preventive measures. They can assess the impact of various factors on risk occurrence and develop mitigation strategies to minimize negative outcomes.
- **Enhanced Customer Insights:** Diagnostic analytics helps organizations gain deeper insights into customer behavior, preferences, and satisfaction. By analyzing historical data, organizations can understand the factors that influence customer actions and make data-backed decisions to improve customer experiences, tailor marketing campaigns, and optimize product offerings.

- **Process Optimization:** By examining historical data, diagnostic analytics enables organizations to identify process inefficiencies, bottlenecks, and areas of improvement. By understanding the factors that contribute to delays, errors, or resource constraints, organizations can streamline processes, eliminate waste, and enhance operational efficiency.
- **Resource Allocation:** This type of analytics aids in optimizing resource allocation. By analyzing past performance and identifying the key drivers of success or failure, organizations can allocate resources effectively. This includes optimizing budget allocation, personnel deployment, inventory management, and capacity planning based on data-driven insights.
- **Continuous Improvement:** The usage of diagnostic analytics facilitates a culture of continuous improvement within organizations. By regularly analyzing historical data, organizations can track progress, evaluate the effectiveness of implemented changes, and identify new areas for improvement. It helps organizations measure the impact of interventions and make iterative adjustments to achieve ongoing enhancements.

While there are several benefits to the use of diagnostic analytics, there are also some potential disadvantages and problems that businesses and organizations should be aware of. Despite these challenges, organizations that address these limitations and effectively leverage diagnostic analytics can gain valuable insights into past events, optimize their operations, and make informed decisions based on historical data (Sharma et al., 2020; Wolniak, 2013, 2016; Hys, Wolniak, 2018). It is important to recognize the limitations and supplement diagnostic analytics with other analytical approaches to achieve a comprehensive understanding of data and drive future success.

Below are some of the key disadvantages and problems associated with the usage of diagnostic analytics (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023, Scappini, 2016; Peter et al., 2023):

- **Time-Intensive Analysis:** Diagnostic analytics involves analyzing large volumes of historical data, which can be a time-consuming process. Extracting, cleaning, and preparing the data for analysis can require substantial effort and resources. Additionally, the analysis itself may involve complex statistical techniques and interpretation, further adding to the time required.
- **Limited Real-Time Insights:** This type of analytics focuses on analyzing past data to understand what happened, rather than providing real-time insights. This means that organizations may miss opportunities to respond immediately to emerging trends, events, or anomalies. Real-time decision-making requires the integration of real-time analytics or other approaches to complement diagnostic analytics.

- **Data Quality and Availability:** The accuracy and reliability of diagnostic analytics heavily depend on the quality of the underlying data. Issues such as incomplete or inaccurate data, data inconsistencies, and data silos can hinder the effectiveness of the analysis. Ensuring data quality and establishing data governance practices are critical for obtaining accurate insights.
- **Lack of Predictive Capabilities:** Method of analytics described in the paper primarily focuses on explaining past events and outcomes, rather than predicting future events. While it helps identify root causes, it may not provide proactive insights or predictive capabilities to anticipate future outcomes. For organizations seeking forward-looking insights, other branches of analytics such as predictive analytics or prescriptive analytics may be necessary.
- **Complexity of Analysis:** Analyzing historical data and identifying root causes can be a complex task. It requires expertise in statistical analysis, data mining, and domain knowledge. Organizations may need skilled analysts or data scientists with a deep understanding of the data and the ability to apply appropriate analytical techniques to derive meaningful insights.
- **Data Privacy and Security Concerns:** This method of analytics involves accessing and analyzing historical data, which can contain sensitive information. Organizations need to ensure data privacy and comply with relevant data protection regulations. Inappropriate data handling or unauthorized access to data can lead to breaches, privacy violations, and legal consequences.
- **Bias and Misinterpretation:** Like any data analysis, diagnostic analytics is susceptible to biases and misinterpretation of results. Biases in data collection, sampling, or analysis can lead to inaccurate or misleading insights. It requires careful consideration of the data context, understanding potential biases, and applying robust analytical methods to mitigate these risks.
- **Difficulty in Identifying Causal Relationships:** While diagnostic analytics can identify correlations and associations between variables, establishing true causal relationships can be challenging. Different factors may be interrelated, and identifying the true cause-effect relationships may require additional research, experimentation, or advanced techniques such as experimental design.

4. Example of descriptive analytics usage in business

Diagnostic analytics finds extensive applications in various business domains. Organizations use diagnostic analytics to understand the factors influencing sales performance. By analyzing historical sales data alongside marketing campaigns, pricing strategies, customer

demographics, and competitor activities, businesses can identify the root causes of sales fluctuations, customer churn, or low conversion rates. This analysis helps in optimizing sales strategies, improving customer targeting, and enhancing overall sales effectiveness (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023, Scappini, 2016; Peter et al., 2023).

Diagnostic analytics enables businesses to delve into customer feedback and satisfaction data to identify key drivers of customer satisfaction or dissatisfaction. By analyzing customer interactions, surveys, social media sentiment, and historical data, organizations can pinpoint areas where customer expectations are not met, address pain points, and make improvements to enhance overall customer satisfaction and loyalty (Cam et al., 2021).

This type of analytics plays a vital role in optimizing operational processes. Organizations analyze historical operational data, including production metrics, supply chain data, and quality control records, to identify bottlenecks, inefficiencies, and process variations. By understanding the root causes of these issues, organizations can streamline workflows, eliminate waste, reduce costs, and improve overall operational efficiency.

Diagnostic analytics is employed to analyze historical data for identifying patterns and anomalies associated with fraud, financial irregularities, or security breaches. By examining transactional data, access logs, and historical behavior patterns, organizations can identify potential fraud instances, mitigate risks, and enhance security measures to protect their assets and maintain regulatory compliance. Organizations leverage diagnostic analytics to assess employee performance and identify factors impacting productivity and engagement. By analyzing historical employee data, including performance metrics, training records, and employee feedback, organizations can identify patterns and factors contributing to high or low performance. This analysis helps in identifying training needs, optimizing workforce allocation, and implementing strategies to enhance employee engagement and productivity (Peter et al., 2023).

Also diagnostic analytics is utilized to optimize supply chain management. Organizations analyze historical data related to procurement, inventory levels, supplier performance, transportation logistics, and customer demand patterns. By understanding the historical trends and root causes of supply chain inefficiencies, organizations can optimize inventory levels, improve demand forecasting, enhance supplier relationships, and reduce costs (Hurwitz et al., 2015).

Describe method of analytics helps organizations evaluate the effectiveness of marketing campaigns. By analyzing historical marketing data, including customer responses, campaign metrics, and customer segmentation, organizations can identify the most successful campaigns, target audience segments with the highest response rates, and determine the factors that lead to campaign success or failure. This analysis guides future marketing strategies and resource allocation for optimal outcomes.

Diagnostic analytics plays a crucial role in quality management by helping organizations identify the root causes of quality issues, optimize processes, and enhance product or service quality. Diagnostic analytics in quality management helps organizations identify the root causes of quality issues, optimize processes, evaluate supplier performance, analyze customer complaints, perform root cause analysis, and implement statistical process control. By leveraging historical data and applying analytical techniques, organizations can improve product or service quality, enhance customer satisfaction, and drive continuous quality improvement initiatives.

Below are some of examples of usage of descriptive analytics in quality management (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023, Scappini, 2016; Peter et al., 2023):

- Diagnostic analytics can be used to analyze historical data on product defects or service failures. By examining data related to defect types, production or service parameters, equipment performance, and customer complaints, organizations can identify patterns and underlying causes of defects. For example, a manufacturing company might analyze defect data to identify common manufacturing process errors or equipment malfunctions causing defects. This analysis helps in implementing corrective actions to improve product quality and reduce defects.
- Organizations can use diagnostic analytics to evaluate the performance of their suppliers and vendors. By analyzing data related to delivery times, product quality, compliance issues, and customer feedback, organizations can identify suppliers that consistently meet quality standards and those that require improvement. This analysis helps in supplier selection, contract negotiations, and establishing quality improvement initiatives with suppliers.
- Diagnostic analytics helps optimize processes to enhance quality. Organizations can analyze historical process data, including process parameters, inputs, and outputs, to identify variations and inefficiencies that affect quality. For instance, a service organization might analyze process data to identify process steps that result in delays or errors, leading to customer complaints. By understanding the root causes, organizations can streamline processes, eliminate non-value-added steps, and reduce errors to improve quality.
- The method of analytics described in the paper enables organizations to analyze customer complaint data to identify recurring quality issues. By examining complaint data, organizations can identify the root causes of complaints and the associated process or product areas that need improvement. For example, a telecommunications company might analyze complaint data to identify common issues related to network outages, billing errors, or customer service interactions. This analysis helps in prioritizing improvement initiatives and addressing customer concerns to enhance overall quality.

- Diagnostic analytics facilitates root cause analysis to identify the underlying factors contributing to quality issues. By analyzing historical data, organizations can identify correlations, trends, and relationships between variables that impact quality. For example, a healthcare organization might analyze patient data to identify factors leading to medical errors or adverse events. This analysis helps in identifying system failures, training needs, or process gaps that need to be addressed to improve quality and patient safety.
- Also diagnostic analytics involves the application of statistical techniques like control charts to monitor and analyze process variations. SPC enables organizations to identify process deviations that may impact quality. By analyzing historical process data against control limits, organizations can detect trends, out-of-control points, or shifts in process performance. This analysis helps in taking timely corrective actions and maintaining consistent quality levels.

5. Conclusion

In conclusion it can be stated that diagnostic analytics is a powerful tool for organizations to understand the underlying factors and reasons behind specific outcomes or events. By analyzing historical data and applying statistical techniques, organizations can identify root causes, patterns, and correlations that explain past events. This understanding enables informed decision-making, performance improvement, risk mitigation, enhanced customer insights, process optimization, resource allocation, and continuous improvement.

Nevertheless, there are several challenges associated with diagnostic analytics. Firstly, the analysis process can be time-consuming due to the need for thorough examination and interpretation of data. Additionally, real-time insights may be limited as diagnostic analytics primarily focuses on historical data. Issues related to data quality and availability may also arise, impacting the accuracy and reliability of the analysis. Furthermore, diagnostic analytics lacks predictive capabilities, making it more challenging to anticipate future outcomes. The complexity of analysis, data privacy and security concerns, risks of bias and misinterpretation, and difficulties in identifying causal relationships further add to the challenges organizations face.

To overcome these limitations, organizations should complement diagnostic analytics with other analytical approaches. By doing so, they can achieve a comprehensive understanding of their data and drive future success. It is crucial to address these challenges and ensure that diagnostic analytics is supplemented with predictive and prescriptive analytics, enabling organizations to anticipate future events and make proactive decisions. Furthermore,

organizations must address data quality issues, enhance data privacy and security measures, and implement measures to mitigate bias and misinterpretation risks.

Despite these challenges, diagnostic analytics finds widespread applications across various domains, including business intelligence, healthcare, finance, marketing, manufacturing, and logistics. It empowers organizations to extract valuable insights from historical data, optimize operations, and make informed, data-driven decisions. By harnessing the benefits of diagnostic analytics and addressing its challenges, organizations can unlock the full potential of their data, drive performance improvements, and remain competitive in today's data-driven landscape.

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**SYSTEMIC BUSINESS CONTINUITY MANAGEMENT
IN THE PROCESS OF BUILDING THE ORGANIZATION'S
RESILIENCE AND IMPROVING ITS SECURITY.
EXPERIENCE OF THE ORGANIZATION IN POLAND**

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Aim: The article aimed to present the essence of the systemic approach to business continuity management (BCMS - Business Continuity Management System) and to determine the level of maturity of business continuity systems implemented in small and medium-sized enterprises about selected groups of external threats, corresponding to current economic, political and legal conditions.

Project/methodology/approach: The subject of this study is an analysis based on the available resources in the literature and the results of the conducted empirical study.

Findings: As a result of the literature study, it has been proven that organizations are exposed to many threats that affect business continuity to varying degrees. The fundamental element of organizational prevention at the operational level is the business continuity plan, which defines response mechanisms in the event of an incident or crisis that negatively affects the stability of implemented projects. The analysis of the research results indicated that the primary response mechanism established in modern organizations transfers the burden of the effects of the crisis to employees, as it is related to the performance of professional duties using remote communication methods and techniques.

Research limitations/implications: The primary research limitation was the difficulty in obtaining a representative research sample, which is why it was decided to limit the scope of the research and carry it out in enterprises belonging to high-tech industries. Bearing in mind that the scope of the study referred to conditions which, due to the increased uncertainty of the general (intermediate) environment, are subject to changes and improvement of modern management systems, it is recommended to conduct the research again in other economic sectors. Expanding the study's scope will allow the development of a catalogue of good practices, including a more comprehensive catalogue of threats to the continuity of modern business organizations.

Originality/value: The article presents previously untested mechanisms ensuring business continuity about current threats – blackout and energy lockdown. The analyses contained therein may be the basis for improving internal crisis response systems, especially in small and medium-sized enterprises.

Keywords: business continuity plan, operational risk, blackout, crisis, incident.

Paper category: research and review publication.

1. Introduction

In recent years, more and more attention in management has been devoted to business continuity and building organizational resilience. In reality, organizations have to deal with increasingly more significant and complex threats, such as natural disasters, cyberattacks, or pandemics, which result in severe financial and reputational losses. To ensure business continuity and minimize the effects of potential threats, more and more organizations are introducing a systemic approach to business continuity management (BCMS - Business Continuity Management System) and focusing their activities on building organizational resilience.

This article presents Polish organizations' experience in systemic business continuity management and building their resistance to threats. The paper will discuss the concepts and tools used within the BCMS and the methods of implementing the system in organizations in Poland. In addition, the results of research on the level of maturity of the organization in the context of improving the security of the organization will be presented.

In light of the growing number of threats and the growing sensitivity of the organization to potential losses, the topic of business continuity and building the organization's resilience is becoming increasingly important. Therefore, implementing a systemic approach to business continuity management, such as BCMS, becomes a critical element of activities to minimize risk and improve the organization's security.

2. Business continuity plan in the enterprise – theoretical basis

Consistent and uninterrupted implementation of current production and service processes shapes the operational continuity of the organization, the results of which directly affect the form and scope of relations established with the environment. Business continuity can be disrupted as a result of both internal and external factors. Therefore, modern organizations carry out many complementary activities to minimize uncertainty leading to business continuity interruption. The high turbulence of the environment, as well as the increased dynamics of changes observed in the right dimension, is the result of emerging crises of a global nature. It encourages entrepreneurs to build organizational prevention, especially at the organizational structure's lowest operational level.

The Bael Agreement indicates that operational risk should be equated with a loss resulting from insufficient or inadequate internal processes, people, and systems, as well as from events external to the company (Basel Committee on Banking Supervision, 2006). The presented approach, developed by the Basel Committee, emphasizes the importance of the effects of unfavourable phenomena while indicating a broad spectrum of circumstances that may disrupt the course of activities and processes. The unique and often ambiguous nature of threats, especially those whose source is in the organization's environment, implies the need to protect critical processes that ensure the continuity of the organization's operation. Scenarios of incidents and crises are developed in business continuity plans, considering the effects, prospects, and value of resources at the organization's disposal.

Business Continuity Plans (BCP) are sets of tested and documented procedures for operational business continuity management, defining the organization and rules of conduct as part of activities constituting a planned response to an unexpected disruption with a destructive impact causing a crisis in the organization's operations (Gołab, 2009). The presented approach indicates that the business continuity plan is a fundamental element of securing the enterprise against the effects of business disruptions. It also makes it possible to ensure a minimum level of process operation in the event of one of the attributes of a crisis, which include: the risk of incurring losses threatening the survival of the organization, loss of supervision over the occurring events, significant negative impact on the organization's resources, insufficient time to implement the undertaken actions (or taking a reaction), lack of reliable information (Krzakiewicz, 2008). The presence of some of the listed threats is a natural consequence of changes occurring simultaneously in the organization and its environment. However, the increased dynamics of changes significantly increase the organization's susceptibility to the occurrence of events, the effects of which significantly increase the uncertainty of operation and, consequently, limit its ability to self-regulate. It is worth noting at this point that modern enterprises have advanced, automated decision-making systems that facilitate the development of variants of action concerning threats originating within the organization.

External threats to the continuity of the organization's operations have a much wider spectrum of occurrence and impact, which is why it isn't easy to develop a universal response methodology. The critical criterion for building organizational prevention in this aspect is sensitivity to the time factor¹. It is assumed that the ability to recognize the sources, scale, and effects of specific external threats increases exponentially, along with the acquisition of new experiences resulting from the organization's completed, current, and planned projects. Of course, some threats are repetitive, thanks to which the entrepreneur can adequately secure resources and means in advance, neutralizing the impact of specific incidents and risks. Most often, however, it is difficult to precisely determine both the time and the level of effects

¹ Every complex organization satisfies the conditions of the ergodic hypothesis, which states that if a system functions for a long enough time, it goes through all possible states, no matter how low the probability of a given state is (Grzesiowski, 2000).

of particular phenomena on the organization, which is why theoretically assumed scenarios of the development of phenomena are created, which in specific circumstances may be a source of the crisis.

Differences in the strength and course of crisis phenomena that have emerged between individual regions of the world, and even countries, lead to the thesis that despite the strong interconnection of economies in the global world, enterprises react differently to similar threats related to the crisis or, more broadly, to the risks resulting from changes in the environment (Romanowska, 2010). The phenomena resulting from the SARS-CoV-2² coronavirus pandemic, which lasted for over three years and spread worldwide, and the armed conflict in Ukraine and Russia, which has been taking place since February 24, 2022, are gaining importance. The indicated conditions significantly contributed to expanding the catalogue of risks that should be included in business continuity plans. Concerning the pandemic, the threats directly impacted the continuity of operation of selected industries, as the legislator imposed a legal ban on the provision of certain services to some organizations (Goldstein, Flynn, 2022). The catalogue of risks has accordingly expanded due to the armed conflict between Russia and Ukraine. Although military operations are local, their effects directly affect the functioning of all industries, even those not involved in the course of the conflict. Russia, as the leading exporter of energy resources, uses political pressure on the countries of Eastern Europe that are militarily weaker and poorer in energy resources (Kułaga-Boczko, 2022). This situation is a source of threats related to the availability of energy resources, which, in the era of the development of modern societies, are the basis for the operation of all types of business organizations. The first of them is a blackout – loss of voltage in the NPS power grid over a large area as a result of a sequence of several random or intentional events, i.e. grid failures, shutdowns of power plants, extreme weather conditions, a terrorist event (NCMP, 2022). The second threat currently identified by government institutions dealing with the security of critical European infrastructure is the energy lockdown. Unlike blackout, this is a phenomenon implemented by state authorities, consisting of partial limitation of the availability of electricity, which is aimed at ensuring the continuity of operation of public benefit organizations and preventing failures of the power grid (Pinto, Fernandes, da Silva, Pereira, 2022).

The COVID-19 pandemic has affected research on business continuity management (BCM) by highlighting the need for BCM programs to adapt to reflect the altered environment (Goldstein, Flynn, 2022). The pandemic has also exposed systemic vulnerabilities at the economic level, highlighting the significance of BCM in protecting the interests of stakeholders (Corrales-Estrada, Gómez-Santos, Bernal-Torres, Rodríguez-López, 2021). In addition, there are few studies analysing the relationship between organizational sustainability capabilities, organizational resilience capabilities, and BCM to comprehend risk management².

² On March 11, 2020, the World Health Organization announced a state of pandemic, which is still formerly in force.

Future research is required to investigate the impact of the pandemic on BCM programs and to identify new trends and guidelines to consider when developing a BCM plan strategy. Another trend is the exploration of information systems security management topics of BCM, including definitions, terminology, trends, and guidelines common to this requirement born essentially from the IT industry (Charoenthammachoke, Leelawat, Tang, Kodaka, 2020). A preliminary systematic literature review explores the trend of BCM, the subject, and the relationship between BCM and associated study fields³. Other trends include the development of a holistic approach to BCM that provides a framework for building resilience and the capability for an effective response that safeguards the interests of its key stakeholders, reputation, brand, and value-creating activities⁴. Furthermore, there is a notable emphasis on the implementation of proficient business continuity management within insurance firms that utilize contemporary e-commerce technologies (Labus, 2017).

3. System Business Continuity Management

The first works related to the concept of business continuity management appeared in the 1970s. One of the first classics to pioneer in this field was Dr David G. Backhurst, who published a number of articles on business continuity planning in the 1970s and 1980s. Another classic from the area was Dr Russell L. Ackoff, who developed the business continuity planning methodology in the 1970s.

In the 1980s and 1990s, the concept of business continuity management gained popularity, and one of the classics who contributed to its development was Dr Jay E. Heizer, who has published several articles and books on business continuity this decade. The work of Dr Robert L. Shannon should also be mentioned, who in 1992 published the book "Business Continuity Planning: A Step-by-Step Guide with Planning Forms".

Nowadays, there are many authors and scientists dealing with the subject of business continuity management.

Systemic management is an approach to management that focuses on a holistic approach to the organization, its processes, and its resources. Within the systemic approach, an organization is treated as a system composed of interrelated elements that work together to achieve specific goals. Systemic management requires an understanding of both internal and external processes that affect the organization and taking into account their impact on the efficiency and effectiveness of the organization.

The basic assumption of systemic management is that changes introduced in one area of the organization affect other areas. Therefore, it is important to take these dependencies into account in the organization management process and to monitor the impact of the introduced changes on the entire system.

Systemic management assumes the use of tools and methods that enable effective management of the entire system. This approach allows you to identify problems and their causes, and then take remedial action to prevent similar problems from arising in the future. Systemic management also includes continuous improvement of organizational processes, which increases the organization's efficiency and effectiveness.

As a result, systemic management can contribute to improving the quality of the organization's work and its financial results. The challenges related to managing an organization are very big today, and a systemic approach is an answer to many of these challenges.

In today's increasingly complex and dynamic business environments, organizations must ensure business continuity in order to survive and thrive in the market. To this end, many organizations use a systemic approach to business continuity management that aims to ensure optimal operational performance and minimize the risk of failure in the event of incidents or disasters.

The systemic approach to business continuity management assumes that the organization must be ready for incidents or disasters and have the ability to act quickly and effectively to restore normal functioning. The systemic approach to business continuity management includes a number of activities aimed at minimizing risk and increasing the organization's resilience to incidents.

The systemic approach to business continuity management is based on several key features. First, it is an integrated approach in which all organizational functions, processes, and resources are interrelated. Second, the systemic approach to business continuity management is customer-oriented, which means that the organization must be prepared for different situations to ensure business continuity and minimize the impact on customers. Third, the systemic approach to business continuity management is process-oriented, which means that an organization must have a thorough knowledge of its processes to be able to react quickly to incidents.

The issue of business continuity management is extremely important and is the current research of many authors.

According to David Lindstedt and Mark Armour, authors of the "Adaptive Business Continuity: A New Approach", business continuity management is a systematic and holistic process of identifying potential threats to an organization and determining what steps should be taken to minimize the impact of these threats on the organization in the event of their effects. Business continuity management is also the process of ensuring that the organization is able to operate without interruption, even in the event of unpredictable events (Lindstedt, Armour, 2018).

The Business Continuity Institute's (BCI's) Good Practice Guidelines define business continuity management as a "holistic process that identifies threats to an organization and the impacts to business operations that those threats if realized, might cause. It provides a framework for building organizational resilience with the capability for an effective response that safeguards the interests of key stakeholders, reputation, brand, and value-creating activities".

The definition of business continuity management according to ISO 22301 is a systemic approach to business continuity management that enables an organization to identify potential threats to business continuity, as well as prepare for and respond to such situations, enabling the organization to restore its critical business functions within a fixed time after a disruption or failure.

According to Herbane, B. (2010). BCM (business continuity management) is a holistic management process that identifies potential threats to an organization and the impacts on business operations that those threats if realized, might cause. It provides a framework for building organizational resilience with the capability for an effective response that safeguards the interests of its key stakeholders, reputation, brand, and value-creating activities.

Niemimaa, M., Järveläinen, J., Heikkilä, M., & Heikkilä, J. (2019). Appoint that business continuity as a company's socio-technical ability to withstand and restore from intra- and extra-organizational contingencies. Business continuity management (BCM) refers to identifying potential threats to an organization and creating a framework for responding to them to ensure the continued operation of critical business functions. The article proposes an extension of existing BCM approaches for organizations to become more holistic and strategic in their planning.

Kawano, T., & Li, Y. (2017) refer that BCM stands for Business Continuity Management. It is a process that aims to identify potential risks and threats to an organization and provides a framework for building resilience and the capability for an effective response that safeguards the interests of its key stakeholders, reputation, brand, and value-creating activities. The paper also discusses how Smart BCM (SBCM) can be used to integrate information and communication technology (ICT), new energies, and other advanced technologies into BCM in order to improve functionality, optimize operation, minimize damage in case of emergency, and shorten restoration time.

The ISO 22301 standard is an international standard for business continuity management in organizations. The ISO 22300 family of standards also includes other standards related to business continuity management that complement ISO 22301. Here are some of them:

- ISO 22301:2019 – Security and resilience – Business continuity management systems – Requirements.
- ISO 22300:2018 – Terminology and basics of the business continuity management system.
- ISO 22313:2020 – Practical guidelines for business continuity.
- ISO 22316:2017 – Anticipation and assessment of threats.
- ISO/IEC 27031:2011 – Business continuity management in information technology.
- ISO/PAS 22399:2007 – Guidelines for business continuity management.
- ISO/TS 22317:2015 – Guidelines for assessing the impact on business continuity.
- ISO/TS 22318:2015 – Business continuity management – mass incident management.

Among the Standards in the field of business continuity management in the organization, the following can also be indicated:

- BS 25999-2:2007 – Business continuity management – Specification.
- NFPA 1600:2019 – Standard for business continuity, crisis and emergency management.
- ISO/IEC 27031:2011 – Business continuity management in information technology.
- ISO/IEC 24762:2008 – Business continuity management in information technology – practical principles and guidelines.
- ISO/IEC 20000-1:2018 – IT service management systems – Requirements.
- ISO 28000:2007 – Supply chain security management – management system specification.
- ANSI/ASIS SPC.1-2009 – Risk and business continuity management – A systemic approach to the threat assessment model.
- ISO 31000:2018 – Risk management – Requirements.
- BS ISO 45001:2018 – Occupational health and safety management – Management system requirements.

Ensuring the continuity of an organization's operations, its resilience to all types of disruptions, and ensuring safety at the macro and microeconomic levels constitutes a source of competitive advantage. The ISO 22301 Security and Resilience - Business continuity management systems - Requirements standard outlines the benefits of implementing a business continuity management system and defines them in four perspectives: business, financial, stakeholders, and internal processes. The following benefits were listed under the financial perspective: supporting strategic objectives, contributing to competitive advantage, protecting and enhancing the organization's reputation and credibility, and increasing organizational resilience. Two benefits were identified from the financial perspective, including reducing exposure to legal and economic consequences and reducing direct and indirect costs of disruptions. From the stakeholders' view, the following benefits can be identified: protecting life, property, and the environment, identifying the expectations of interested parties and analyzing them, and ensuring confidence in the organization's ability to achieve success. The final perspective is the internal processes perspective. Under this criterion, the following benefits can be identified: increasing the organization's ability to maintain effectiveness during disruptions, demonstrating effective and efficient proactive risk monitoring, and eliminating weaknesses in operational activities (ISO 22301:2019).

4. The area and scope of business continuity plans in small and medium-sized enterprises – analysis of research results

In the literature on the subject, little content is devoted to the characteristics and description of systems ensuring business continuity in modern organizations. Therefore, to learn and present the mechanisms shaping business continuity systems established in business organizations, an empirical study was conducted, allowing for a more precise reference to the indicated issue.

The study's main subject was identifying mechanisms ensuring business continuity in small and medium-sized organizations belonging to high-tech industries. All organizations surveyed focus their activities on research and development in the field of technical sciences. The research problem was formulated in the form of a question: which areas, in the light of current economic conditions, pose the greatest challenge in the process of ensuring business continuity in enterprises operating in the field of high-tech technologies? The research was carried out using the diagnostic survey method, a survey technique, carried out with the use of an original research tool – a questionnaire. Bearing in mind the difficulty in recognizing the significance of the indicated threats by the respondents, resulting from the narrowed research area as well as the unusual nomenclature of threats, the definitions of "blackout" and "energy lockdown" were included in the questionnaire.

The survey was conducted in January and February 2022 among 43 people holding managerial or coordinating functions, representing 9 small and 5 medium-sized enterprises, respectively, operating in the Mazovia voivodeship. The respondents included 15 women (35%) and 28 men (65%). The respondents represented three age groups, respectively, in the range from 26 to 35 years (40%), in the range from 36 to 45 years (47%), and in the range from 46 to 55 years (13%).

The first part of the study focused on defining the scope of the business continuity assurance system in relations to threats originating in the environment of the surveyed enterprises. Fig. 1 presents a summary of respondents' opinions relating to the identified external threats to the organization.

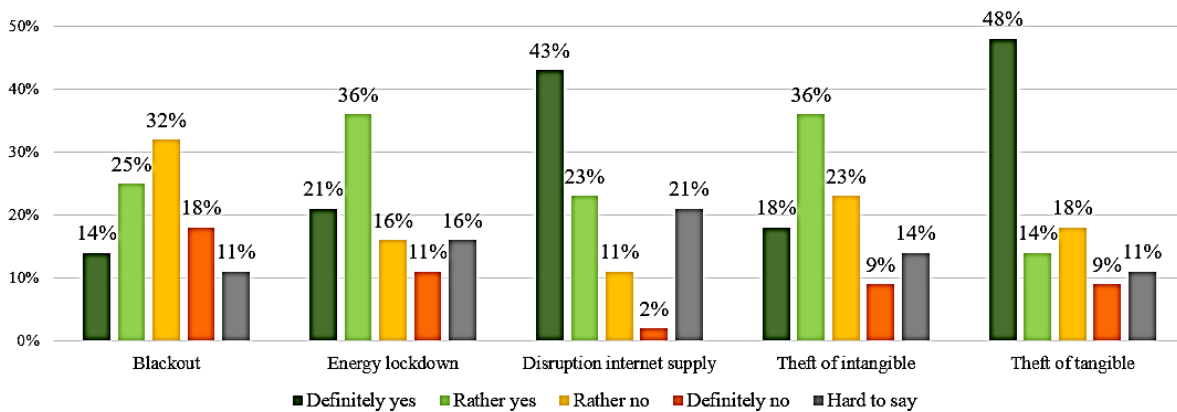


Figure 1. External threats articulated in business continuity plans indicated by respondents.

Source: own study.

Indications of the respondents illustrated in Fig. 1, clearly indicate that in modern organizations, in particular, areas are identified that affect the continuity of operations and shape the security of the organization in the objective dimension. This approach has its organizational justification, as it allows the entrepreneur to formulate general procedures for reacting in the event of an incident. However, it is insufficient when the risk materializes and the area of its occurrence is focused within a single key process responsible for ensuring the continuity of the organization's operation. It should be emphasized here that the respondents' indications do not take into account the links between individual threats. The occurrence of a blackout as well as an energy lockdown partially or completely limits the availability of the Internet and some intangible resources that can be used by means of automated electronic or computer systems. The indicated ambiguity may result from ignorance or non-occurrence of such events in the organization itself and in its environment. Nevertheless, shaping the safety culture in the company requires the creation of new attitudes and values with the participation of all members of the group. The aim of these activities is to persuade employees to eliminate excessive risks in the workplace (Krupa, 2017). Therefore, it is extremely important to systematically monitor the risk horizon and involve employees in the risk identification process.

The second element that was the subject of the study was the impact of identified threats on ensuring business continuity. Fig. 2 illustrates the opinions of respondents, outlining the degree of impact of specific threats on the interruption of business continuity.

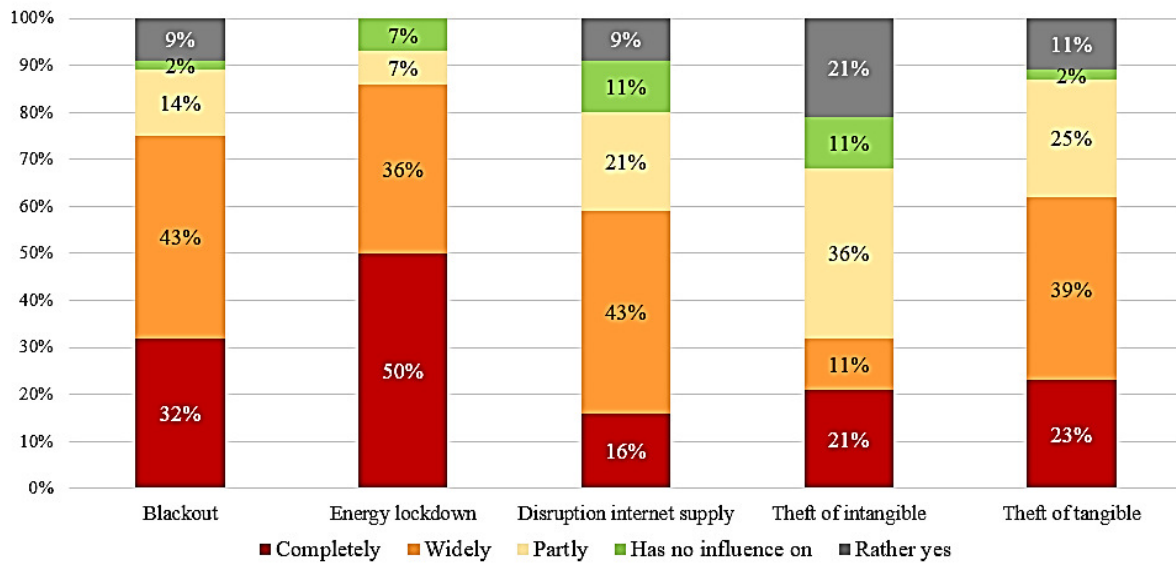


Figure 2. Opinion of respondents regarding the level of impact of specific threats on the ability to ensure business continuity.

Source: own study.

Research results presented in Fig. 2 reveal a kind of contradiction in the approach of the surveyed organizations to business continuity management. In the first part of the survey, 39% of respondents indicated that they listed blackout as a threat in their business continuity plans. In the second part of the study, as many as 75% of respondents indicated that blackout contributes to interrupting business continuity. The indicated difference shows irrefutably that entrepreneurs similarly use identical or mismatched mechanisms both to identify operational risk and during business continuity management. Within the framework of the risk management concept, the effects are analysed statically, while within the framework of business continuity in dynamic terms. This means that the effects are analysed over time along with the change in the severity of the threat or the duration of the crisis situation (Zapłata, 2012). At the same time, as many as 86% of respondents indicated that the energy lockdown affects the interruption of business continuity, and only 32% of respondents indicated that the theft of intangible resources affects the interruption of business continuity. Referring to the indicated differences in the approach to business continuity management, it should be emphasized that the unquestionable basis for the efficient and uninterrupted functioning of an organization is the implementation of (Zawiła-Niedźwiecki, Gołąb, 2010):

- solutions, preventing the emergence and development of continuity threats,
- mechanisms, for removing the effects of disruptions as quickly as possible,
- systems, enabling continuation of operations in critical conditions.

The aim of the third part of the study was to determine the response mechanisms indicated in the business continuity plans in the event of specific threats. Fig. 3 presents the indications of the respondents, shaping the context and scope of actions in the event of an incident leading to the interruption of business continuity.

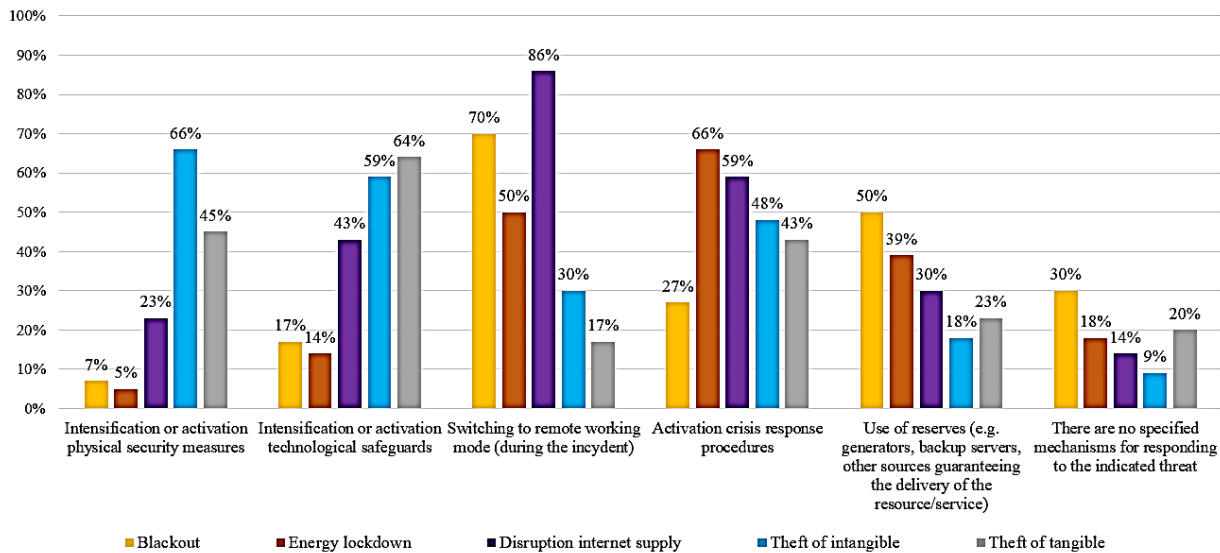


Figure 3. Response mechanisms articulated in business continuity plans and response systems in contemporary organization.

Source: own study.

Percentage of respondents' opinions illustrated in Fig. 3, indicates that the most frequently indicated mechanism, established in business continuity plans, is the change of the working mode, ensuring the possibility of performing part or all of the work remotely. The instrument was adequately indicated most often in relation to the interruption of Internet supplies – 86% of responses, as well as in the event of a blackout – i.e. 70% of responses. However, it should be emphasized here that changing the form of performing current tasks is possible to a limited extent and does not contribute directly to eliminating the source of the threat. Therefore, an important aspect that constructs the methodology of the organization's operation in a crisis is to indicate several complementary response mechanisms (Zawiła-Niedźwiecki, Gołąb, 2010). Another, most frequently presented instrument, allowing for active resolution of disruptions, was the launch of crisis response procedures. This mechanism was most often indicated in relation to the energy lockdown and the interruption of Internet supplies. The literature on the subject indicates that detailed crisis response procedures in organizations that take into account many scenarios of the development of threats allow you to accurately and purposefully identify the methods, ways and resources necessary to restore the efficiency of the organization to the level before the occurrence of the incident. The authors of the study pay special attention to the percentage of 30% of respondents who indicates that the business continuity plans established in their organizations did not specify mechanisms for responding to the occurrence of a blackout.

Failure to isolate response mechanisms in the fact of threats whose occurrence is highly probable indicates the immaturity of business continuity assurance systems. The catalogue of risks, threats and weaknesses of the organization that affect or potentially affect the interruption of the ongoing processes should be constantly monitored and supplemented. Especially in a situation of increased uncertainty resulting from dynamic changes in the environment.

The lack of an adequate reaction to changes is most often associated with the materialization of losses both in the financial and image perspective, because the effects of interrupting the continuity of the company's operations are directly observed at the level of relationship management.

5. Summary

In the article, the authors focused on presenting the experience of organizations in Poland in the field of business continuity management. The authors point to the importance of a systemic approach to business continuity management, which allows to increase the organization's resistance to various types of threats and crises.

The article presents issues related to the definition and objectives of business continuity management, as well as various approaches and methods used in the business continuity management process. Then, the experiences and practices of organizations in Poland in the field of business continuity management were discussed, including examples of actions taken to increase the organization's resistance to various types of threats.

The authors emphasize the importance of effective business continuity management for improving the organization's security and for increasing its competitiveness on the market. They also indicate the need for continuous improvement of business continuity management processes and the need to take into account the changing market conditions and business environment.

In conclusion, the article shows how important it is to effectively manage business continuity in organizations, and what benefits such an approach can bring. The experiences of organizations in Poland presented in the article are a valuable source of knowledge for other enterprises that want to take action to increase their resistance to various types of threats.

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**IMPACT OF CONSUMERS' AWARENESS CONCERNING
ECO-LABELLING ON THEIR BEHAVIOR.
A PROOF BASED ON LITERATURE REVIEW**

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Purpose: Identifying the impact of consumers' awareness concerning eco-labelling on their pro-ecological market behavior.

Design/methodology/approach: A critical and comparative literature review was chosen as a research method.

Findings: Most of the results found in the literature confirm that awareness concerning eco-labelling positively impacts consumers' pro-ecological behavior. Generally the findings indicate that eco-labelling is often worthwhile because it enhances the business rationale for delivering products with eco-components.

Research implications: The change in consumer awareness in the area of eco-labelling leads to the change of consumer behavior towards ecological products. Hence the use of eco-labels can be an important marketing tool in shaping consumer behavior on the market.

Practical implications: The findings indicate that eco-labelling is worthwhile as it enhances the business rationale for delivering products with eco-components.

Originality/value: The identification, estimation and evaluation of the model of direct relation between consumer awareness concerning eco-labelling and consumer pro-ecological behavior on the market.

Keywords: eco-labelling, consumer behavior, sustainable purchasing, environmental marketing.

Category of the paper: literature review.

1. Introduction

With increasing consumer concern about the environmental impact of the goods and services they buy, environmental labelling has emerged as a key tool for making sustainable purchasing decisions (ISO, 2019). Environmental labels provide information about a product or service in terms of its overall environmental benefits. At a time when more and more consumers are motivated to purchase environmentally benign products, this information can positively influence consumer choices (ISO, 2019).

An ecolabel is a marketing tool used by producers to raise awareness about the environmental quality of a product (Brecard et al., 2009; Taufique et al., 2019; Riskos et al., 2021). International Standards Organization (ISO) defines ecolabels as providing information about a product or service in terms of its overall environmental benefits, such as the recyclability of its packaging, or the absence of noxious ingredients (ISO, 2018). Ecolabels are a significant emerging trend in green marketing and green advertising (Riskos et al., 2021) as well as a marketing tool providing consumers important information and promoting green products (Hornibrook, May, Fearne, 2015; Testa et al., 2015). Their role is to inform consumers about the special environmental qualities of products and assure them of the truthfulness of these claims (Atkinson, Rosenthal, 2014; Riskos et al., 2021). Ecolabels enhance transparency and consumer trust towards environmental claims (CEC, 2007; Thogersen, Haugaard, Olesen, 2010). Ecolabelling improves consumer perception about a brand in the name of ecological concern (Taufique et al., 2014; Bickart, Ruth, 2012).

However also an increasing scepticism towards the claims of eco-labels can be observed (Georgakarakou et al., 2020). The commercial benefits of environmental labelling for both buyers and suppliers has given rise to a multitude of environmental claims, labelling schemes and initiatives (ISO, 2019). The increasing proliferation of such labelling has led to concerns of “greenwashing” and exaggerated marketing claims. This has increased the awareness of the environmental impact of products and services, but not without some confusion in the market (ISO, 2019). The following factors are said to hit the credibility of eco-labels (Thogersen, Haugaard, Olesen, 2010; Riskos et al., 2021):

- lack of awareness among consumers,
- lack of trust on certification agencies,
- fake ecolabels,
- lack of monitoring institutions.

As one can notice, the lack of awareness among consumers is the main factor. It should be underlined, that eco-labels are commonly regarded as an exceptional marketing and advertising tool that informs contemporary consumers about the green traits of a product. They provide information that should motivate consumers to exhibit a positive attitude and actual behavior towards green product purchase (Riskos et al., 2021).

Further, growing concerns about the environment led to the emergence of a new type of consumer whose buying behavior exhibits environmental sensitivity (Chamorro, Banegil, 2006; Otto, Kaiser, 2014; Riskos et al., 2021). Modern consumers seem to be really concerned about the eventual negative impact of their buying decisions, which in turn influences their purchasing behavior (Taufique et al., 2017). Eco-labels can be thought of as a crucial green marketing and advertising tool, widely used to provide consumers with knowledge about the green aspects of the product (Sharma, Kushwaha, 2019). Since consumers cannot verify the characteristics of green products directly, they need to rely on eco-labels to authenticate such claims. Eco-labels are said to rapidly impact sustainable consumers behavior without limiting their freedom of choice (Riskos et al., 2021). They also reduce uncertainty and information search costs (Grunert, Wills, 2007; Kollman, Prakash, 2001).

To synthesize the relationship between eco-labelling and consumer behavior, the aim of the paper was specified as follows:

Identifying the impact of consumers' awareness concerning eco-labelling on their pro-ecological market behavior.

Corresponding with the aim, a working hypothesis was derived:

H1: Consumers' awareness concerning eco-labelling positively impacts their pro-ecological market behavior.

The hypothesis was verified on the basis of the critical and comparative literature review.

2. Eco-labels and consumer behavior

Consumer behavior, among others, is the reaction to external stimuluses, whereas the factor which activates them in the market are their needs (Rudnicki, 2012). Diverse offer of competing entities forces the manufacturers to satisfy a wide range of consumer needs. Getting rich of the consumers and their shopping experiences encourage the buyers to a constant search for something new, special, personalized and something that allows for distinction (Berbeka, 2016). The market of products evaluates and is subject to new consumer trends. For example, the trend of healthy lifestyle and care for the proper body condition as well as physical fitness results in the increase of the popularity of eco foods among the consumers (Kowalczyk-Vasilev et al., 2011; IJHARS, 2013).

Issues connected with the product ecology significantly influence consumer behavior in the market. Ecological and social sensitivity and the fact that goods are produced with respect of the natural environment more frequently becomes the determinant of the purchase (Koszevska, 2012). According to the pharmaceutical studies conducted by Eurobarometer, 32% of the Europeans buys and consumes more eco foods (32%) and 16% takes into consideration the carbon footprint of their foods purchases what sometimes influences their purchase decisions

(Report, 2021). Therefore, the purchase of a sustainable product except for the striving for the satisfaction of material needs is particularly important for a responsible consumer.

The term of sustainable products appears in the sustainable development strategy. In publications we may find definitions that are coherent with the above mentioned term such as: sustainable consumption (Cruz, Katz-Gero, 2016) or sustainable consumer (Fuchs et al., 2021). Sustainable products come into existence in the consequence of the enrichment of conventional products in added values mainly connected with ecological issues, guaranteed quality, innovation or ethical behavior of manufacturers (Żuchowska-Grzywacz, Żuchowski, 2020). The packaging of these products is marked by the producer with adequate labels. Most frequently the labels are the marks and ecological certificates which among others allow to distinguish the ecological and organic production from the massive production.

The consumer to a greater extent makes a decision based on the situation factors including the analysis of information placed on the product packaging (Chudzian, Chatys, 2014). A particular role in the market decisions concerning the ecological offer of the product is played by the ecological labelling, the so-called eco-labelling. The task of the eco-labelling is to inform the consumers about the environmental qualification of the product, ecological quality of the products and processes connected with their production. They are deemed as reliable instrument which confirms the ecological features and supports better perception of the product on the market (Wilk, 2016).

There is a huge number of marks and certificates in the world with a large variation depending on the geographical region. The European Union regulated the issue of placing all products on the market as "organic" in 2007 on the basis of the Regulation, establishing the "Euroleaf" with the formal logo of organic production (Council Regulation (EC) No 834/2007). Currently, this issue is regulated at the EU level by the Regulation of 30 May 2018 (Regulation (EU) 2018/848). On the other hand, at the national level in Poland, the relevant and up-to-date legal act is the Act on Organic Farming and Organic Production (Journal of Laws of 2022, item 1370). Certificates issued by accredited organizations guarantee that the product meets stringent requirements regarding health protection, no negative impact on the environment and economic use of natural resources throughout the product's life cycle. The manufacturer and seller should display labels that assure consumers of the guaranteed environmental performance of the products. Reliable ecolabels are a form of promoting sustainable consumption patterns. They also provide consumers with information that helps them choose goods and services with the right level of environmental responsibility. Thanks to compliance with specific criteria, verified in an impartial manner, they enable the standardization of pro-ecological promotional messages (Wilk, 2016).

It should be emphasized that eco, bio or organic markings placed by producers on packaging labels, which are not confirmed by adequate certificates, may unfortunately deliberately mislead consumers. It happens that producers take advantage of the ignorance and lack of awareness of buyers in this regard. Such dishonest marketing communication based on false or

misleading declarations of product compliance with the principles of environmental protection is called greenwashing (Karwowska, 2020). Growing awareness of greenwashing can be dangerous as consumers may lose faith that their green purchasing decisions make sense. Therefore, among others, eco-labelling conducted in a manner consistent with legal regulations contributes to the elimination of this unfavourable phenomenon in the long term.

3. Research method

In our study a critical and comparative literature review was chosen as a research method. We chose it, because literature reviews play a critical role in scholarship because science remains a cumulative endeavour (vom Brocke et al., 2009). A literature review was selected as the method to reach the goal of this research, as quite many studies focusing on the explored topic can be found. This method is especially adequate in a situation where knowledge production in the researched topic is accelerating, at the same time remaining fragmented and interdisciplinary and in the result making it hard to keep up with state-of-the-art research (Snyder, 2019). This is why the literature review as a research method seems to be relevant in this case. A literature review can be defined as a way of collecting and synthesizing previous research (Tranfield, Denyer, Smart, 2003). A literature review is a survey of scholarly sources on a specific topic. It provides an overview of current knowledge, allowing you to identify relevant theories, methods, and gaps in the existing research (McCombes, 2023). An effective and well-conducted review as a research method creates a firm foundation for advancing knowledge and facilitating theory development. It is said to be “analysis of the past and preparation for the future” (Webster, Watson, 2002). By integrating findings and perspectives from many empirical findings, a literature review can address research questions with a power that no single study has. This is because literature reviews play an important role as a foundation for all types of research. They can serve as a basis for knowledge development, create guidelines for policy and practice, provide evidence of an effect, and have the capacity to raise new ideas or directions for a particular field of science. As such, they serve as the grounds for developing future research and theory (Snyder, 2019).

In our study, to search and screen references and then collect data, the query was performed on December 8th-10th 2022 in Google Scholar by typing the phrases *eco-labelling + consumer behavior*. Together 20 studies were considered. Most of the results come from the last five years.

4. Results and discussion

The demand for green products has broadened to a wide variety of sectors (Vermeir, Verbeke, 2006; Kang et al., 2013). A literature review was selected as the method of this research, as quite many studies can be found concerning in this area. Their authors tried to verify the impact of eco-labelling on consumer behavior.

The researchers (Hameed, Waris, 2018) explored the relationship between eco-labels and eco-conscious consumer behavior for green products. Mediation effect of consumer trust regarding green products and their concern for the sustainability of environment have also been analyzed. The findings of research highlight the positive impact of eco-labels on consumers' eco-conscious behavior. The results show full mediation effect of green trust on the relationship between eco-labels and eco-conscious consumer behavior.

Another researchers (Hameed, Waris, Amin ul Haq, 2019) incorporated green trust, environmental concerns, and intrinsic religious orientation as a moderator into the theory of planned behavior (TPB). They aimed to validate the TPB to predict consumers' eco-conscious behavior, and simultaneously assess the moderating effect of intrinsic religious orientation on consumers' attitude towards green products. The results of structural equations modeling (SEM) indicate that all paths in the model are significant, except the path from attitude towards green products to eco-conscious behavior.

The objective of another paper (Song, Quin, Yuan, 2019) was to test the effects of eco-labelling on product attributes, environmental attitude, environmental concern and consequent purchase behavior from the young generation perspective. The intermediary role of product attribute was first investigated in the labelling-driven purchase, and the environmental attitude and concern were tested respectively to better understand the young generation's awareness, compared to previous relevant studies. SEM was used to analyse data. The results showed the impact of eco-label mediated by product attributes on environmental attitude and environmental concern, and how green purchase behavior was influenced through this process significantly.

Another researchers (Garcia de Leaniz, Crespo, Lopez, 2018) developed a model that investigated the relationship between green practices, green image, environmental consciousness and the behavioral intentions of customers. The study examined the direct and moderating role of environmental consciousness in the formation of behavioral intentions based on green initiatives. The authors found that the higher the environmental consciousness of consumers, the greater their intention to spread positive word-of-mouth and pay a premium for eco-labeled products.

Some other study (Harms, Linton, 2015) showed that consumers with pro-environmental attitudes and awareness particularly exhibit green buying behavior. The findings indicate that eco-labelling is often worthwhile because it enhances the business rationale for delivering products with eco-components.

The objective of another paper (Yusiana, Widodo, Sumarsih, 2021) was to analyse an advertisement through the concept of green marketing, one of the supporting elements of communication in promotion is an eco brand and eco-label. The research used multiple linear regression analysis. The results of hypothesis testing demonstrate a significant difference in customer buying behavior between eco-label, eco brand, and environmental advertisement. The partial hypothesis test revealed that the factors (e.g. eco-label, eco brand, and environmental advertisement) had a substantial impact on customer buying behavior.

Another researchers (Adrita, Mohiuddin, 2020) observed the gap between consumers' favourable attitude toward environment and actual purchase behavior of green products, referred to as "green purchasing inconsistency". The purpose of their work was to explain why this gap still exists and to investigate whether the influence of moderator variables can minimize it. To analyse data, SEM was used. The findings suggest that ability can play a key role in motivating the consumers toward more green purchase behavior along with eco-label knowledge, but not with general knowledge of environment.

The purpose of another research (Shabbir et al., 2020) was to analyze the main green marketing approaches and their impact on consumer behavior towards the environment. The findings suggest interesting inferences regarding eco-labelling, green packaging and branding, green products, premium, and pricing, and the environmental concerns and beliefs of consumers that affect their perceptions of the environment. It was found that key factors of green marketing, such as eco-labelling and green products, premium and pricing, have a significant positive influence on consumer beliefs towards the environment.

Another team of researchers (Sheikh et al., 2014) evaluated consumer attitudes about green products and their purchasing decisions. It was stated that brand and gender differentiation have a very low link with green customer behavior, while price, quality, and green marketing (including eco-labelling) have a significant positive correlation.

M. Cheung with a colleague (2019) presented and verified an extended value-attitude behavior model to give details concerning green purchase behavior. SEM discovered that consumers' awareness concerning eco-labels influenced their attitudes toward environmental problems and eco-social profit, which influenced their green purchasing behavior. It turned out that a crucial determinant of green purchase behavior is product information, including eco-labelling.

Another researchers (Seyrek, Gul, 2017) studied factors affecting the consumers' green purchasing behavior. As a result of ANOVA and multiple regression analysis performed, they found that the factors encompassing environmentalism, behaving economically and knowledge concerning eco-certificates have significant and positive effects on green purchasing behavior. Also, green purchasing behavior of consumers depends on their age group and income level.

R. Yadav and G. Pathak (2017) verified whether individual green consumption can help decrease the environmental impact of consumption. The study sought to analyze green product purchasing behavior. SEM was performed to assess the strength of correlations between components. The results fully supported consumers' intention to acquire green items, influencing their green purchase behavior.

Another study (Alkhayat, Stita, 2021) showed the existence of a strong statistically significant correlation between people's environmental information and knowledge, including knowledge on eco-labelling, towards purchasing an environmentally friendly products – green cosmetics.

Results obtained by other researchers (Riskos et al., 2021) highlight the crucial role of eco-label credibility that positively influences attitude towards green product purchase as well as eco-label involvement. Findings can provide useful guidance to green marketers so that they can generate effective strategies based on eco-labels and favor a positive attitude towards green product purchase that ultimately will enhance green product purchase behavior.

Another scientists (Lehmann, Beikirch, 2020) investigated if available eco-labels have an influence on consumers' choices in electricity tariffs. The study also examines the relative importance of other common attributes of electricity tariffs, namely the type of supplier, the electricity mix, the share of regional generation, and the price. Results using Hierarchical Bayesian analysis show substantial differences in the two survey parts. They found out that on this market eco-labels seem to have a big influence on the consumers' choice behavior. On the contrary, analysis of the general awareness levels reveals that the certification criteria of the eco-labels are unknown to the majority of consumers, often even the labels themselves.

The aim of the study by L. Rutten (2022) was to acquire a broader understanding of how the use of certified eco-labels on clothing affects consumer behavior. It turned out that certified eco-labels generally positively affect attitude towards companies. That is, respondents generally felt more positive towards companies that used certified eco-labels than those that did not use these kind of eco-labels. This was also the case for respondents' purchase intention: respondents had a higher purchase intention for clothing with a certified eco-label than for clothing without such a label.

Another team of reserarchers (Taufique, Vocino, Polonsky, 2016) tried to integrate consumers' knowledge and trust in eco-labels with their environmental knowledge to determine how these affect pro-environmental consumer behavior. The findings suggest environmental and eco-label knowledge is positively associated with attitudes towards the environment, and that positive environmental attitudes and trust in eco-labels affect consumer behavior. This implies that firms, policy-makers and accreditation organisations can educate consumers about eco-labels to increase their pro-ecological behavior.

Then again K. Taufique with colleagues (2016), using the Theory of Reasoned Action looked at attitude-behavior relationship that integrates both general environmental knowledge and knowledge of eco-labels in the model to investigate their role in predicting ecologically

conscious consumer behavior. The authors found out that both general environmental knowledge and eco-label knowledge positively influence consumer attitudes towards environment in driving ecologically conscious consumer behavior. The findings suggest that modern marketing strategies need to focus on educating consumers about eco-labelling along with general environmental knowledge

The purpose of another study (Waris, Dad, Hameed, 2022) was to extend the theory of planned behavior and understand consumers' purchase intention of energy-efficient appliances from the perspective of pro-environmental behavior. This study focuses on knowledge of eco-labels and altruism for the consumers' purchase intention of these appliances. SEM was used for the analysis of data. The findings of the study reveal that altruism and knowledge of eco-labels promote the purchase of energy-efficient appliances. Further, the results indicate that altruism was the key predictor that leads to the consumption of environmentally friendly appliances.

At last, R. Lavuri with the team (2021) examined behavioral differences between Millennials and Gen Z. With the use of SEM it they proved that variables such as media exposure, environmental concern, environmental knowledge (including eco-labelling), and attitude, had a significant impact on the purchase intentions.

Finally, the categorized summary of the critical and comparative literature analysis is shown in Table 1.

Table 1.
Summary of literature review

| Author(s) and year | Market | Geographical scope | Method | Character of relationship | Hypothesis supported? |
|--|----------------|----------------------|----------------------------|---------------------------|-----------------------|
| Hameed, Waris (2018) | Green products | Pakistan | SEM | Direct and indirect | Y |
| Hameed, Waris, Amin ul Haq (2019) | Green products | Pakistan | SEM | Direct and indirect | Y |
| Song, Qin, Yuan (2019) | Green products | China | SEM | Direct and indirect | Y |
| Garcia de Leaniz, Crespo, Lopez (2018) | Hotel services | Spain | SEM | Direct and indirect | Y |
| Harms, Linton (2015) | Green products | The Netherlands | Multivariate correlation | Direct | Y |
| Yusiana, Widodo, Sumarsih (2021) | Green products | Indonesia | Multiple regression | Direct | Y |
| Adrita, Mohiuddin (2020) | Green products | Bangladesh | SEM | Direct and indirect | Y |
| Shabbir et al. (2020) | Green products | United Arab Emirates | SEM | Direct and indirect | Y |
| Sheikh et al. (2014) | Green products | Pakistan | Multivariate correlation | Direct | Y |
| M. Cheung (2019) | Green products | China | SEM | Direct and indirect | Y |
| Seyrek, Gul (2017) | Green products | Turkey | ANOVA, Multiple regression | Direct | Y |

Cont. table 1.

| | | | | | |
|-----------------------------------|-----------------------------|-----------------|----------------------------------|---------------------|---|
| Yadav, Pathak (2017) | Green products | India | SEM | Direct and indirect | Y |
| Alkhayyat, Stita (2021) | Green cosmetics | Sweden | Correlation | Direct | Y |
| Riskos et al. (2021) | Green products | Greece | SEM | Direct and indirect | Y |
| Rutten (2022) | Clothes | The Netherlands | MANOVA, differentiation tests | Direct | Y |
| Taufique, Vocino, Polonsky (2016) | Green products | Malaysia | Correlation | Direct | Y |
| Waris, Dad, Hameed (2022) | Energy-efficient appliances | Pakistan | SEM | Direct and indirect | Y |
| Lehmann, Beikirch (2020) | Electricity tariffs | Germany | Hierarchical Bayesian analysis | Direct | Y |
| Taufique et al. (2017) | Green products | Malaysia | SEM | Indirect | Y |
| Lavuri et al. (2021) | Green products | India | Correlation, Multiple regression | Direct | Y |

Source: own elaboration.

As can be seen from Table 1, all of the results obtained by different authors unambiguously confirm that awareness concerning eco-labelling impacts consumers' pro-ecological behavior. The analyzed studies were published between years 2015 and 2022. The reviewed works focused on different markets and geographical regions. The analyses were performed with the use of different multidimensional statistical methods, still most of the studies were carried with the use of structural equations modelling (SEM). Hence the assumed causal relationship in majority of cases turned out to be of direct, and in minority of indirect character. Instead of differences between the analyzed papers, encompassing different markets, regions, statistical tools and type of relationship, in all cases the hypotheses assuming statistically significant, positive causal relationship between consumers' awareness concerning eco-labelling and their pro-ecological market behavior were supported.

5. Conclusions

Summing up, in the course of this analysis working hypothesis was supported. As the result of the carried literature analysis it was proved that:

1. The assumed causal relationship between consumer awareness concerning eco-labels and their pro-ecological behavior on the market finds clear and strong confirmation in contemporary scientific works.

2. The reviewed papers examined not only different kinds of products (green products in general, green cosmetics, clothes, energy-efficient appliances), but also some services (hotel services, electricity tariffs).
3. The reviewed studies were carried out in both developing (e.g. Pakistan, Bangladesh) and highly developed countries (e.g. The Netherlands, Germany, Sweden).
4. The results of the most of the reviewed studies were obtained with the use of one of the most advanced methods of exploring causal relationships – SEM (Hair et al., 2014), which allows exploring both direct and indirect causal relationships. Still, in some studies other statistical procedures were used.

Together, the obtained results testify to the important role of ecological certificates as a marketing tool of promoting sustainable products. This means that eco-labels can be used to successfully influence customer behavior on the market.

6. Limitations and future research

As it comes to research limitations, it should be remembered that customer behavior can be influenced by many other factors, for example the perception of prices, customer inertia and switching costs, as considered by D. Gremler and S. Brown (1996). Hence the presented research should be treated as a pilotage, forming a starting point for more extensive and detailed analysis, including carrying out own empirical research with the use of both qualitative and quantitative methods. In the second case, the assumed relationships could be examined with the use of different tools of multidimensional exploratory analysis, e.g. neural networks (Lotko et al., 2018) or classification trees (Lotko, Korneta, 2019).

Further research could also discuss several additional topics, such as consumers' purchase power, supplementary products according to the customers' needs, and benefits identified after using green products. Moreover, future research could also aim to explore customer awareness concerning the environmental effects of consumption as well as stopping those effects by using these environmentally or eco-friendly green products (Alkhayyat, Stita, 2021).

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